TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

RECEIVER GAIN MONITOR EQUIPMENT INCLUDING: MONITOR, RADIO FREQUENCY ID-1935/G (NSN - 5895 - 00 - 279 - 8475) MONITOR, PILOT CARRIERS ID-1916/G (NSN 5895-00-251-8091) FOR SATELLITE COMMUNICATION TERMINALS AN/FSC-78(V) AND AN/FSC-79

This copy is a reprint which includes current pages from Change 1.

DEPARTMENTS OF THE ARMY, THE NAVY, AND THE AIR FORCE
MAY 1978

WARNING

120 V ac is present in this equipment. Serious injury or death may result if normal precautions are not observed. Front panel circuit breakers do not completely isolate the 120 V ac; this voltage still exists as a potential hazard at the circuit breaker input terminals. Do not take chances.

WARNING

Receiver gain monitor HTA-3A6 weighs 102 lb.

CHANGE)
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No. 1)

DEPARTMENTS OF THE ARMY,
THE NAVY, AND THE AIR FORCE
Washington, DC, *Date 1984*

Direct Support And General Support
Maintenance Manual

RECEIVER GAIN MONITOR EQUIPMENT
INCLUDING
MONITOR, RADIO FREQUENCY ID-1935/G (NSN 5895-00-279-8475)
MONITOR, PILOT CARRIERS ID-1916/G (NSN 5895-00-251-8091)
FOR
SATELLITE COMMUNICATION TERMINALS
AN/FSC-78 (V), AN/FSC-79, AND AN/GSC-39 (V)

TM 11-5895-909-34/NAVELEX 0967-LP-546-6300/TO 31R5-2G-182, 30 May 1978, is changed as follows:

1. The title of the manual is changed as shown above. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the illustration title.

2. Remove old pages and insert new pages as indicated below.

Remove pages	*Insert pages*
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2 and 1-2.1/(1-2.2 blank)
3-13 and 3-14	3-13, 3-14 and 3-14.1/(3-14.2 blank)
3-15 and 3-16	3-15 and 3-16
3-45 and 3-46	3-45 and 3-46
4-7 through 4-10	4-7 through 4-10
A-5/(A-6 blank)	A-5 and A-6
FO-4 (Sheet 1 of 5)	FO-4 (Sheet 1 of 5)
FO-6 (Sheet 2 of 2)	FO-6 (Sheet 2 of 2)

3. File this change sheet in the front of publication.

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NO. 11-5895-909-34
TECHNICAL MANUAL
NAVELEX 0967-LP-546-6300
TECHNICAL ORDER
TO 31R5-2G-182

DEPARTMENTS OF THE ARMY.
THE NAVY, AND THE AIR FORCE
WASHINGTON, DC, *30 May 1978*

DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL

RECEIVER GAIN MONITOR EQUIPMENT INCLUDING: MONITOR, RADIO FREQUENCY ID-1935/G (NSN-5895-00-279-8475) MONITOR, PILOT CARRIERS ID-1916/G (NSN-5895-00-251-8091) FOR SATELLITE COMMUNICATION TERMINALS AN/FSC-78 (V), AN/FSC-79, AND AN/GSC-39 (V)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703.

For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, Section VI, T.O. 00-5-1. Forward direct to prime ALC/MST.

For Navy, mail comments to the Commander, Navel Electronics Systems Command, ATTN: ELEX 8122, Washington, DC 20360.

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

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CHAPTER 1
INTRODUCTION

SECTION I. GENERAL

1-1. Scope

This manual contains direct and general support instructions for tracking receiver equipment in Satellite Communications Terminals AN FSC-78(V), AN FSC-79. and AN GSC-39(V). Unless otherwise specified, information applicable to the AN FSC-78(V) is also applicable to the AN GSC-39(V). Included are discussion on how the equipment functions. And procedures for troubleshooting, testing, and adjusting the equipment. Maintenance instructions are included for repairing the equipment and for replacing specified maintenance parts. Also included are lists of tools, materials, and test equipment required for direct and general support maintenance.

1-2. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army Forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update. Air Force personnel will use AFR 66-1 for maintenance reporting and T0-00-35D54 for unsatisfactory equipment reporting. Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Subsystem(MDCS) IAW OPNAVINST 4790.2, Vol 3 and unsatisfactory material/conditions (UR submissions) IAW OPNAVINST 4790.2. Vol 2, chapter 17

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73A/AFR 400-54/MCO 4430 3F.

c. *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy In Shipment Report (DISRFP) (SF 361) as prescribed in AR 55-38 NAVSIPINSF 4610 33C AFR 75-18 MCO P4610.19D DILAR 4500.15

1.3. Administrative Storage

Administrative storage of equipment issued to and used by Army activities shall be in accordance with TM 740-90-1.

1.4. Reporting Equipment Improvement Recommendations (EIR)

a. Army. If your equipment needs improvement. let us know. Send us an EIR. You, the user, are the only one who can tell us "hat you don't like about your equipment. Let us know why 3 you don't like the design. Put It on an SF 368 (Quality Deficiency Report). Mail it to Commander, U S Army Communications-Electronic Command and Fort Monmouth. ATTN: DRSEL-MF-MP, Fort Monmouth. New Jersey 07703. We'll send you a reply.

b. Air Force. Fort-c. Air Force personnel are encouraged to submit EIR's in accordance with AFR 900-4.

c. Navy. Navy personnel are encouraged to submit EIR's through their local Beneficial Suggestion Program.

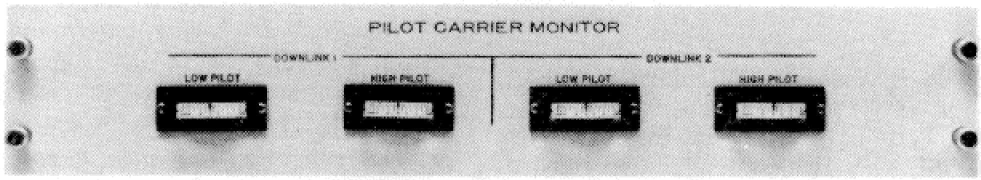
SECTION II. DESCRIPTION AND DATA

1.5. General Description

The receiver gain monitor equipment is part of the monitoring and switching function described in the following technical manuals:

TM 11-5895-898-12	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN FSC-78(V)
TM 11-5895-899-12	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN, FSC-79
TM 11-5895-1050-12	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN GSC-39(V)1
TM 11-5895-1043-12	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN GSC-39(V)2
TM 11-5985-358-14	Operator, Organizational, Direct Support and General Support Maintenance Manual for Antenna Group OE-222 G for Satellite Communication Terminal AN GSC-39(V)

a. Purpose and Use. Receiver gain monitor equipment shown in figure 1-1 monitors amplifier gain. Downlink amplifiers consist of parametric amplifiers HTA-3A2. and HTA-3A3 (antenna unit HIA-3A2, and HTA-3A3) and Radio Frequency Amplifier AM-6644 G (receive interfacility link amplifier HTA-3A8). When perform-



PILOT CARRIERS MONITOR ID-1916/G
(PILOT CARRIER MONITOR PANEL 14A26)

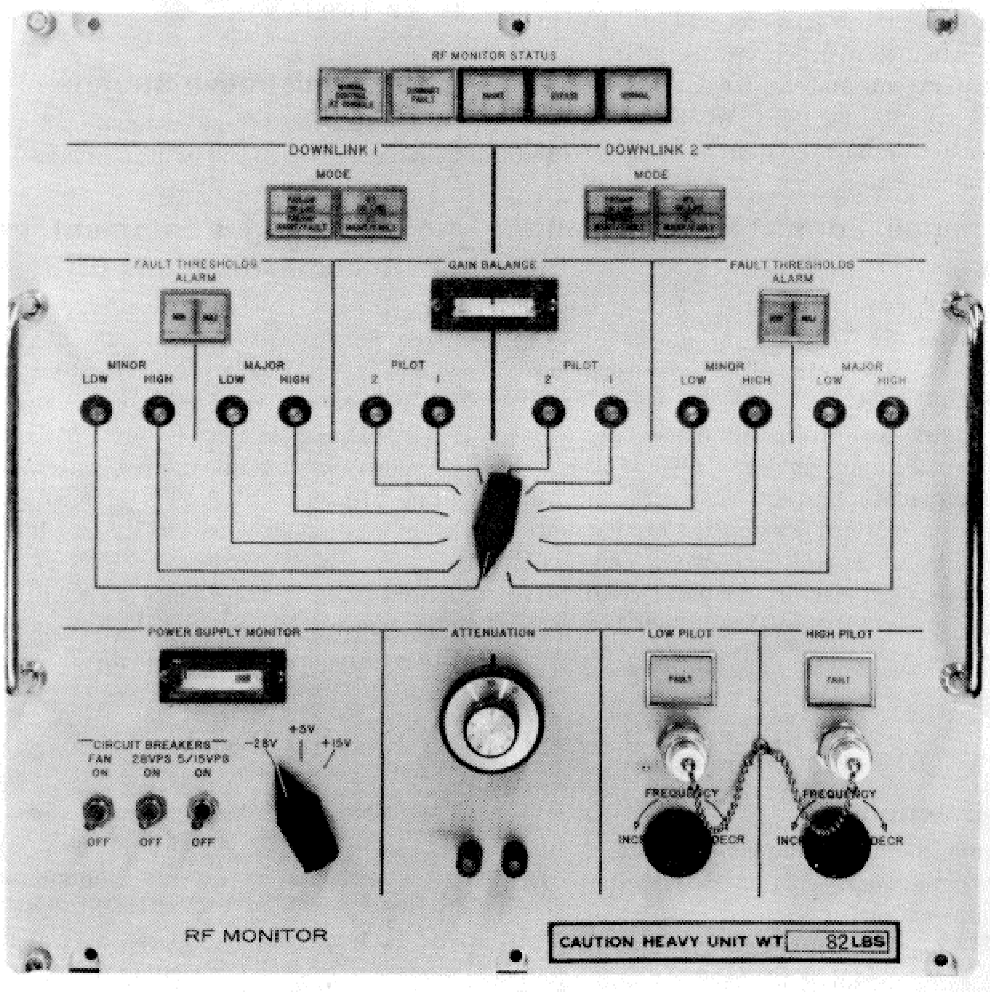


Figure 1-1. Receiver gain monitor equipment.

ance degradation occurs, receiver gain monitor equipment automatically switches offline parametric amplifiers and/or receive interfacility link amplifier circuits online. Receiver gain monitor equipment also provides alert, fault, and maintenance signals to Control- Monitor C-9861/G (system status logic unit 15A5) to light indications on Control-Indicator ID-2028/G (fault and system status panel 14A16).

h. Equipment Description (Fig. 1-1). The receiver gain monitor HTA-3A6). monitor equipment consists of Pilot Carriers Monitor ID-1916/G (pilot carrier monitor panel 14A26) and Radio Frequency Monitor ID-1935/G (receiver gain. Pilot carrier monitor panel 14A26 is installed in Communication Control Console OJ-356/G (control console unit 14). The receiver gain monitor is installed on the rf equipment group (rf plate HTA-3). Descriptions of the receiver gain monitor equipment assemblies appear in paragraphs 1-6 and 1-7.

1.6. Pilot Carrier Monitor Panel 14A26 Description (fig. 1-2).

The pilot carrier monitor panel contains only meters, which are located on the front panel. These meters allow remote monitoring of the gain of the downlink amplifiers. The signals to operate these meters originate in receiver gain monitor HTA-3A6 and enter through connector J 1 at the rear of the pilot carrier monitor panel.

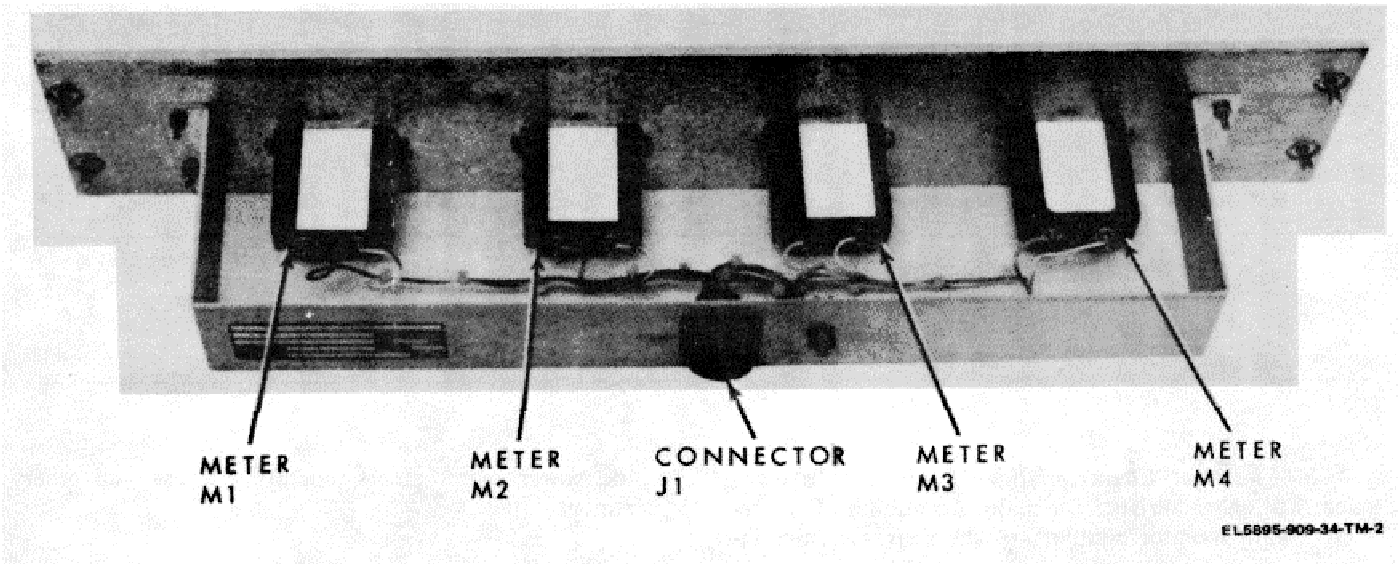


Figure 1-2. Pilot carrier monitor panel 14A26.

1-7. Receiver Gain Monitor HTA-3A6 Description (fig. 1-3).

a. The receiver gain monitor continuously monitors the gain of parametric amplifiers HTA-3A2, and HTA- 3A3 and receive interfacility link amplifier HTA-3A8. When online downlink signal level changes exceed preset major fault threshold levels, the receiver gain monitor places offline standby equipment on line. The front panel of the receiver gain monitor (fig. 1-1) contains controls, indicators, and test points for the following purposes:

(1) To control and indicate the status of the receiver gain monitor (RGMU STATUS indicators and switches).

(2) To indicate the status of the parametric amplifiers and receive interfacility amplifier (DOWNLINK I MODE and DOWNLINK 2 MODE indicators).

(3) To indicate the level of the four pilot signals (GAIN BALANCE meter and rotary switch).

(4) To indicate minor and major alarms in downlink 1 and downlink 2 amplifiers (FAULT THRESHOLDS ALARM indicators).

(5) To set threshold alarm levels and downlink pilot levels (12 potentiometers).

(6) To monitor the -28, +5, and +15 V dc power supplies (POWER SUPPLY MONITOR meter and rotary switch).

(7) To control power to the fan, to the -28 V dc power supply, and to the +5 and + 15 V dc power supplies (CIRCUIT BREAKERS).

(8) To adjust output power levels from receiver gain monitor (ATTENUATION control).

(9) To monitor the settings of the 12 potentiometers when selected by rotary switch (test points below step attenuator).

(10) To indicate low pilot and high pilot faults (FAULT indicators).

(11) To monitor low pilot and high pilot signals (terminations and jacks below FAULT indicators).

(12) To adjust frequency of low pilot and high pilot signals (FREQUENCY control knobs).

b. When the front panel is open (fig. 1-3), internal components of the receiver gain monitor are visible. The +5 V dc power supply, PS3, is located below monitor subassembly A6. On the right side of the receiver gain monitor are connectors JI through J7.

1-8. Tabulated Data. This paragraph provides a tabulation of technical characteristics and a cross-reference index for the receiver gain monitor equipment. The technical characteristics include physical data, and electrical characteristics. The cross-reference index relates equip- ment reference designations to functional group numbers.

a. ***Physical Data***. Table 1-1 lists the physical characteristics for the receiver gain monitor equipment.

Table 1-1. Dimensions and Weights

Ref des	Equipment	Qty	Dimensions (inches)			Weight
			Height	Width	Depth	(pounds)
14A26	Pilot carrier monitor panel	1	3.5	19.0	5.0	15
HTA-3A6	Receiver gain monitor	1	19.0	21.0	13.0	102

b. Electrical Characteristics. Table 1-2 lists the electrical characteristics for major assemblies of the receiver gain monitor equipment. The characteristics include power requirements, operating levels, and other pertinent data.

Table 1-2. Electrical Characteristics

Characteristic	Specification
Pilot carrier monitor panel 14A26	
Meters:	
Range	-6 dB to +6 dB (-0.96 mA to 0.97 mA dc)
Resistance	30 ohms nominal
Resolution	better than 0.2 dB
Response time	1.6 seconds, maximum
Receiver gain monitor HTA-3A6	
Input voltage	120 V ac, 60 Hz, 1-ph
Generated voltage	-28 V dc
	+5 V dc
	+15 V dc
Input signals:	
Pilot level	-42 dBm nominal
Output signals:	
Pilot level	-32 dBm to -51 dBm (adjustable in 1 dB steps with ATTENUATION control on front panel)
Pilot frequency	7.25 to 7.75 GHz

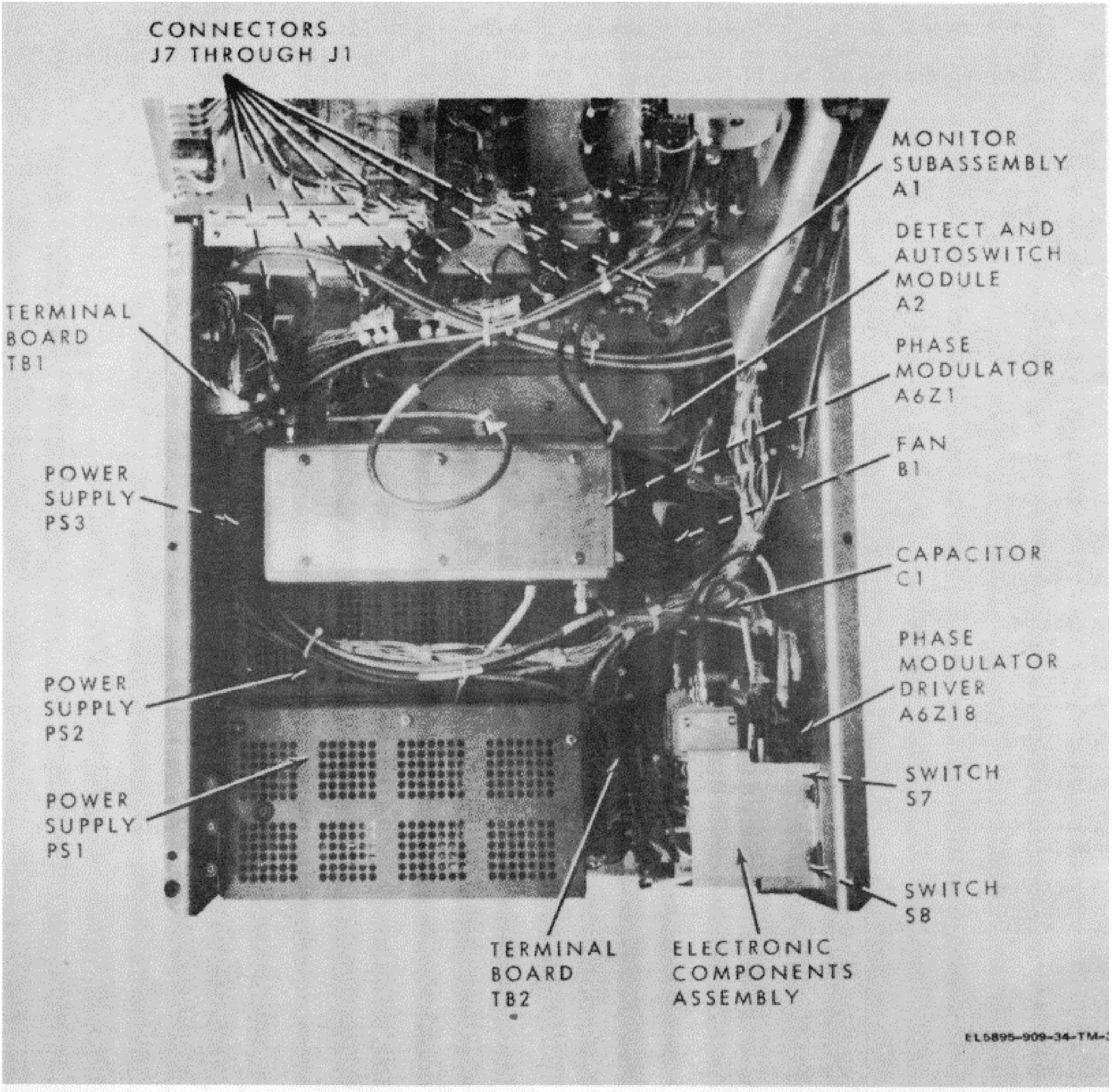


Figure 1-3. Receiver gain monitor HTA-3A6.

c. ***Cross-Reference Index***. Table 1-3 provides across-reference Index between equipment reference designations and functional group number (FGN) assignments as they apply to Maintenance Allocation Charts (MAC) and Repair Parts and Special Tools Lists (RPSTL).

Table 1-3. Cross-Reference Index

Ref des	Common name	FGN
HTA-3A6	Receiver gain monitor	1102
HTA-3A6AT1	Variable attenuator	110209
HTA-3A6AT4 and HTA-3A6AT5	Attenuator	110212
HTA-3A6A1	Monitor subassembly	110201
HTA-3A6A1A1	Linear detect and threshold card	11020201
HTA-3A6A1A2	Fault qualification card	11020102
HTA-3A6A2	Detect and autoswitch module	110202
HTA-3A6A2A1	Linear detect and threshold card	11020101
HTA-3A6A2A2	Autoswitch control card	11020202
HTA-3A6A6	Rf monitor subassembly	110203
HTA-3A6A6Z1	Phase modulator	11020301
HTA-3A6A6Z18	Phase modulator driver	11020302
HTA-3A6A7	Electronic components assembly	110213
HTA-3A6A7DC1 thru 3A6A7DC5	Coaxial coupler	11021302
HTA-3A6A7Z2 thru 3A6A7Z10	Power divider	11021301
HTA-3A6A7Z11 thru 3A6A7Z14	Crystal mixer	11021303
HTA-3A6A8	Electric blanket heater	110204
HTA-3A6CR1 and HTA-3A6CR2	Tunnel diode detector	110210
HTA-3A6PS1	28 V dc power supply	110205
HTA-3A6PS2	15 V dc power supply	110206
HTA-3A6PS3	5 V dc power supply	110207
HTA-3A6S7, 3A6S8	Rf transmission line switch	110211
HTA-3A6Y1, 3A6Y2	Pilot oscillator	110208
14A26	Pilot carrier monitor panel	1101

CHAPTER 2
FUNCTIONING OF EQUIPMENT

SECTION I. FUNCTIONAL ANALYSIS

2-1. Introduction. This chapter explains the functioning of the receiver gain monitor equipment as an aid to understanding the maintenance instructions contained in chapters 3 and 4. Section I contains a block diagram discussion of the equipment function. Section II contains circuit theory of the receiver gain monitor equipment assemblies.

2-2. General Functional Analysis (fig. FO-2).
Receiver gain monitor equipment consists of receiver gain monitor HTA-3A6 and pilot carrier monitor panel 14A26. Receiver gain monitor equipment continuously monitors the gain of the downlink I and downlink 2 amplifiers. Downlink 1 amplifiers consist of receive interfacility link amplifier 1 (IFLA 1) and the associate parametric amplifier. Downlink 2 amplifiers consist of receive interfacility link amplifier 2 (IFLA 2) and the associate parametric amplifier. Gain of the parametric amplifiers and the interfacility link amplifiers in cascade is measured across a 500 MHz spectrum by inserting a low pilot carrier and a high pilot carrier. As the level of the pilot carriers is known, the wideband gain of the two amplifiers in cascade can be determined by a measurement at the output of the interfacility link amplifiers. The following subparagraphs describe the normal, maintenance, and maintenance bypass modes of operation.

a. Normal Mode. Receiver gain monitor HTA-3A6 generates low and high pilots (7.25 to 7.75 GHz). These pilots are phase modulated and routed to output circuits. The output circuits route the phase modulated pilots through directional couplers to online and offline para- metric amplifiers HTA-3A2 and HTA-3A3. After amplification with the downlink carrier signals by the downlink amplifiers, receive interfacility link amplifier HTA-3A8 output signals are sampled. The IFLA 1 and IFLA 2 sample signals are routed to the receiver gain monitor input circuits. The input circuits compare low and high pilots from oscillators with pilot signals contained in the IFLA I and 2 sample signals to determine amplifier gain. The input circuits supply gain level signals to the linear detect and threshold circuits for generation of gain fault signals. Gain fault detection is accomplished by comparison of the gain levels with preset reference levels. These reference levels are determined by settings of threshold potentiometers located on the receiver gain monitor front panel. The linear detect and threshold circuits also supply gain levels to pilot carrier monitor panel 14A26 for operator monitoring. Upon receipt of gain fault signals, the fault qualification circuits check waveguide switch status and receiver gain monitor status. Waveguide switch status is checked to determine if the gain fault is associated with online or with offline amplifiers. Receiver gain monitor status is checked to determine that the receiver gain monitor is not in maintenance mode, and does not have a summary fault. If the receiver gain monitor is not in the maintenance mode, and no summary fault exists, gain fault alarms are routed to system status logic unit 15A5. When a major gain fault occurs in the online down- link amplifiers, parametric amplifier, and/or IFLA switch, signals are routed to the autoswitch control cir- cuits. In the generation of these signals, the status of the parametric amplifiers and IFLA's are considered to determine if the amplifiers are available for use. Parametric amplifier and IFLA switch signals at the autoswitch control circuits generate waveguide switch signals for application to the waveguide switches. Generation of waveguide switch signals is determined by waveguide switch status, receiver gain monitor status, and status of AUTO/MANUAL switch from system status logic unit 15AS. The AUTO/MANUAL switch is located on fault and system status panel 14A16. Low and high pilots are used by the autoswitch control circuits in determining if a summary fault exists.

b. Maintenance Mode. The maintenance mode is used when troubleshooting receiver gain monitor HTA- 3A6. Maintenance mode is selected by pressing MAINT switch on the receiver gain monitor front panel. The MAINT switch deactivates the NORMAL switch and applies a maintenance signal to autoswitch control cir- cuits. The receiver gain monitor status signal applied from the autoswitch control circuits to the fault qualification circuits signifies that maintenance mode has been selected. In the maintenance mode, IFLA sample signals are received by the receiver gain monitor input circuits and gain levels are determined. Linear detect and threshold circuits determine whether or not gain faults exist. As in the normal mode, gain levels are sent to pilot carrier monitor panel 14A26, and gain fault signals are sent to fault qualification circuits. The receiver gain monitor status signal (signifying maintenance mode) applied to the fault qualification circuits inhibit generation of the gain fault alarms to system status logic unit 1 5A5. Generation of parametric amplifier and IFLA switch signals are also inhibited.

c. Maintenance-Bypass Mode. The maintenance-bypass mode is used when setting gain fault threshold levels. and in troubleshooting The maintenance-bypass mode is selected with the BYPASS switch on the receiver gain monitor HTA-3A front panel In the maintenance-bypass mode. IFLA 1 and 2 sample signals are bypassed at the input circuits The input circuits compare the bypass pilot, and the loss and high pilots from oscillators to determine gain levels The gain level is varied by changing attenuation with the variable attenuator Variable gain levels, at the linear detect and threshold circuits., allow adjustment of the fault threshold potentiometers to generate gain fault signals The fault qualification circuits receive gain fault signals, but are inhibited from generating gain fault alarms and switching signals by receiver gain monitor status signals denoting the maintenance mode Receiver gain monitor status signals, from the autoswitch circuits, also indicate the maintenance mode to system status logic unit 15A5.

2-3. Detailed Functional Analysis. Receiver gain monitor equipment employs phase modulation-phase detection to determine the gain change of the downlink amplifiers The following subparagraphs describe the operation of the receiver gain monitor equipment.

a. Pilot Signal Generation (fig. FO-3, sh 1). Low pilot oscillator Y1 generates an adjustable 7.25 to 7 75 (GHz low pilot signal The low pilot frequency is adjusted by means of a front panel control The low pilot signal is fed through rf isolator AT4 and rf capacitor assembly AT13 to directional coupler DC1 Rf Isolator AT4 isolates the low pilot oscillator. Rf capacitor assembly AT13 prevents the flow of dc and audio frequencies A low pilot sample signal from the COUP output of directional coupler DC1 is applied to power divider Z2 for monitoring and comparison. The low pilot signal from the MAIN output of directional coupler DC1 is fed to directional coupler DC3. The low pilot signal 1 from the MAIN output of directional coupler DC3 is routed to power divider Z7. Low pilot signal 2 from COUP output of directional coupler DC3 is sent to power combiner Z6 At power combiner Z6, low pilot signal 2 is combined with high pilot signal 2. High pilot signal 2 (7.25-7.75 GHz) originates at high pilot oscillator Y2 and is developed Identically as low pilot signal 2 From power combiner Z6 the combined pilots signal is applied to monitor subassembly A6 for phase modulation. Monitor subassembly A6 consists of phase modulator Z1 and 7.5 kHz phase modulator driver Z18. The angle of the combined pilots signal sine wave is sinusoidally shifted $\pm$180 deg Phase shifting is by an amount proportional to the instantaneous value of the 7.5 kHz modulating signal. Variable attenuator ATI adjusts the output level of the phase modulated pilots signal in 1 dB steps, from -32 dBm to -51 dBm. Variable attenuator AT1 is used in setting gain fault thresholds. From variable attenuator ATI, the phase modulated pilots signal is fed through directional coupler DC5 to power divider Z4. The bypass pilots from the COUP output of directional coupler DC5 is routed to attenuator AT8. The bypass pilots signal is used during maintenance-bypass mode to set fault threshold levels and to troubleshoot receiver gain monitor HTA-3A6. The OUT 2 output of power divider Z4 is sent through coaxial attenuator AT6 to connector J4. The OUT 1 output of power divider Z4 is sent through coaxial attenuator AT7 to connector J5. Attenuators AT6 and AT7 are fixed attenuators that set the proper levels and provide isolation. From connectors J4 and J5, pilots signals are sent to parametric amplifiers HTA-3A2 and HTA-3A3.

b. Pilot Signal Detection (fig. FO-3, sh 2). After amplification by the downlink amplifiers, IFLA 1 and 2 sample signals from receive interfacility link amplifier HTA-3A8, are received at connectors J6 and J7. Since the flow for both signals is the same, only the IFLA 1 sample signal is discussed. In the normal and maintenance modes of operation, rf transmission line switch S8 routes the IFLA 1 sample signal to power divider Z10. Power divider 710 outputs. downlink 1A and 1B, are applied to mixers Z13 and Z14, respectively. Low pilot signal 1 is divided at power divider Z7 and applied to mixers Z13 and Z14 as low pilot signals 1A and 1B, respectively. Since the mixers function identically, only mixer Z13 and associated signals are discussed. Mixer Z13 is applied is applied, as a phase demodulator, by algebraically adding the unmodulated low pilot 1A signal to the phase modulated downlink 1A signal The level of the demodulated 7.5 kHz gain signal is directly proportional to the gain of the downlink 1A rf signal when the low pilot (reference) signal is held constant. The downlink 1 low pilot 7.5 kHz gain signal is applied to the linear detect and threshold circuits. At the linear detector and threshold card, the downlink 1 low pilot gain is amplified by amplifiers U1 and U3, and U9. PILOT 2 GAIN BALANCE potentiometer R5 controls amplifier gain Differential amplifier U13 and dc amplifier U15 provide additional dc gain and low Impedance drive to the downlink 1 low pilot gain. The downlink 1 low pilot gain is applied to pilot carrier monitor panel 14A26. When selected by receiver gain monitor HtTA-3A6 GAIN BALANCE selector switch S4, the downlink I low pilot gain is applied to GAIN BALANCE meter M1 and to test points TP1 and TP2. The output of de amplifier U15 is also applied to dual comparators U11and U12. Dual comparator U12 compares the downlink I low pilot gain with voltage levels selected by MINOR LOW FAULT THRESHOLDS potentiometer R1 and MINOR HIGH FAULT THRESHOLDS potentiometer R2. A downlink I low pilot minor gain fault signal is generated if the downlink 1 low pilot gain changes $\pm$1 to $\pm$5 dB from nominal gain. Dual comparator U11 compares the downlink I low pilot gain with voltage levels selected by MAJOR LOW FAULT THRESHOLDS potentiometer R3 and MAJOR HIGH FAULT THRESHOLDS potentiometer R4 A downlink 1 low pilot major gain fault signal is generated if the downlink 1 low pilot gain deviates ± 2 to ± 5 dB from nominal gain.

c. Fault Qualification and Autoswitch Functions (fig.FO-3, sh 3). The eight gain fault signals are compared with the delayed IFLA I online signal by gain fault assignment circuits. This comparison qualifies the major or minor gain fault as a major online or offline fault, or a minor online fault. A major gain fault generates gain fault signals, which are routed to system status logic unit 15A5. A minor online gain fault generates a gain alert signal, which is routed to the system status logic unit. These gain faults also light indicators on the receiver gain monitor front panel. Occurrence of an online major gain fault or concurrent online and offline major gain faults enables switch signal generation circuits. When the receiver gain monitor has a summary fault or is in maintenance, gain fault signals to the system status logic unit and switch signal generation circuits are inhibited. Only receiver gain monitor front panel indicators display the gain fault status. Paramp and IFLA unit fault and maintenance status signals from the four downlink amplifiers (via system status logic unit 15A5) are monitored by unit fault/maintenance circuits. These status signals are compared with delayed paramp and offline amplifiers. Unit fault/maintenance circuits generate signals to display amplifier status on receiver gain monitor front panel indicators. These circuits also provide amplifier nonavailability status signals to switch signal generation circuits.

(1) The switch generation circuits generate switch paramp or switch IFLA signals to transfer the available paramp or IFLA online. Switch control generation circuits monitor waveguide switch position signals, summary fault status of the receiver gain monitor, and the auto control signal from system status logic unit 15A5. With an enabling auto control signal and no summary fault in the receiver gain monitor, switch paramp and IFLA signals applied to switch generation control circuits generate switch control signals that position waveguide switches. Switch control signals transfer available equipment online. Switch control generation circuits route delayed paramp and IFLA signals to the fault assignment circuits to prevent returning faulted equipment to the online configuration. Switch control generation circuits also provide signals to light status indicators on the receiver gain monitor front panel.

(2) Fault logic circuits monitor receiver gain status to produce maintenance and fault signals. Pilot detector outputs are compared with reference voltages at comparators U I and U2. When the pilot detector output varies from its preset reference, a pilot fault is routed to the fault logic circuits. Pilot fault signals or the loss of power supply voltage generates a summary fault signal. A summary fault signal inhibits gain fault assignment and switch control generation circuits from switching downlink amplifiers. Fault logic circuits also provide a summary fault signal to light the receiver gain monitor front panel SUMMARY FAULT indicator. When the receiver gain monitor MAINT switch is pressed, the NORMAL switch is disabled, applying a maintenance signal to the fault logic circuits. The maintenance condition also inhibits receiver gain monitor switching of downlink amplifiers. Receiver gain monitor maintenance and fault signals are sent to system status logic unit 1 5A5 as status signals.

d. Sample Signal (fig. FO-3, sh 1). The low pilot sample signal from the COUP output of directional coupler DCI is sent to power divider Z2 where the OUT 2 signal (low pilot monitoring output) appears at connector J8 on the receiver gain monitor HTA-3A6 front panel. When the signal is not monitored, coaxial termination AT2 terminates the signal. The OUT 1 signal from power divider Z2 (low pilot comparison signal) goes to detector CR 1. The low pilot detector output is routed to comparator U2 (sh 3) on the autoswitch control circuit card. At comparator U2, the low pilot detector output is compared with a preset voltage reference level. If oscillator Y1 fails, the fault logic of the autoswitch control card generates a summary fault signal that prevents autoswitching. The high pilot sample signal from directional coupler DC2 is processed identically as the low pilot sample signal.

e. Bypass Operation (fig. FO-3, sh 2). Bypass switch S2 places receiver gain monitor HTA-3A6 in the maintenance-bypass mode of operation. The maintenance-bypass mode is used in troubleshooting and in setting gain fault threshold levels. Pressing BYPASS switch S2 rotates rf transmission line switches S8 and S7. In maintenance-bypass mode, IFLA 1 and 2 sample signals are terminated at terminations ATIO and AT9. The bypass pilots signal is routed through level control attenuator AT8 and applied to power divider Z5. Bypass pilots 1 and 2 from power divider Z5 are switched by rf transmission line switches S8 and S7 to power dividers Z10 and Z9. To set fault threshold potentiometers, the desired dB variation to cause a gain fault is placed in variable attenuator AT1. With the desired gain change in the gain level, the threshold potentiometer is then varied until the gain fault indicator changes state.

SECTION II. CIRCUIT ANALYSIS

2-4. Pilot Carrier Monitor Panel 14A26 Circuit Analysis (fig. 2-1). Pilot carrier monitor panel 14A26 consists of four identical dc meters DOWN LINK 2 HIGH PILOT, DOWNLINK 2 LOW PILOT, DOWNLINK I HIGH PILOT, and DOWNLINK I LOW PII.OT meters (MI through N14) are supplied their respective signals from receiver gain monitor HTA-3A6 through connector J1 Each meter Is zero at center scale and measures up to +6 dB to right of center, and -6 dB to left of center. Meter resolution is better than ±0 2 dB A 1 mA current causes full scale deflection

2-5. Receiver Gain Monitor HTA-3A6 Circuit Analysis (fig. FO-2). Receiver gain monitor IITA-3A6 continuously monitors the gain of the downlink amplifiers. When gain changes exceed preset fault threshold levels, the receiver gain monitor provides major and minor alarm signals to the front panel indicators, routes receiver gain alarm signals to system status logic unit 15A5, and initiates signals to switch offline parametric amplifier HTA3A2 and HTA-3A3 and/or radio frequency amplifier (rf amplifiers HTA-3A8A2 and HTA-3A8A3) on line.

a. Power Distribution (fig. FO-4, sh 1). The 120 V ac power to operate receiver gain monitor HTA-3A6 enters through connector J I, is filtered by rf line filters FL I and FL2, and is applied to terminal boards TBI-I and TBI-2 Terminal board TBI-I routes 120 V ac to circuit breakers CBI, CB2, and CB3. Circuit breaker CBI routes 120 V ac through terminal board TBI-5 to electric blanket heater A8 and fan BI (through thermostatic switch S6). Circuit breaker CB2 applies 120 V ac through terminal board TBI-3 to the -28 V dc power supply. Circuit breaker CB3 applies 120 V ac through terminal board TBI-4 to the +5 and +15 V dc power supplies. The fan and electric blanket heater maintain a controlled operating temperature for the components of the receiver gain monitor. Terminal board TB2 is the distribution point for the dc voltages. From terminal boards TB2-1 and TB2-2, -28 V dc is applied to the circuit cards of detect and qualification module A i (sh 4), and the circuit cards of detect and autoswitch module A2 (sh 5). From terminal board TB2-1, -28 V dc is applied to monitor subassembly A6 (sh 3). The -28 V is also applied through load resistor RI 3 to indicators DSI, DS2, DS3, and DS6 through DSIO In addition, -28 V dc is applied through resistor R13 to BYPASS switch S2-3C for lighting BYPASS indicators when in normally open position, to NORMAL switch S3-2C for lighting NORMAL indicators when in normally open position, and to MAINT indicators of SI when In normally closed position. From terminal board TB2-2, -28 V de is also applied to switches SI-IC, S2-IC, and S3-IC The -28 V dc at switch SI-IC to INC is part of the holding circuit for the coil of switch S3 The -28 V dc at switch S2-IC is applied to either rf transmission line switch S8 in normal and maintenance mode, or to switch S7 in maintenance-bypass mode. The -28 V dc to switch S3-IC is applied to the autoswitch control card (sh 5) when in the normal mode. From terminal board TB2-3, +15 V dc is applied to the circuit cards of detect and qualification module Al (sh 4), and the circuit cards of detect and autoswitch module A2 (sh 5). Terminal board TB2-4 applies +15 V dc to low pilot and high pilot oscillators. From terminal board TB2-5, +5 V dc is applied to detect and qualification module A I fault qualification card (sh 4), and to detect and autoswitch module A2 autoswitch control card (sh 5).

b. Mode Switching (fig. FO-4, sh 2). With power removed from receiver gain monitor HTA-3A6, MAINT switch SI (momentary action) and NORMAL switch S3 (momentary action with holding coil) will be in normally closed position. BYPASS switch S2 (alternate action) can be in either position. After power application, the receiver gain monitor will be in either maintenance or maintenance-bypass modes, depending upon state of BYPASS switch S2. If the BYPASS switch S2 is in maintenance-bypass mode (BYPASS indicator switch lighted) and normal mode is required, pressing BYPASS switch S2 extinguishes the BYPASS indication. Pressing NORMAL switch S3 then causes -28 V dc to be applied through switch contacts SI-IC to INC, S2-2C to 2NC, and S3-3C to 3NO to holding coil LI. The holding coil holds NORMAL switch S3 in the normally open position. The -28 V dc is applied from terminal board TB2IA (sh I) through NORMAL switch contacts S3-2C to 2NO (sh 2) to light the NORMAL indicators. The -28 V dc is applied through contacts S3-IC to 1NO, indicating to the autoswitch control card that normal mode has been selected The receiver gain monitor stays in the normal mode until either MAINT switch SI or BYPASS switch S2 is pressed.

(1) Pressing MAINT switch S1 opens the -28 V dc path for the holding coil of NORMAL switch S3. With -28 V dc removed from its holding coil, NORMAL switch S3 returns to the normally closed position. When MAINT switch SI is released, it returns to the normally closed position, applying -28 V dc to NORMAL switch S3-3C. Since NORMAL switch S3 is now in the normally closed position, the -28 V dc circuit for the holding coil is still broken at contacts S3-3C to 3NO. The -28 V dc at contacts S3-2C is removed from 2NO (extinguishing switch S3 NORMAL indicators) and applied to 2NC (lighting switch S1 MAINT indicators). The -28 V dc at contact S3-1C is removed from INO, indicating to the autoswitch control card that the maintenance mode has been selected.

(2) BYPASS switch S2 can be pressed when in normal mode or maintenance mode. When in the normal mode, pressing BYPASS switch S2 opens the -28 V dc path for the holding coil of NORMAL switch S3 by removing the -28 V dc at contact S2-2C from contact

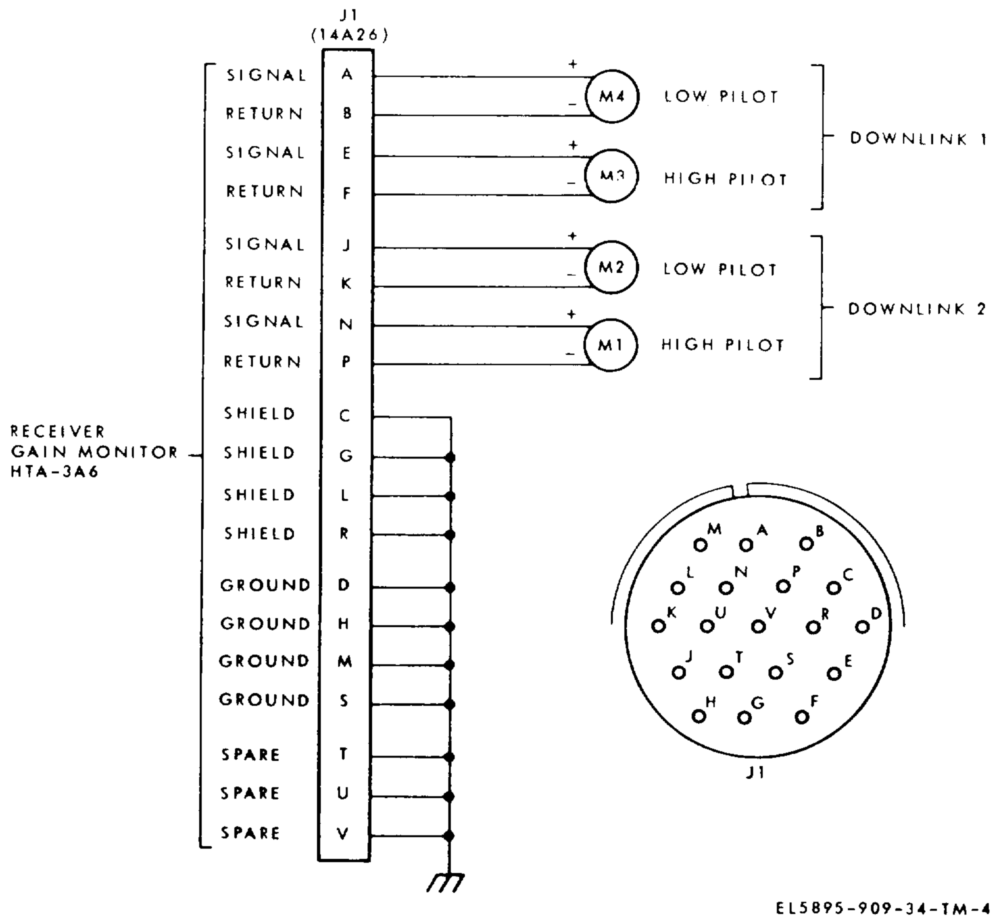


Figure 2-1. Pilot carrier monitor panel 14A26, schematic diagram.

2NC. NORMAL switch S3 returns to the normally closed position as explained when MAINT switch S1 is pressed. BYPASS switch S2 is an alternate action switch, and remains in the normally open position. The -28 V dc at contact S2-3C is applied to contact 3NO and lights the BYPASS indicators of switch S2. The -28 V dc at contact S2-1C is removed from contact INC and applied to contact 1 NO. Contacts S2- INC and S2- 1 NO are connected to rf transmission line switches S8 and S7, respectively (sh 3). In the normal and maintenance modes, the sample signals from the IFLA's pass through switches S8 and S7 to power divider Z10 and Z9. The bypass pilots from power divider Z5 pass through switches S8 and S7 and are terminated in terminations ATO1 and AT9. In the maintenance-bypass mode, the switches rotate so that the IFLA sample signals are terminated in termination ATO1 and AT9, and the bypass pilot pass through switches S8 and S7 to power dividers Z10 and Z9.

c. Pilot Signal Circuit Functions (fig. FO-4). The microwave components, located on the front panel and within receiver gain monitor HTA-3A6 (sh 3), perform the following functions:

(1) Generate, and set the frequency of the low and high pilot signals.

(2) Provide pilot monitoring outputs on the front panel of the receiver gain monitor.

(3) Provide sample signals to the autoswitch control card to determine if the signal level is within prescribed limits.

(4) Provide bypass pilot signals to rf transmission line switches S7 and S8 for use in maintenance-bypass mode for self-test.

(5) Provide phase-modulated pilots to parametric amplifiers HTA-3A2 and HTA-3A3.

(6) Receive IFLA 1 and IFLA 2 sample signals from the receive interfacility amplifier HTA-3A8 and compare them with pilot signals to determine the gain of the downlink amplifiers.

d. Pilot Signal Circuit Operation (fig. FO-4, sh 3). As the signal paths for both the low pilot signal and the high pilot signal are the same. only the low pilot signal is discussed

(1) Application of +15 V dc to low pilot oscillator Y1 generates a low pilot signal In the 7.25 to 7.75 GHz range The exact frequency Is controlled by the respective FREQUENCY control on the front panel of the receiver gain monitor. From the low pilot oscillator, the low pilot signal passes through rf isolator AT4 and rf capacitor, assembly AT13 to directional coupler DC1. The low pilot sample signal from the COUP connector of directional coupler DC1 is fed to power divider Z2 where the signal is divided for comparison and monitoring purposes. The low pilot comparison signal from the OUT 1 connector of power divider Z2 is fed to detector CR1 Detector CR1 converts the power level of the low pilot comparison signal to a voltage level that is sent to the autoswitch control card (sh 5) for comparison purposes The low pilot monitoring output from the OUT 2 connector of power divider Z2 (sh 3) is available at LOW PILOT connector J8 on the front panel of the receiver gain monitor If the signal is not to be monitored, coaxial termination AT2 is used to provide a 50-ohm load The MAIN output of directional coupler DC1 is fed to directional coupler DC3. Directional coupler DC3 Is used to divide the low pilot signal for application to power combiner Z6 and to power divider Z7. Low pilot signal 1 from the MAIN connector of directional coupler DC3 is sent to power divider Z7, which divides the low pilot signal 1 for application to mixers Z13 and Z11

(2) In the same manner, the corresponding high pilot signal Is applied to mixers Z14 and Z12 Low pilot signal 2 from COUP connector of directional coupler DC3 is fed to power combiner Z6, where it is combined with high pilot signal 2 to form the combined pilots signal The combined pilots signal from power combiner Z6 is applied to monitor subassembly A6, consisting of phase modulator Z1 and phase modulator driver Z18. At monitor subassembly A6, modulator driver Z18 generates a 7.5 kH7 modulation signal, which is used to drive modulator Z1 At modulator Z1, the combined pilots signal from power combiner Z6 is modulated and routed to variable attenuator AT1 Variable attenuator AT1, by means of front panel control, adjusts the output level of the phase modulated pilots. Variable attenuator AT1 is used in setting fault threshold levels From variable attenuator ATI, the phase-modulated pilots signal is sent to directional coupler DC5, which provides a bypass pilot signal (taken from COUP connector) for use in the maintenance-bypass mode From the MAIN connector of directional coupler DC5, the phase modulated pilots signal is fed to power divider Z4. At power divider Z4, the phase modulated pilots signal is divided and applied through attenuators AT6 and AT7 to connectors J4 and J5, respectively.

e. Signal Comparison Circuits (fig. FO-4, sh 3). Connectors J6 and J7 are input connectors to receiver gain monitor HTA-3A6 and receive the IFLA 1 and IFLA 2 sample signals from rf amplifier HTA-3A8A2 and HTA-3A8A.3. Since the processing of these two signals is the same, only the signal path for low pilot from rf amplifier 1 HTA-3A8A2 (downlink 1) is discussed in detail.

(1) From connector J6, the downlink 1 signal is fed to rf transmission line switch S8 Rf transmission line switches S8 and S7 are controlled with BYPASS switch S2 (sh 2) on the front panel of the receiver gain monitor. The other input to rf transmission line switch S8 (sh 3) is the bypass pilots signal, which originates at the COUP connector of directional coupler DC5 From directional coupler DC5, the bypass pilot signal passes through attenuator AT8, where proper signal level is set, to power divider Z5 where it is divided and routed to rf transmission line switches S8 and S7. On figure FO-4, sheet 3, the two rf transmission line switches are shown as they are before power is applied to the receiver gain monitor. When power is applied to the receiver gain monitor, -28 V dc is applied through BYPASS switch S2 (sh 2) to either rf transmission line switch S7 or S8. With -28 V dc applied to rf transmission line switch S8 (MAINTENANCE and NORMAL modes), the switch rotates 90 degrees. In this position, the bypass pilots are terminated in terminations AT10 and AT9, and the IFLA 1 and IFLA 2 sample signals from the rf amplifiers are applied to power dividers Z10 and Z9.

(2) In the MAINTENANCE-BYPASS mode, -28 V dc is removed from rf transmission line switch S8, causing the switch to rotate back to the position shown, and -28 V dc is applied to rf transmission line switch S7, causing the switch to rotate 90 degrees from the position shown. In the MAINTENANCE-BYPASS mode, the IFLA 1 and IFLA 2 sample signals from the rf amplifiers are terminated in terminators AT10 and AT9, and the bypass pilots are applied to power dividers Z10 and Z9. The signal from rf transmission line switch S8 to power divider Z10 is split for application to mixers Z13 and Z14. Mixer Z13 has two inputs; the downlink 1A signal, which is the phase modulated pilots from rf amplifier 1 HTA-3A8A2, and low pilot signal 1A, which is the low pilot signal from the low pilot oscillator. At each mixer, the phase of the amplified pilot sample signal is compared with the reference signal from oscillator Y1 or Y2. A mixer output represents the phase difference of the unmodulated (reference) pilot signal and the phase modulated pilot signal of the same frequency. Since the output level of a pilot oscillator is constant, the amplitude of a mixer output indicates the gain provided by the downlink 1 or 2 amplifiers. The resulting outputs from the four mixers are analog signals at a 7.5 kHz rate, which represent the amplified low pilot signal from downlink 1, the amplified high pilot signal from downlink 1, the amplified low pilot from downlink 2, and the amplified high pilot from downlink 2. These analog signals are applied to identical threshold detect circuits in the two linear detect and threshold circuit card assembly A (linear detect and threshold card).

***f. Monitor Subassemblies A1 and A2 (fig. FO-4, sh 4.5*).** Each monitor subassembly contains two printed circuit cards A1 and A2. POWER SUPPLY MONITOR meter M2 and selector switch S5, located on receiver gain monitor HTA-3A6 front panel, and connector J2 are shown on figure FO-4, sheet 4. POWER SUPPLY MONITOR meter M2 and selector switch S5 are used to monitor voltage level of power supplies PS1, PS2, and PS3. Monitor subassembly Al contains fault qualification card A2 and linear detect and threshold card A1 associated with downlink 1 amplifiers. GAIN BALANCE meter M1, selector switch S4, test points TP 1 and TP2, and downlink 1 and 2 adjustment potentiometers R1 through R2 are shown on sheet 5. Connector J3 and monitor subassembly A2 are also shown. GAIN BALANCE meter M1 displays gain of the respective pilot selected by selector switch S4 (position 5 through 8). Selector switch S4 also selects voltage levels for monitoring at test points TP1 and TP2. Potentiometers R1 through R4 and R9 through R12 set levels for gain fault thresholds. Potentiometers R5 through R8 are used to set levels of pilot gain signals. Monitor subassembly A2 contains autoswitch control card A2 and linear detect and threshold card A1 associated with downlink 2 amplifiers.

2-6. Linear Detect and Threshold Card Circuit Analysis (fig. FO-5). There are two linear detect and threshold cards A1A1 and A2A1 within the receiver gain monitor HTA-3A6. As both linear detect and threshold cards are identical, only the card located in monitor sub- assembly Al and associated with downlink 1 amplifiers is discussed. The main function of the linear detect and threshold card is to provide an alarm when the low pilot or high pilot signal exceeds preset levels.

a. The downlink 1 low pilot gain input at connector J2-A1 is amplified by operational amplifiers U1 and U3. The output of amplifier U3 is developed across a load consisting of resistors R25 and R27 and DOWNLINK 1 PILOT 2 GAIN BALANCE potentiometer R5 (located on the receiver gain monitor front panel, fig. FO-4, sh 5) before application to amplifier U9. Potentiometer R5 adjusts the gain balance input to operational amplifier U9. The output of amplifier U9 is clamped at approximately -1V, and then peak detected by capacitor C37, and diodes CR3 and CR14. The peak detector output is filtered by filter network consisting of resistors R59, R63, and R72, and capacitor C42, and the resulting dc level is routed to amplifier U 13. Thermistor R53 is used to compensate for temperature changes to provide circuit stability.

(1) Potentiometers R62 and R74 are used in adjusting the feedback applied to amplifier U13 The downlink 1 low pilot signal is amplified by amplifier U13 and applied to linear current amplifier U15, which provides additional dc gain and a low impedance drive. Zener diodes CR16 and CR17 limit the voltage (from +5.1 to -2.7 V dc) applied to amplifier UL15. The downlink 1 low pilot output of amplifier UI5 Is applied to the pilot carrier monitor panel from connector J1-8 (low pilot remote meter) and, when selected by the GAIN BALANCE selector switch S4, to the front panel test points from connector J6-20 and to the GAIN BALANCE meter M1 from connector J6-19. The downlink 1 low pilot signal from amplifier U 15 is also applied to dual comparators U12 and U11. Dual comparators U12 and U11 compare the downlink 1 low pilot signal with fault threshold levels set by potentiometers R1 through R4 located on the receiver gain monitor front panel. The voltage levels selected by MINOR LOW FAULT THRESHOLDS potentiometer R1 and MINOR HIGH FAULT THRESHOLDS potentiometer R2 are amplified by amplifiers U7 and U8 before being applied to comparator U12. One side of comparator U12 compares the low pilot signal with the minor low fault threshold level. The other side of comparator U12 compares the low pilot signal with the minor high fault threshold level. Zener diodes CR9 and CR10 and zener diodes CR11 and CR12 are used to limit the signals (±3.9 V de) to be compared at dual comparator U12.

(2) If the low pilot signal from amplifier U 15 exceeds the minor fault levels, a low pilot minor gain fault signal is generated in dual comparator U12 and sent through connector J2-6 to the fault qualification card. Dual comparator U11 compares the low pilot signal from amplifier U15 with major low fault threshold and major high fault threshold levels from potentiometers R3 and R4 after amplification by amplifiers U5 and U6. Amplifier U11 generates a low pilot major gain fault signal if the low pilot exceeds the major fault levels.

b. In the same manner, the downlink 1 high pilot enters the linear detect and threshold card at connectors J2-A2 and is amplified by amplifiers U2, U4, U10, U14 and U16. Like amplifier U15, the output of U16 is applied to monitoring points and is sent to dual comparators U18 and U17. Voltage levels from potentiometers R I through R4 on the front panel are also applied to dual comparators U18 and U17, and are compared with the downlink 1 high pilot signal. The outputs from comparators U18 and U17, which are generated when the downlink 1 high pilot exceeds the fault threshold levels, are the high pilot minor gain fault and the high pilot major gain fault. The four gain fault signals are routed to the fault qualification card. Zener diode CR1 is used to regulate the voltage applied to low fault threshold potentiometers R1 and R3 to -6.5 V de. Zener diode CR2 is used to regulate the voltage applied to high fault threshold potentiometers R2 and R4 to +12.28 V dc

2-7. Fault Qualification Card Circuit Analysis (fig. FO-6). Fault qualification card A1A2 generates switch paramp and/or switch IFLA signals. These signals are sent to the autoswitch control card to initiate switching of parametric amplifiers HTA-3A2 and HTA-3A3 and/or rf amplifiers HTA-3A8A2 and HTA-3A8A3. The fault qualification card provides online and offline receiver gain fault, and online receiver gain alert signals to system status logic unit 15A5. Fault qualification card circuits also provide signals to light the two MIN (minor) and two MAJ (major) alarm lights and two PARAMP MAINT/FAULT and two IFLA MAINT/FAULT lights on receiver gain monitor HTA-3A6 front panel.

a. Status Signals. In generating switch paramp and/or switch IFLA signals, the fault qualification card monitors the following status signals:

(1) Receiver gain monitor summary fault or maintenance signal at connector J5-11.

(2) The four major and four minor pilot gain fault signals at terminals 24 and 25 of connector J3, terminals 8, 9, 10, I 11, 13 and 14 of connector J4.

(3) The four maintenance and four unit fault signals from the downlink amplifiers at terminals 2, 4, 10, 12, 14, 16, 20, and 23 of connector J3.

(4) The delayed IFLA 1 online and delayed paramp 1 online signals at terminals 8 and 18 of connector J3. Delayed online signals maintain the online or offline status of the 1 FLA and parametric amplifier after generation of switch control signals. Delay is maintained to allow waveguide switches to change position and prevent generation of erroneous switch control signals that would switch the faulted equipment back on line.

b. Receiver Gain monitor Summary Fault or Maintenance Signal (fig. FO-6, sh 2). The receiver gain monitor summary fault or maintenance signal inhibits generation of the online and offline receiver gain fault, online receiver gain alert, and the switching signals when the re- ceiver gain monitor HTA-3A6 is in the maintenance mode of operation or has a summary fault. The receiver gain monitor summary fault or maintenance signal received at terminal 11 of connector J5 is a logic 0 (0 V dc) when the receiver gain monitor is in the normal mode of operation and a summary fault does not exist In this condition, the logic 0 at terminal 11 of connector J5 is inverted to a logic 1 (+5 V dc) by inverters U13-2, U13-4, and U13-6 Logic 1 allows the online and offline gain fault and online minor gain fault signals through NAND gates U15-3, U15-6, and U15-8 to generate the switch signals and receiver gain fault and alert signals. When the maintenance mode Is selected or a summary fault occurs, the receiver gain monitor summary fault or maintenance signal becomes a logic 1 This logic 1 is inverted to a logic 0 by inverters U13-2, U13-4, and U13-6 Logic 0 inhibits generation of the switching signals and receiver gain alert signals at NAND gates U15-3, U15-6, and U15-8.

c. Downlink Gain Fault Signals. The downlink gain fault signals signify that the gain level has exceeded a preset fault threshold level. The linear detect and thresh- old cards make this determination and route a logic 1 (+5 V de) to the fault qualification card when a gain fault occurs. A downlink I major gain fault in the low pilot causes a logic 1 at jack J3-24. This logic 1 is inverted to a logic 0 (0 V dc) by inverter U2-6. NOR gate U5-3 becomes a logic 1, indicating a downlink 1 major gain fault, as a result of either a low pilot fault or a high pilot fault. NOR gates U5-6. U5-8, and US-11 become a logic I as a result of downlink 2 major gain fault, downlink 1 minor gain fault, and downlink 2 minor gamin fault, respectively These four gain faults are inverted by inverters U32-2, U32-4, U32-10 and U32-12, causing transistors Q8, 9, 10, and 11 to conduct. When these four transistors conduct, the two MAJ (major) and two MIN (minor) FAULT THRESHOLD ALARM indicators on receiver gain monitor HTA-3A6 front panel are lighted.

(1) At this point it is not known if the faults at NOR gates U5-3, U5-6, U5-8, and U5-11 are online or offline gain faults. The gain fault is compared with delayed IFLA 1 online signal to determine if a gain fault is online or offline. The delayed IFLA 1 online signal at jack J3-8 (sh 1) is a logic 1 when IFLA 1 is online, and a logic 0 when IFLA 2 is online. When IFLA 1 is online, and a downlink 1 major gain fault occurs, NAND gates U 10-13 and U 10-12 (sh 2) both will be a logic 1. In this condition, NAND gate U10-11 becomes a logic 0, causing NOR gate U 10-8 to become a logic 1. If IFLA 2 is online (logic 0 at jack J3-8) inverter U10-3 applies a logic 1 to NAND gate U10-4. When a downlink 2 major gain fault occurs, a logic 1 is applied to NAND gate U10-5. With a logic 1 on both input pins, NAND gate U 10-6 becomes a logic 0 and causes NOR gate U 10-8 to become a logic 1. A logic 1 at NOR gate U10-8 represents an online major gain fault. When IFLA 1 is online, a logic 1 is applied to NAND gate U11-2. A downlink 2 major gain fault applies a logic 1 to NAND gate U 11-1. With a logic 1 on the input pins, NAND gate U11-3 becomes a logic 0, causing NOR gate U11-6 to become logic 1. When IFLA 2 is online and a downlink 1 major gain fault occurs, inverter U 10-3 applies a logic 1 to NAND gate U 11-9 and a logic 1 is applied to U11-10. With a logic 1 on both input pins, NAND gate U11-8 becomes a logic 0, causing NOR gate U11-6 to become a logic 1. A logic 1 at negated-input OR gate U11-6 represents an offline major gain fault. A logic 1 at NOR gate U12-8 represents an online minor gain fault.

(2) There is no logic to recognize an offline minor gain fault. If the receiver gain monitor does not have a summary fault and is not in the maintenance mode, a logic 1 is applied to NAND gate U15-1. In this condition, an online major gain fault causes NAND gate U15-3 to become a logic 0. A logic 0 on pin 13 causes inverter U13-12 to become a logic I. A logic I at inverter U 13-12 causes inverter U25-11 to become a logic 0 and transistor Q1 conducts. When transistor Q1 conducts, relay K2 operates, sending an online receiver gain fault signal to the system status logic unit 15A5. Identical circuitry sends offline receiver gain fault and online receiver gain alert signals to the system status logic unit as a result of an offline major gain fault and online minor gain fault, respectively.

(3) In addition to generating receiver gain status signals, offline major gain fault signals initiate switching action. With no offline major gain fault, NOR gate U1 1- 6 is a logic 0. This logic 0 through NAND gate U 15-6 and inverter U 13- 10 causes the online and offline major gain fault at NAND gate U19-3 to remain a logic 1. The online and offline major gain fault at NAND gate U19-3 is a logic 0. When an online major gain fault and an offline major gain fault occur both apply a logic I to the input pins. With only an online major gain fault, the online and offline major gain fault signal at NAND gate U 19-3 will be a logic 1. This logic I at NAND gate U19-3 through inverter U19-6, NAND gate U23-6, and inverter U23-8 applies a logic 0 at NAND gates U28-9 and U28- 5. With a logic 0 at the input gates, switching of parametric amplifiers HTA-3A2 and HTA-3A3 and IFLAs HTA-3A8A2 and HTA3A8A3 is not allowed at NAND gates U28-8 and U28-6. The logic 1 at NAND gate U19- 3 (no offline major gain fault) is applied through inverters U19-6 and U25-3 and causes NAND gate U25-4 to re- main a logic I. An online major gain alert, logic 1 at NOR gate UIO-8, through NAND gate U15-3 and inverter U13-12, applies a logic 1 to NAND gate U25-5. An online major gain fault and no offline major gain fault cause NAND gate U25-6 to become a logic 0. This logic 0 is inverted by U25-8 and is applied as a logic 1 to NAND gates U29-5 and U29-9. When an online major gain fault occurs but offline gain is normal, switching of parametric amplifiers and/or IFLA's will occur through NAND gate U29-6 and/or U29-8. When an online and an offline major gain fault occurs, the online and offline major gain fault signal at NAND gate U19-3 will become a logic 0. This logic 0 through inverters U19-6 and U25-3 will apply a logic 0 to NAND gate U25-4 and prevent the online major gain fault (logic 1 at NAND gate U25-5) from allowing switching through NAND gates U29-5 and U29-9 The logic 1 at inverter U19-6 is applied to NAND gate U23-5.

(4) The logic that determines the state of NAND gate U23-4 is discussed in subparagraph ***d*** below, but for this discussion it is assumed that the conditions that inhibit switching are not present, and NAND gate U23-4 is a logic 1. With both input pins at a logic 1 level, NAND gate U23-6 becomes a logic 0. This logic 0 is inverted and a logic I is applied to NAND gates U28-9 and U28-5. With a logic 1 on NAND gates U28-9 and U28-5, the input at NAND gates U28-10 and U28-4 determine if the parametric amplifier or IFLA will be switched.

d. Downlink Amplifier Status Signals. The maintenance and unit fault status of the downlink amplifiers are routed to the fault qualification circuit card. When rf amplifier HTA-3A8A2 (IFLA 1) is placed in maintenance, a logic I appears at jack J3-2. This logic I is inverted by inverter Ul-2 and is applied as a logic 0 to NOR gate U4-1 If IFLA 1 has a unit fault, the logic 1 at jack J3-4 is inverted by inverter UI-4 and applied as a logic 0 to NOR gate U4-2. Thus, when IFLA 1 is placed in maintenance or has a unit fault, NOR gate U4-3 be- comes a logic 1. In the same manner NOR gates U4-6, U4-8, and U4-11 become a logic 1 when IFLA 2, para- metric amplifier 1, and parametric amplifier 2. respectively, are placed in maintenance or develop a unit fault. These four conditions cause the appropriate NIAINT/ FAULT indicators to be lighted. When a downlink amplifier is in maintenance, or has a unit fault, it is considered not available for online use. The logic for determining whether the unavailable amplifier is online or offline is the same as the logic that determines if a major gain fault is online or offline as discussed In subparagraph c above. NOR gates U6-8, U7-6, U8-8 and U9-6 become a logic 1 if online IFLA, offline IFLA, online paramp, and offline paramp, respectively. are not avail- able.

(1) As explained in subparagraph c above, when a major gain fault occurs in the online amplifiers but not in the offline amplifiers, switching is inhibited through NAND gates U28-8 and U28-6. However, switching is allowed through NAND gates U29-6 and U29-8. Since there is no offline major gain fault, it would be desirable to switch both offline parametric amplifier and offline IFLA online. Assume an online major gain fault and neither offline amplifier has a unit fault or is in maintenance (both available). An online major gain fault causes a logic 1 at NAND gates U29-5 and U29-9. Since both offline parametric amplifier and offline IFLA are available, NOR gates U9-6 and U7-6 are a logic 0 The logic 0 at NOR gate U9-6 (offline paramp available) through inverter U26-8 is applied as a logic I to NAND gate U26-5. The logic 0 at NOR gate U7-6 (offline IFLA available) holds a logic 1 at NAND gate U16-8 regardless of the logic level at pin 9 (availability of online 1 FLA) The logic 1 from NAND gate U16-is applied to NAND gate U26-4. With a logic 1 on both input pins, NAND gate U26-6 is a logic 0 and inverter U29-11 is a logic 1. With logic 1 at pins 10 and 9, NAND gate U29-8 becomes a logic 0 and NAND gate U30-3 a logic I. Through identical logic, the availability of the offline paramp and IFLA (logic 0 at NOR gates U9-6 and U7-6) causes NAND gate U30-6 to be a logic 1. Logic 1 at NAND gates U30-3 and U30-6 route switch parametric amplifier and switch IFLA signals to the autoswitch control card. In the situation where an offline and online major gain fault occur, switching is not allowed at NAND gates U29-6 and U29-8, but is allowed at NAND gates U28-8 and U28-6 if not inhibited at NAND gate U23-4. There are five conditions listed in table 2-1 that will inhibit switching at NAND gate U23-4.

(2) If all amplifiers are available (logic 0 at NOR gates U6-8, U7-6, U8-8, and U9-6), the outputs from inverters U14-2, U14-4, U14-6, and U14-8 will be logic 1. Inverted-input OR gates will apply logic 0 to inverters U18-2 and U18-4, which, in turn, apply logic 1 to NOR gate U20-3. With a logic 0 at NOR gate U20-3, NAND gate U21-8 is held at logic 1 and inverter U23-3 at logic

0. The logic 0 on pin 4 holds NAND gate U23-6 at a logic 1 and Inverter U23-8 at logic 0. With logic 0 on pins 5 and 9 of NAND gates U28-6 and U28-8, switching is inhibited. If at least one of the amplifiers is not available, NAND gate U21-9 will be a logic 1. NAND gate U21-10 is a logic 0 if one of the other four conditions that prevent autoswitching is present. One of these conditions is that both online IFLA and offline IFLA are not available. When this occurs, input pins 9 and 10 become a logic 1, and NAND gate U16-8 is a logic 0. This logic 0 causes NOR gate U20-6 to become a logic 1, inverter U22-3 a logic 0, and NOR gate U22-11 to be a logic 1. NOR gate U22-11 will also be a logic 1 as a result of both online amplifiers not available, both offline amplifiers not avail- able, and both parametric amplifiers not available (logic 0 at NOR gates U16-11, U17-3, and U17-6).

(3) If none of the five conditions that prevent autoswitching are present, NAND gate U21-8 will be a logic 0 and apply a logic 1 to NAND gate U23-4. When an online and offline major gain fault (logic 1 at NAND gate U23-5) occur, NAND gate U23-6 will be a logic 0, inverter U23-8 a logic 1, and NAND gates U28-9 and U28-5 a logic 1. With NAND gates U28-9 and U28-5 at logic 1 level, switching depends upon the inputs from NOR gates U28-11 and U28-3. Assume an online and offline major gain fault, a unit fault in the online parametric amplifier, and offline IFLA in maintenance. Under these conditions, NOR gates U6-8, U7-6, U8-8, and U9-6 will be a logic 0, 1, 1, and 0, respectively. As none of these inhibit switching, NAND gates U28-9 and U28- 5 will be a logic 1. The logic 1 at NOR gates U7-6 and U8-8 are inverted by inverters U27-2 and U27-4 and a logic 0 is applied to NOR gates U28-13 and U28-12. NOR gate U28-11 applies a logic 1 to NAND gate U28- 10. NAND gate U28-8 becomes logic 0 causing NOR gate U30-3 to become a logic 1. This logic 1 is sent to the autoswitch control card as the switch parametric amplifier signal. Table 2-1 lists the automatic switching per- formed by the receiver gain monitor HTA-3A6 under different conditions of amplifier availability.

Table 2-1. Receiver Gain Monitor HTA-3A6 Autoswitching Conditions

Major gain fault		Paramp/IFLA availability				Automatic switching
Online amplifiers	Offline amplifiers	Online paramp	Online IFLA	Offline paramp	Offline IFLA	
Yes	No	NE	NE	Yes	Yes	Switch IFLA and paramp
Yes	No	NE	Yes	Yes	No	Switch paramp
Yes	No	Yes	NE	No	Yes	Switch IFLA
Yes	No	NE	NE	No	No	No switch
Yes	No	NE	No	Yes	No	No switch
Yes	No	No	NE	No	Yes	No switch
Yes	Yes	No	Yes	Yes	NE	Switch paramp
Yes	Yes	NE	Yes	Yes	No	Switch paramp
Yes	Yes	Yes	No	NE	Yes	Switch IFLA
Yes	Yes	Yes	NE	No	Yes	Switch IFLA
Yes	Yes	NE	NE	No	No	No switch
Yes	Yes	NE	No	Yes	No	No switch
Yes	Yes	No	NE	No	Yes	No switch
Yes	Yes	No	No	Yes	Yes	No switch
Yes	Yes	Yes	Yes	Yes	Yes	No switch

NE – No effect on automatic switching performed

2-8. Autoswitch Control Card Circuit Analysis (fig. FO-7).

a. Autoswitch control card A2A2 generates the signals that control the position of waveguide switches HTA-3S1 and 3S2 and rf transmission line switch HTA-3A8A4S1 associated with the downlink amplifiers. The inputs to the autoswitch control card are the three power supply voltages, maintenance status indication from the NORMAL switch on receiver gain monitor HTA-3A6 front panel, outputs of the low and high pilot detectors, auto control signal from system status logic unit 15A5, status of the two waveguide switches and the rf transmission line switch associated with the downlink amplifiers, and the switch paramp and switch IFLA signals from the fault qualification card. The outputs from the autoswitch control card include eight status signals to lamps on the front panel, two status signals (receiver gain monitor maintenance and receiver gain monitor fault) to the system status logic unit 15A5, three status signals (delayed status of waveguide switch number 1 HTA-3S1, delayed status of the rf transmission line switch HTA-3A8A4S1, and receiver gain monitor summary fault or maintenance status) to the fault qualification circuit card, and a pair of control signals to each of the two waveguide switches and the rf transmission line switch.

b. The high and low pilot detector outputs enter the autoswitch control card at connectors J4-A1 and J4-A2, and are applied to comparators U1 and U2, where the signal level is compared with preset reference levels deter- mined by potentiometers R5 and R 1. If the high pilot or low pilot signal levels exceed these preset reference levels, the outputs from comparators U1 and U2 cause the high and low pilot FAULT indicators DS9 and DS10 to light. The outputs of comparator U1 and U2 are also applied through inverters U3-4 and U3-2 to NOR gate U4-8, where a high or low pilot fault causes transistor Q10 to stop conducting. Transistor Q10 is one of four transistors in series in the ground side of relay K2. Transistors Q8, Q9, and Q11 stop conducting as a result of loss of the + 15, +5, and -28 V dc power supplies, respectively. When the ground side of relay K2 is opened, -28 V dc is removed from the A2 terminal of relay K3 (used for switching the waveguide switches and rf transmission line switch) and applied to SUMMARY FAULT lamp DS5 on the front panel, and receiver gain monitor fault status is sent to the system status logic unit 15A5 from jacks J5-13 and J3-14. When transistors Q8 through Q11 stop conducting as a result of a summary fault, the junction of transistor Q8 and resistor R33 is no longer at ground, but at a -28 V dc level, which causes transistor Q12 to stop conducting. When transistor Q12 stops conducting, NAND gate U4- 13 becomes a logic 0. Pin 12 of NAND gate U4 becomes a logic 0 when NORMAL switch S3 on front panel is not activated (MAINT switch SI lighted). Thus NAND gate U4- I 1 sends a logic 1 signal to the fault qualification card in the event of a summary fault, or if the receiver gain monitor is in the maintenance mode.

c. Being in the maintenance mode also restores relay K1, opening contacts B2 and B1 and provides a maintenance signal to system status logic unit 15A5 indicating that the receiver gain monitor is in the maintenance mode. The auto control signal entering at connector J4-9 (fig. FO-7, sh 2) from the AUTO/MANUAL switch on fault and system status panel 14A16 via system status logic unit 15A5 blocks the generation of a switch signal at NAND gate U7-6 (fig. FO-7, sh 1) by holding this pin at a logic 1 when the manual mode is selected. The auto control signal, when in the manual mode, also causes relay K3 to restore, removing the -28 V dc that would have switched the waveguide switches, and applying -28 V dc to the MANUAL CONTROL AT CONSOLE lamp DS4 to indicate that the downlink amplifiers are under manual control at fault and system status panel 14A16. The switch paramp and switch IFLA signals from the fault qualification card enter the autoswitch control card at connectors J5-8 and J5-9 (fig. FO-7, sh 2). NAND gates U15-3, U15-6, U15-8, U15-11 and U16-8 extend the time that the switch paramps and switch IF- LAs signals are active so that the waveguide switches, or waveguide switch and rf transmission switch, affected will have time to complete their rotation. Either switch paramps or switch IFLAs signal from the fault qualification card will cause NOR gate U5-3 (fig. FO-7, sh 1) to go to a logic 1 and initiate the switching action, if the signal at NAND gate U7-5 indicates that the receiver gain monitor is in automatic mode (logic 1).

d. There are only two signals (switch paramps and switch IFLAs) to control the two waveguide switches and the rf transmission line switch in the downlink amplifiers. If both offline amplifiers are to be switched online, both switch paramps and switch IFLAs signals are active, operating relays K4 and K6 (fig. FO-7, sh 2), and causing waveguide switch HTA-3S1 and the rf transmission line switch to operate. If only the parametric amplifier or the rf amplifier is to be switched, inverters U6-6 (fig. FO-7, sh 1) and U6-4 NOR gate U7-11, and NAND gates U7-8, U7-3 cause relay K5 (sh 2) to operate along with either relay K4 or K6. Thus, if only the parametric amplifier is to be switched, waveguide switches HTA-3SI and HTA-3S2 operate; if only the rf amplifier is to be switched, waveguide switch S2 and the rf transmission line switch operate. The paramp I online, SW 2 THRU POS, and IFLA 1 online signals from the downlink wave- guide switches are applied to similar circuits (with two exceptions) on the autoswitch control card, and only the paramp 1 online signal is discussed.

e. The two exceptions mentioned are that the SW 2
THRU POS signal does not have a status indication on the receiver gain monitor front panel, and a delayed status signal is not sent to the fault qualification card as is the case with the paramp 1 online and IFLA 1 online signals. The paramp 1 online signal is applied to inverter U11-3 and NAND gate U10-13. The other input to this circuit appears at inverter U11-1 and is generated at monostable multivibrator U8-6. This signal also operates relay K4 and applies -28 V dc through relays K2, K3, K4, and K7 to waveguide switch S1. As soon as the waveguide switch begins rotation, the status back to the receiver gain monitor is changed and would change the state of relay K7 but for the fact that the switch signal input to inverter U11-1 does not allow relay K7 to change until the waveguide switch has finished rotating to its new position.

Therefore, the status signal from NAND gate U10-8 is named delayed paramp 1 online. The signals from relays K7, K8, and K9 light the appropriate status lamps, and cause waveguide switches S1 and S2 and the rf transmission line switch to configure the desired paramp and rf amplifier online.

2-9. 28 V DC Power Supply HTA-3ASPS1 Circuit Analysis (fig. FO-8). The 28 V dc power supply provides a regulated 28 V dc output at 6 A and contains protective circuits for overcurrent conditions. The 28 V dc power supply consists of an ac input circuit, a bias supply, a main rectifier, and a series voltage regulator circuit.

a. AC Input Circuit. Single phase 120 V ac input power is applied through fuse Fl and thermostat SI to transformer TI Fuse Fl protects the ac input circuit. Thermostat S I opens to protect the supply if overheating occurs, and resets automatically when the overtemperature condition is eliminated. Transformer TI, which contains two secondary windings, steps down the input voltage for application to the main and auxiliary rectifiers.

b. Bias Supply. The bias supply, consisting of halfwave auxiliary rectifier CR7, filter capacitor C7, and zener diode regulator CR6, provides operating voltage for error amplifiers Q1 and Q2 and current limit amplifier Q3. Zener diode CR I and resistor R5, which are connected across the bias supply, provide a regulated, temperature compensated reference voltage. Resistor R4 compensates for input voltage variations.

c. Main Rectifier. The main rectifier consists of bridge rectifiers CR8 through CR11 and filter capacitor C8. Bridge rectifiers CR8 through CRII perform full-wave rectification of the ac voltage from transformer T1 to provide a dc voltage that is filtered by capacitor C8. The filtered dc voltage is applied to series regulators Q8 through Q13.

d. Series Voltage Regulator Circuit. The voltage regulator circuit regulates the dc output voltage and provides overcurrent protection. The series voltage regulator circuit is composed of error amplifiers Q1 and Q2, current limit amplifier Q3, drivers Q5 and Q6, and series regulators Q8 through Q13. Series regulators Q8 through Q13 receive the dc voltage from the main rectifier and control the output by presenting a variable impedance in series with the load. The regulated 28 V dc output is taken across pins 6 and 4 of terminal board TBI. The dc output voltage is adjustable from 26.6 to 29.4 V dc by potentiometer R1. Series regulators Q8 through Q13, which regulate the dc output voltage to the adjustable value established by potentiometer R1, are controlled by signals derived from error amplifiers Q1 and Q2 and current limit amplifier Q3. Error amplifier Q1 and Q2 provide the control signal under normal load conditions, and current limit amplifier Q3 provides the control signal during overload conditions.

(1) Normal load regulation. Operation of the series regulator circuit is determined by changes in the output voltage. A change in the output voltage is sensed by sensing divider resistors R2 and R3 and potentiometer R1, which compare output voltage with the +S reference voltage. The +S reference voltage is established by zener diode CRI and resistor R5. Comparison of the output voltage with the +S reference voltage produces an error voltage at the junction of resistors R2 and R3, which is amplified by error amplifiers Q1 and Q2 and is current amplified by drivers Q5 and Q6. The corresponding change in driver Q6 emitter current drives the emitter-base junctions of series regulators Q8 through Q13. This action increases the emitter-to-collector voltage drop of series regulators Q8 through Q13 to decrease the output voltage if the output voltage has increased, and decreases the emitter-to-collector voltage drop to increase the out- put voltage if the output voltage has decreased.

(2) Overcurrent operation. In the event of a large increase in load current, current limit amplifier Q3 takes over regulation control at a specific point and effectively current-regulates the output. Operation of current limit amplifier Q3 is controlled by a preset voltage reference applied to the base junction and a voltage applied to the emitter junction, which is proportional to output load current. The preset voltage reference is developed by the voltage divider composed of potentiometer R17 and resistor R18. The current limit value is determined by the setting of potentiometer R17. The output load current is sampled by resistor R25, which is in series with the output current path. Under normal load conditions, current limit amplifier Q3 is held at cutoff by the preset reference voltage. A large increase in load current produces in- creased forward bias for Q3, developed by resistor R25, and at a specific point, overcomes the preset voltage reference, at which time Q3 conducts. Conduction of current limit amplifier Q3 results in decreased conduction of drivers Q5 and Q6 Decreased conduction of drivers Q5 and Q6 causes a less positive potential to be developed across resistor R23 and, consequently, a reduction in the forward bias of series regulators Q8 through Q13. As a result, the emitter-impedance of Q8 through Q13 is increased, reducing the output voltage lower than the initial drop due to the overload, effectively limiting the output current to a safe value. When operating conditions approach short circuit, the output voltage decreases. Since the voltage determined by potentiometer R17 and resistor R18 is proportional to the output voltage, current limit amplifier Q3 is successively biased to turn on at lower and lower load currents as the output voltage decreases. This action permits current limit amplifier Q3 to turn on at lower and lower load currents until the output voltage decreases to zero and current decreases to a predetermined low value.

2-10. 15 V DC Power Supply HTA-3ASPS2 Circuit Analysis (fig. FO-9). The 15 V dc power supply provides a regulated 15 V dc output at 3.5 A and contains protective circuits for overcurrent conditions. The 15 V dc power supply consists of an ac input circuit, a bias supply, a main rectifier, and a series voltage regulator circuit.

a. AC Input Circuit. Single-phase, 120 V ac input power is applied through thermostat S1 to transformer T1. Thermostat SI opens to protect the supply if over- heating occurs and resets automatically when the over-temperature condition is eliminated. Transformer T1, which contains two secondary windings, steps down the input voltage for application to the main and auxiliary rectifiers.

b. Bias Supply. The bias supply, consisting of half- wave auxiliary rectifier CR7, filter capacitor C7, and zener diode regulator CR6, provides operating voltage for error amplifiers QI and Q2 and current limit amplifier Q3. Zener diode CR1 and resistor R5, which are connected across the bias supply, provide a regulated, temperature compensated, reference voltage. Resistor R4 compensates for input voltage variations.

c. Main Rectifier. The main rectifier consists of bridge rectifiers CR8 through CR11 and filter capacitor C8. Bridge rectifiers CR8 through CR 1 perform full-wave rectification of the ac voltage from transformer TI to provide a dc voltage that is filtered by capacitor C8. The filtered dc voltage is applied to series regulators Q8 and Q9.

d. Series Voltage Regulator Circuit. The voltage regulator circuit regulates the dc output voltage and provides overcurrent protection. The series voltage regulator circuit is composed of error amplifiers Q1 and Q2, current limit amplifier Q3, drivers Q5 and Q6, and series regulators Q8 and Q9. Series regulators Q8 and Q9 receive the dc voltage from the main rectifier and control the output by presenting a variable impedance in series with the load. The regulated 15 V dc output is taken across pins 6 and 4 of terminal board TB1. The dc output voltage is adjustable from 14.25 to 15.75 V dc by potentiometer R1. Series regulators Q8 and Q9, which regulate the dc output voltage to the adjustable value established by potentiometer RI, are controlled by signals derived from error amplifiers Q1 and Q2 or current limit amplifier Q3. Error amplifiers Q1 and Q2 provide the control signal under normal load conditions, and current limit amplifier Q3 provides the control signal during overload conditions.

(1) Normal load regulation. Operation of the series regulator circuit is determined by changes in the output voltage. A change in the output voltage is sensed by sensing divider resistors R2 and R3 and potentiometer R1, which compare the output voltage with the +S reference voltage. The +S reference voltage is established by zener diode CRI and resistor R5. Comparison of the output voltage with the +S reference voltage produces an error voltage at the junction of resistors R2 and R3, which is amplified by error amplifiers Q1 and Q2 and is current amplified by drivers Q5 and Q6. The corresponding change in driver Q6 emitter current drives the emitter-base junctions of series regulators Q8 and Q9. This action increases the emitter-to-collector voltage drop of series regulators Q8 and Q9 to decrease the output voltage if the output voltage has increased, and decreases the emitter to-collector drop to increase the output voltage if the output voltage has decreased.

(2) Overcurrent operation. In the event of a large increase in load current, current limit amplifier Q3 takes over regulation control at a specific point and effectively current-regulates the output. Operation of current limit amplifier Q3 is controlled by a preset voltage reference applied to the base junction and a voltage applied to the emitter junction, which is proportional to output load current. The preset voltage reference is developed by the voltage divider composed of potentiometer R17 and resistor R18. The current limit value is determined by the setting of potentiometer R17. The output load current is sampled by resistor R28, which is in series with the output current path. Under normal load conditions, current limit amplifier Q3 is held at cutoff by the preset reference voltage. A large increase in load current produces in- creased forward bias for Q3 developed by resistor R28 and, at a specific point, overcomes the preset voltage reference, at which time Q3 conducts. Conduction of current limit amplifier Q3 results in decreased conduction of drivers Q5 and Q6. Decreased conduction of drivers Q5 and Q6 causes a less positive potential to be developed across resistor R23 and, consequently, a reduction in the forward bias of series regulators Q8 and Q9. As a result, the emitter-collector impedance of Q8 and Q9 is increased, reducing the output voltage lower than the initial drop due to the overload, effectively limiting the output current to a safe value. When operating conditions approach short circuit, the output voltage decreases. Since the voltage determined by potentiometer R 17 and resistor R18 is proportional to the output voltage, current limit amplifier Q3 is successively biased to turn on at lower and lower load currents as the output voltage decreases. This action permits current limit amplifier Q3 to turn on at lower and lower load currents until the output voltage decreases to zero and current decreases to a predetermined low value.

2-11. 5 V DC Power Supply HTA-3A6PS3 Circuit Analysis (fig. FO-10). The 5 V dc power supply provides a regulated 5 V dc output at 5 A and contains protective circuits for overcurrent conditions. The 5 V dc power supply consists of an ac input circuit, a bias supply, a main rectifier, and a series voltage regulator circuit.

a. Ac Input Circuit. Single-phase, 120 V ac input power is applied through thermostat SI to transformer T 1. Thermostat SI opens to protect the supply when overheating occurs and resets automatically when the overtemperature condition is eliminated Transformer T1, which contains two secondary windings, steps down the input voltage for application to the main and auxiliary rectifiers

b. Bias Supply. The bias supply, consisting of half-wave auxiliary rectifier CR7, filter capacitor C7, and zener diode regulator CR6, provides operating voltage for error amplifiers Q1 and Q2 and current limit amplifier Q3 Zener diode CR I and resistor R5, which are connected across the bias supply, provide a regulated, temperature compensated, reference voltage. Resistor R4 compensates for input voltage variations.

c. Main Rectifier. The main rectifier consists of bridge rectifiers CR8 and CR10 and filter capacitor C8. Rectifiers CR8 and CR10 perform full-wave rectification of the ac voltage from transformer T1 to provide a dc voltage that is filtered by capacitor C8. The filtered dc voltage is applied to series regulators Q8 and Q9.

d. Series Voltage Regulator Circuit. The voltage regulator circuit regulates the dc output voltage and pro- vides overcurrent protection. The series voltage regulator circuit is composed of error amplifiers Q1 and Q2, current limit amplifier Q3, drivers Q5 and Q6, and series regulators Q8 and Q9. Series regulators Q8 and Q9 receive the dc voltage from the main rectifier and control the output by presenting a variable impedance in series with the load. The regulated 5 V dc output is taken across pins 6 and 4 of terminal board TBI. The dc output voltage is adjustable from 4.75 to 5.25 V dc by potentiometer R1. Series regulators Q8 and Q9, which regulate the dc output voltage to the adjustable value established by potentiometer R1. are controlled by signals derived from error amplifiers Q1 and Q2 or current limit amplifier Q3. Error amplifiers Q1 and Q2 provide the control signal under normal load conditions, and current limit amplifier Q3 provides the control signal during overload conditions.

(1) Normal load regulation. Operation of the series regulator circuit is determined by changes in the output voltage. A change in the output voltage is sensed by sensing divider resistors R2 and R3 and potentiometer R1, which compare the output voltage with the +S reference voltage. The +S reference voltage is established by zener diode CRI and resistor R5. Comparison of the output voltage with the +S reference voltage produces an error voltage at the junction of resistors R2 and R3, which is amplified by error amplifiers Q1 and Q2 and is current amplified by drivers Q5 and Q6. The corresponding change in driver Q6 emitter current drives the emitter-base junctions of series regulators Q8 and Q9. This action increases the emitter-to-collector voltage drop of series regulators Q8 and Q9 to decrease the output voltage if the output voltage has increased, and decreases the emitter-to-collector drop to increase the output voltage if the output voltage has decreased.

(2) Overcurrent operation. In the event of a large increase in load current, current limit amplifier Q3 takes over regulation control at a specific point and effectively current-regulates the output. Operation of current limit amplifier Q3 is controlled by a preset voltage reference applied to the base junction and a voltage applied to the emitter junction, which is proportional to output load current. The preset voltage reference is developed by the voltage divider composed of potentiometer R17 and resistor R18. The current limit value is determined by the setting of resistor R28, which is in series with the output current path. Under normal load conditions, current limit amplifier Q3 is held at cutoff by the preset reference voltage. A large increase in load current produces in- creased forward bias for Q3 developed by resistor R28 and, at a specific point, overcomes the preset voltage reference, at which time Q3 conducts. Conduction of cur- rent limit amplifier Q3 results in decreased conduction of drivers Q5 and Q6. Decreased conduction of drivers Q5 and Q6 causes a less positive potential to be developed across resistor R23 and consequently, a reduction in the forward bias of series regulators Q8 and Q9. As a result, the emitter-collector impedance of Q8 and Q9 is in- creased, reducing the output voltage lower than the initial drop due to the overload, effectively limiting the output current to a safe value. When operating conditions approach short circuit, the output voltage decreases. Since the voltage determined by potentiometer RI 7 and resistor R18 is proportional to the output voltage, current limit amplifier Q3 is successively biased to turn on at lower and lower load currents as the output voltage decreases. This action permits current limit amplifier Q3 to turn on at lower and lower load currents until the output voltage decreases to zero and current decreases to a predetermined low value.

CHAPTER 3
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

SECTION I. GENERAL

3-1. Voltage and Resistance Measurements. The voltage and resistance measurements required to perform direct support maintenance on the receiver gain monitor equipment are contained in the troubleshooting and performance test tables of this chapter. The receiver gain monitor equipment is composed of pilot carrier monitor panel 14A26 and receiver gain monitor HTA-3A6. General procedures for making voltage and resistance measurements are provided in paragraph 3-3.

3-2. Tools and Equipment. Tools and test equipment required for maintenance of the receiver gain monitor equipment are described in the Repair Parts and Special Tools List (RPSTL) TM 11-5895-909-34P. Additional tools and test equipment required for maintenance are also listed in table 3-1.

Table 3-1. Tools and Test Equipment Required for Maintenance

Common name	Official nomenclature	Part/model no.	Qty	Manufacturer
AC Line Cord		17449	1	Belden
Adapter, AC 3-Wire to 2-Wire		785-0419	1	Allied
Adapter, Banana Jack to Size 16 Female Connector		3562	3	Pomona
Adapter, Banana Jack to Size 20 Female Connector		3560	10	Pomona
Adapter, Banana Jack to Size 20 Male Connector		3561	10	Pomona
Adapter, Banana Jack to Spade Lug		3744	7	Pomona
Adapter, BNC Plug to Dual Binding Post		103-0035-00	1	Tektronix
Adapter, N Jack to N Jack		679-1	1	Bendix
Adapter, OSM Jack to OSM Jack		217	1	Omni Spectra
Adapter, OSM Plug to N Jack		21030	1	Omni Spectra
Adapter, Single Banana Plug to Binding Post		2894	3	Pomona
Adapter, WR112 Waveguide to N Jack		H281A	4	Hewlett-Packard
Ammeter, Clamp On		749-2091001	1	Weston Instruments
Ammeter		931-2902001	1	Weston Instruments
Analyzer, Spectrum, IF Unit	Converter, Intermediate Frequency CV3287/U	8552B	1	Hewlett-Packard
Analyzer, Spectrum, Mainframe	Analyzer, Spectrum IP-1216(P)/GR	141T	1	Hewlett-Packard
Analyzer, Spectrum, RF Unit	Tuner, Radio Frequency TN-554/	8555A	1	Hewlett-Packard

Table 3-1. Tools and Test Equipment Required for Maintenance-Continued

Common name	Official nomenclature	Part/model no.	Qty	Manufacturer
	GR			
Attenuator, Variable (0 to 60 dB)		H101	2	PDR Electronics
Converter, Frequency, Electronic	Converter, Frequency Electronic CV-3059/U	5255A	1	Hewlett-Packard
Counter, Digital, Electronic	Counter, Electronic, Digital CP-772/U	5245L	1	Hewlett-Packard
Generator, Signal, SHF	Generator, Signal SG-944/U	620B	1	Hewlett-Packard
Kit, Tool, Electrical Equipment		TK-105/G	1	
Meter, Dial, Thermometer		19385-1	1	Central Scientific
Meter, Multifunction	Multimeter ME-482(P)/U	3450B OPT 001, 002	1	Hewlett-Packard
Meter, Power, Microwave		460B	1	General Microwave
Milliammeter, Volt-Ohm-		260-6	1	Simpson
Mount, Thermoelectic		N422C	1	General Microwave
Oscilloscope, Dual-Trace	Oscilloscope OS-261/U	475	1	Tektronix
Power Supply, 0-80/0-40 V		LPD-422A-FM	1	Lambda
Probe, Oscilloscope, X1, X10		010-6063	1	Tektronix
Potentiometer, 0 to 100K, 2 W		JAN1N200P104UA	1	Allen Bradley
Rheostat, Carbon Compression		82905	1	Central Scientific
Test Lead, Banana Plug to Alligator Clip		1166-36-B	2	Pomona
Test Lead, Banana Plug to Alligator Clip		1166-36-R	1	Pomona
Test Lead, Banana Plug to Banana Plug		B-12	10	Pomona
Test Lead, Banana Plug to Banana Plug		B-48-B	4	Pomona
Test Lead, Banana Plug to Banana Plug		B-48-R	2	Pomona
Test Lead, Banana Plug to Test Probe		1986-36-B	2	Pomona
Test Lead, Banana Plug to Test Probe		1986-36-R	2	Pomona
Test Lead, BNC Plug to Double Banana (44 inches)		11001A	1	Hewlett-Packard
Test Lead, N Plug to N Plug (72 inches)		11500A	1	Hewlett-Packard
Test Lead, N Plug to N Plug		1658-T-36	7	Pomona
Test Lead, Spade Lug to Banana Plug		1370-24-B	1	Pomona
Test Lead, Spade Lug to Banana Plug		1370-24-R	1	Pomona
Test Lead, Spade Lug to Spade Lug		1743-36-R	3	Pomona

Table 3-1. Tools and Test Equipment Required for Maintenance -Continued

Common name	Official nomenclature	Part/model no.	Qty	Manufacturer
Thermofit Mini-gun		CV5300	1	
Transformer, Variable		3PN2210	1	Staco

3-3. General Troubleshooting Instructions. This paragraph contains general procedures for voltage and resistance measurements as an aid for troubleshooting.

a. Voltage Measurements. In-circuit voltage measurements are useful in isolating a defective component or stage. Transistors can be easily checked by measuring the base to emitter bias. A transistor functioning as an amplifier is always forward biased. The base-to-emitter voltage of any turned-on silicon transistor is approximately 0.8 V dc; that of a germanium-type transistor approximately 0.4 V dc. A nonconducting transistor shows the full supply voltage at the collector.

(1) A quick method to check whether or not a forward biased transistor is functioning as an amplifier is to remove the forward bias by shorting the emitter to base. The collector voltage should rise to the approximate level of the supply voltage.

(2) Incorrect or absent supply voltage is usually caused by defective zener diodes. Check for correct operating voltage across the zener diode. Refer to the appropriate schematic, troubleshooting procedure, and/or semiconductor reference books.

(3) Field effect transistors (fet) can be checked varying the voltage at the gate and observing the voltage change appearing at drain and source.

CAUTION

Be careful when using a vtvm or oscilloscope to measure voltage within an operating module. The measuring instrument may upset the characteristics of some circuits, and false indications may be obtained. Refer to the appropriate module troubleshooting procedure for correct use of measuring instruments.

(4) Checking signal voltages within an operating module is, in most cases, an effective way of troubleshooting a module. Signal voltages can be checked using a vtvm or oscilloscope.

(5) Peak-to-peak voltages of pulse and square wave can be measured with an oscilloscope.

(6) When measuring voltages, use the test points provided, rather than break the conformal coating to get to connections.

b. It-Circuit Resistance Measurements. In-circuit checking of components should be done as much as possible. Most components can be checked for open or shorted conditions using a multimeter. Rx100 or Rx10K scale when there is possibility of damaging the components. Loss of signal or supply voltage in a module may be caused by shorts, poor connections at plugs, or broken wires. Continuity checks using a multimeter will usually indicate the source of trouble; use the appropriate schematic diagram and interconnecting diagram for guidance. In-circuit resistance checking will usually provide adequate indication of a faulty transistor or diode. The following is a suggested method.

(1) Npn transistors. With the red (+) lead of the multimeter on the base and the black (-) lead first on the collector and then on the emitter, the multimeter should normally indicate several hundred ohms (Rx100 scale). With reverse leads (black (-) on base) the resistance to collector should be very high or infinity, while the resistance to the emitter should be several megohms (depending on the other components in the circuit).

(2) ***Pop transistors***. Reverse connections and indications in (l) above.

(3) ***Diodes***. To check diodes place the black (-) lead of multimeter on the cathode, the red (+) on the anode; the meter should indicate several hundred ohms. Reverse the leads and a very high or infinite resistance should be obtained, depending on the circuit configuration.

CAUTION

Do not check field effect transistors with the multimeter; static charge from hands to gate when the transistor is out of circuit and when leads are not shorted can damage the component.

c. Out-of-Circuit Resistance Measurements. Under certain conditions, due to circuit configurations, it may not be possible to check a transistor or other component in-circuit; in this case the component must be disconnected. Remove the suspected faulty component using the proper procedure (para 3-4b) and check as described in b above. Only one end need be disconnected in order to check diodes, varicaps, and some types of zener diodes. An additional test for an npn transistor consists of connecting the black (-) lead of the multimeter to the emitter and the red (+) lead to the collector, which should give an infinite resistance indication. Next connect the red (+) lead to base and note the resistance, then short the base lead to collector; this should produce a slightly lower indication on the meter. Reverse multimeter leads for pnp transistor.

3-4. General Repair Instructions. This paragraph provides general procedures for soldering and unsoldering, component replacement, and connector repair.

a. Soldering and Unsoldering Procedures. To ensure high reliability of electrical connections, certain procedures for hand soldering must be adhered to.

(1) Use low wattage or temperature controlled soldering irons and heat sinks to prevent damage to heat-sensitive components, such as semiconductors, glass bead capacitors, and insulating materials.

(2) Use appropriate soldering iron tips and solder quickly to prevent long periods of excessive heat during soldering and unsoldering on printed circuit boards covered with conformal coating.

(3) Do not use transformer-type solder guns.

(4) Check condition of soldering tips. Do not allow oxidation scale to accumulate on the tip. Maintain a bright, thin, but continuous tinned tip surface.

(5) Use a 60/40 type solder for tinning and general use. Use a low-melting point 63/37 type solder on printed circuit boards and when soldering heat-sensitive components.

(6) Remove excess flux, grease, or oil from the solder joints, using ethyl or isopropyl alcohol.

(7) Remove conformal coating from the joint to be soldered with a broad knife or soldering iron

(8) Use a heated copper braid to absorb the melted solder when unsoldering. Avoid using a solder sucker to remove the solder from printed circuit boards; this method may damage the joint and/or the printed circuit board.

(9) Avoid excessive temperatures to prevent unreliable joints and damage to parts. Use heat sinks, such as long-nose pliers, to protect the components.

(10) Allow solder to cool to room temperature. Do not use liquids to cool a soldered connection.

NOTE

Never use any abrasive cleaning agents on solder areas.

(11) Remove all visible flux and impurities from a cool solder joint using a medium stiff material or synthetic bristle brush and approved solvent. The soldered connection should be clean and have a smooth, undisturbed appearance.

(12) Use a wire brush to remove oxide, paint, and any other foreign matter from terminals before attaching wires and leads for soldering. Use a special type white eraser to remove gold plating from solder areas.

b. Replacement of Components. The following subparagraphs provide general instructions for replacing chassis mounted components. For replacing components mounted on printed circuit boards, refer to general support maintenance instructions.

(1) Tag electrical wires connected to component for identification. Unsolder leads from component by following approved unsoldering procedures (para 3-4a).

(2) Remove component and repair or replace with a new component.

(3) Check and clean all replacement component leads prior to soldering, regardless of visual appearance.

(4) Observe polarity of replacement diodes, transistors, and electrolytic and tantalum capacitors.

(5) Position replacement component in the same place as the removal component. Do not mount components on top of other components. Position replacement components so that any identification mark, such as the part number, symbol, value, etc., is readily visible.

(6) When components are mounted on standoff terminals, allow sufficient slack in the leads to components to allow for vibration and temperature changes.

(7) When wires are attached to terminals, sufficient insulation should be stripped off the wire to avoid contact between the insulation and the solder connection. Use proper stripping tools to avoid nicking, damaging, or breaking wires.

(8) The ends of wires soldered to terminals should be wrapped around the terminals 1/2 to 3/4 turn (wires larger than 26 AWG) or 3/4 to 1 1/2 turns (wires smaller than 26 AWG). All portions of stranded wire and component leads which will be soldered should be properly tinned before attachment.

(9) Use the correct type of insulated heatshrinkable sleeving when replacing a circuit breaker. Use a thermogun for shrinking the sleeving.

c. Component Replacement Procedure. Component replacement procedures are as follows:

(1) ***Air-core coils***. Install replacement air-core coil, using approved soldering techniques, without changing the contour of the coil, and maintaining the same board-to-coil distance. A complete realignment of the module will be required.

(2) ***Ferrite tuned coils.*** To replace ferrite tuned coils proceed as instructed in (1) above, observing polarity, start, and finish of the coil. Realignment is required after replacement.

(3) ***Relays***. Mark the relay pin numbers on individual connecting wires with masking tape before removing the faulty relay. Replace the relay using approved soldering techniques (para 3-4m).

(4) ***Small components.*** Small fixed capacitors, chokes, fixed resistors, varicaps, and diodes are all replaced following the general procedures described in b above. Observe polarity on all types of diodes, varicaps, and electrolytic capacitors. Figure FO-1 illustrates color code markings for small components.

(5) ***Potentiometers***. Replace the potentiometer following general procedures in b above; refer to applicable paragraph for alignment procedures.

(6) ***Transformers***. Transformers are readily replaced. Identify all connecting wires before removing the defective component to facilitate installation of the replacement transformer.

d. Multipin Connector Repair Procedures. Repair of multipin connectors is performed as follows:

(1) Tag and disconnect cable to faulty connector.

(2) Tag and unsolder wires to connector pins.

(3) Remove screws, washers, and nuts securing connector to panel.

(4) Remove connector and repair or replace with a new connector.

(5) Clean all wires of solder and ensure that the wires are properly stripped.

(6) Fill pin cups on replacement connector with a small amount of solder.

(**7)** Identify wires by tag and insert and solder wire ends into the pin cups.

(8) Allow solder to cool, pull the wire to ensure that it is solidly attached, then slide the insulating sleeve over the solder connection so that the sleeve fits snugly against the connector.

(9) Install connector on the panel and secure to panel with screws, washers, and nuts.

(10) Identify cables by tag and connect to connector.

e. Coaxial Connector Repair Procedure. The basic procedure for repair of a coaxial connector is provided as follows:

(1) Slide connector nut and gasket over the cable and remove 5/16 in. of the outer covering of the cable.

(2) Comb the braid and fold it out.

(3) Pull braid wires forward and taper to the center conductor.

(4) Fold back the braid wires, trim to the proper length, and fold over the cable.

(5) Cut back dielectric to correct length so that the contact pin fits snugly against the center conductor.

(6) Solder contact pin to the center conductor through opening in the contact pin.

(7) Insert cable end with the soldered contact into the contact body.

(8) Ensure that contact pin is properly seated in the connector body. Tighten nut.

NOTE

In a plug, the end of the contact pin should be flush with the insulator. In a jack, there should be a clearance of 0.10 in. between the end of the contact and the top of the insulator.

SECTION II. TROUBLESHOOTING OF PILOT CARRIER MONITOR PANEL 14A26

3-5. General. This section contains preliminary procedures and troubleshooting procedures for localizing fault to a malfunctioning piece part of pilot carrier ml tor panel 14A26. Preliminary procedures consist of taining the listed test equipment, making the prescribed test connections, and initially setting equipment cont to specified settings. These settings and all subsequent settings listed in the troubleshooting procedures must be made carefully to ensure accurate test results.

3-6.Test Equipment and Materials. Table 3-2 lists the test equipment required for troubleshooting pilot carrier monitor panel 14A26.

Table 3-2. Test Equipment Required for Pilot Carrier Monitor Panel 14A26 Maintenance

Common name	Part/model no.	Qty	Manufacturer
Adapter, Banana Jack to Size 20 Female Connector	3560	2	Pomona
Kit. Tool. Electronic Equipment	TK-105/G	1	
Milliammeter, Volt-Ohm-	260-6	1	Simpson
Power Supply, 0-80/0-40 V	LPD-422A-FM	I	Lambda
Potentiometer, 0 to IOOK. 2 W	JAIN200P104UA	I	Allen Bradley
Test Lead. Banana Plug to Alligator Clip	1166-36-R	2	Pomona
Test Lead, Banana Plug to Banana Plug	B-12	I	Pomona
Test Lead. Banana Plug to Banana Plug	B-48-B	1	Pomona
Test Lead, Banana Plug to Banana Plug	B-48-R	1	Pomona

3-7. Test Connections and Conditions (fig. 3-1). Troubleshooting of pilot carrier monitor panel 14A26 is performed in a bench test setup. Refer to paragraph 3-36 for removal procedures of the pilot carrier monitor panel. Adjust potentiometer for 10 kilohm resistance. Connect test equipment to connector pin for meter that is suspected of being faulty, using pins specified in figure 3-1. Connect power supply to 120 V ac power source.

3-8. Initial Control Settings. Set controls as follows:

a. Set dual-output power supply OUTPUT VOLTAGE control fully counterclockwise.

b. Set volt-ohm-milliammeter (vom) function switch to +DC and range switch to 1 mA.

c. Set dual output power supply ON/OFF switch to ON.

3-9. Troubleshooting Procedures. Follow the steps listed below to confirm trouble in one of the meter circuits.

a. Adjust OUTPUT VOLTAGE control on dualoutput power supply until meter under test indicates +6 dB.

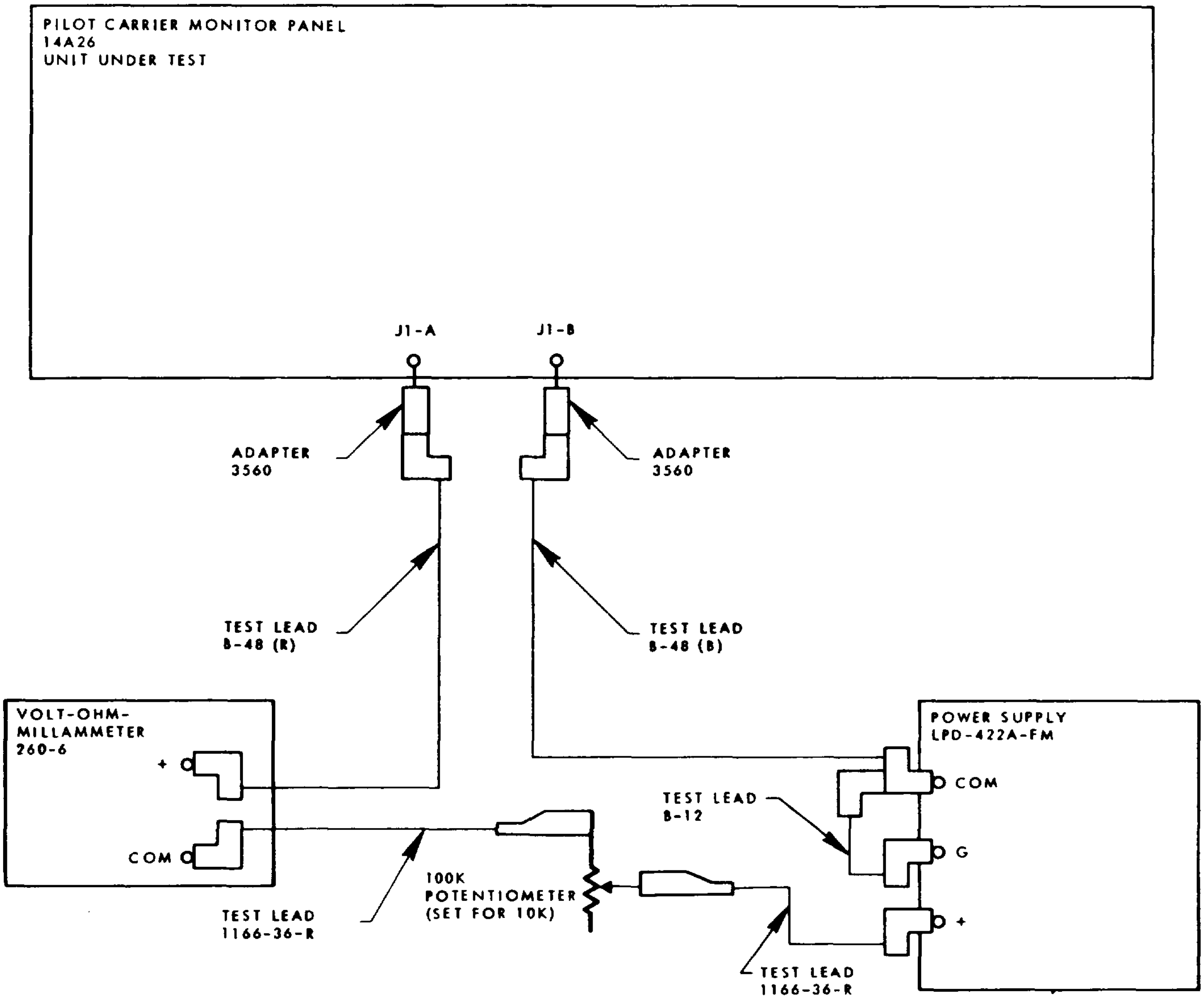
b. Observe vom for 0.97 -0.07 mA indication and dual-output power supply DC VOLTS meter for approximately 10 V dc indication.

c. Set dual-output power supply OUTPUT VOLTAGE control fully counterclockwise.

d. Reverse test leads at connector J1.

e. Adjust OUTPUT VOLTAGE control on dualoutput power supply until meter under test indicates -6 dB.

f. Observe vom for 0.96 -0.07 mA indication and dual-output power supply DC VOLTS meter for approximately 10 V dc. After fault in a meter circuit is confirmed, use a vom to determine whether the fault is in the connector, in the wiring, or in the meter. Refer to paragraphs 3-36 and 3-37 for removal and replacement procedures for the meter and connector. After the faulty item has



PILOT CARRIER MONITOR PANEL,
CONNECTOR PIN ASSIGNMENTS

METER	SIGNAL	RETURN
DOWNLINK 1 LOW PILOT	J1-A	J1-B
DOWNLINK 1 HIGH PILOT	J1-E	J1-F
DOWNLINK 2 LOW PILOT	J1-J	J1-K
DOWNLINK 2 HIGH PILOT	J1-N	J1-P

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Figure 3-1. Pilot carrier monitor panel 14A26, test setup diagram.

been replaced, carry out the performance test described in section XVI of this chapter. Upon satisfactory completion of the performance test, the equipment may be returned to service.

SECTION III. TROUBLESHOOTING

3-10. General. This section contains preliminary procedures and troubleshooting procedures for localizing a fault to a malfunctioning assembly, subassembly, or module of receiver gain monitor HTA-3A6. Preliminary procedures consist of obtaining listed test equipment, making prescribed test connections, and initially setting equipment controls to specified settings. These settings, and all subsequent settings given in the troubleshooting chart, must be made carefully to ensure accurate test results.

3-11. Test Equipment and Materials. Table 3-3 lists the test equipment required for troubleshooting receiver gain monitor HTA-3A6.

Table 3-3. Test Equipment Required for Receiver Gain Monitor HTA-3A6 Troubleshooting

Common name	Part/model no.	Qty	Manufacturer
AC Line Cord	17449	1	Belden
Adapter, Banana Jack to Size 16 Female Connector	3562	3	Pomona
Adapter, N Jack to N Jack	679-1	1	Bendix
Adapter. OSM Jack to OSM Jack	217	1	Omni Spectra
Adapter, OSM Plug to N Jack	21030	1	Omni Spectra
Adapter, Single Banana Plug to Binding Post	2894	3	Pomona
Adapter, WRII 2 Waveguide to N Jack	H2SIA	4	Hewlett-Packard
Ammeter, Clamp On	749-2091001	1	Weston Instruments
Attenuator, Variable (O to 60 dB)	H101	2	PDR Electronic
Attenuator, 20 dB	8491A	1	Hewlett-Packard
Kit, Tool, Electronic Equipment	TK-105/G		
Meter, Dial, Thermometer	19385-1	1	Central Scientific
Meter, Multifunction	3450B OPT 001, 002	1	Hewlett-Packard
Meter, Power Microwave	460B	1	General Microwave
Mount, Thermoelectric	N422C	1	General Microwave
Test, Lead, Banana Plug to Banana Plug	B-48-B	1	Pomona
Test Lead, Banana Plug to Banana Plug	B48-R	1	Pomona
Test Lead, Banana Plug to Test Probe	1986-36-B	1	Pomona
Test Lead, Banana Plug to Test Probe	1986-36-R	5	Pomona
Test Lead, N Plug to N Plug	1658-T-36	1	Pomona
Thermofit Mini-gun	CV5300	1	

3-12. Test Connections and Conditions (fig. FO 11). Troubleshooting of the receiver gain monitor is performed on the workbench. Refer to paragraph 3-39 f instructions for removing receiver gain monitor from ,late.

3-13. Initial Control Settings. Prior to troubleshot ing, perform the following control settings.

Control	Position
Receiver gain monitor	
FAN, 28VPS, 5/15 VPS CIRCUIT BREAKERS (fig. 1-1)	ON
MAINT	ON (press)
Multifunction meter	
LINE switch	Up
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Power meter	
EFF	Set to value a determined from graph on mount N422
115V-230V LINE switch (rear)	115V
RESPONSE switch (rear)	NORM
RANGE	3 W/+35 dBm (press)
POWER	LINE ON (press); Allow 15 min warmup period.
RANGE	3 mW/+5 dBm (press)
ZERO METER	Adjust to indicate 0 dB on meter
Attenuator 1, 2	
Attenuation	6 dB

3-14. Troubleshooting Procedures. After comple ing the preliminary procedures (para 3-12 and 3-13 perform the necessary troubleshooting procedures table 3-4 as specified by symptom/probable cause list below. If the list does not include a recognizable symptom for any malfunction, perform the steps in table 3-4 in t sequence given until the malfunctioning item is found Receiver gain monitor equipment detailed block diagram (fig. FO-3) will assist in performing the troubleshooting procedures. After the faulty item has been replaced, carry out the performance test described in section XVII of this chapter. Upon satisfactory completion of the performance test, receiver gain monitor HTA-3A6 can be returned to service.

Symptom	Probable cause
SUMMARY FAULT indicator DSS lighted.	One or more of the three power supplies is faulted. Perform steps 1, 2, 3, and 4.
LOW PILOT FAULT indicator DS9 and SUMMARY FAULT indicator DS5 are lighted and gain faults are indicated by MIN and MAJ portions of FAULT THRESHOLDS ALARM indicators for downlinkl 1 and 2.	Low pilot oscillator YI defective. Perform step 5. Rf isolator AT4 defective. Perform step 6. Directional coupler DCI defective. Perform step 7.
LOW PILOT FAULT indicator DS9 and SUMMARY FAULT indicator DS5 are lighted.	Power divider Z2 or directional coupler DCI defec tive. Perform step . Detector CR1 or autoswitch control card is defective. Perform step 9.
HIGH PILOT FAULT indicator DSIO and SUMMARY FAULT indicator DS5 are lighted and gain faults are indicated by MIN and MAJ portions of FAULT THRESHOLDS ALARM indicators for downlinks 1 and 2.	High pilot oscillator Y2 defective. Perform step 10. Rf isolator AT5 defective. Perform step 11. Directional coupler DC2 defective. Perform step 12.
HIGH PILOT FAULT indicator DSIO and SUMMARY FAULT indicator DS5 are lighted.	Power divider Z3 or directional coupler DC2 defective. Perform step 13. Detector CR2 or autoswitch control card is defective. Perform step 14.
MIN and/or MAJ portion	IN and/or MAJ portion of

Symptom	Probable cause	Symptom	Probable cause
of FAULT THRESHOLDS ALARM indicator DSI does not light when gain fault exists in downlink 1.	indicator DSI defective, or linear detect and threshold card AIAI defec- tive Perform step	1 and 2. MIN and MAJ portions of FAULT THRESHOLDS 15. ALARM indicator DSI are lighted when no gain fault exists in	sent. Perform step 17. Amplified phase modulated frequency pilots signal from radio frequency ampli- fier I not present at mixers Z13 and Z14. Perform step
MIN and/or MAJ portion	MIN and/or MAJ portion of	downlink 1.	18.
of FAULT THRESHOLD ALARM indicator DS8 does not light when gain fault exists in	indicator DS8 defective or linear detect and threshold card A2A1 defec- tive. Perform step 16.	MIN and MAJ portions of FAULT THRESHOLDS ALARM indicator DS8 are	Amplified phase modulated frequency pilots signal from radio frequency
downlink 2.		lighted wen no pin fault exists in downlink 2.	amplifier 2 not present at mixers Z1 1 and Z12. Perform step 19.
MIN and MAJ portions of FAULT THRESHOLDS ALARM indicators DS1 and DS8 are lighted when no gain faults exist in downlinks	One or more of the inputs to the downlink I mixers (Z13 and Z14) and one or or more of the inputs to the downlink 2 mixers (Z11 and Z12) are not pre-	No autoswitching when major gain fault exists and standby units are available.	Fault qualification or auto- switch control card defec- tive. Replace circuit cards as directed in paragraph 3-41.

Table 3-4. Receiver Gain Monitor HTA-3A6 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
1	DC voltage levels	Set POWER SUPPLY MONITOR selector switch S5 to -28V, +5V, and then +15V.		POWER SUPPLY MONITOR meter M2 in- dication is in green area for each power supply select- ed.	If indications are normal, proceed to step 5. If indication is outside green area for any selector switch setting, refer to paragraph 3- 62 for adjustment procedures. If all three power supplies indi- cate O V, and no front panel indicators are lit, perform step 2. If all three power supplies indi- cate 0 V, and any front panel indicators are lit, perform step 3. If any power supply indi- cates O V and at least one oth- er shows normal indication. proceed to step 4.
2	AC Input	Verify that FAN, 28 VPS, and 5/IS VPS CIRCUIT BREAK- ERS are set to ON.	a. On multifunction meter press FUNCTION-AC, and check voltage across filter inputs (FLI-B and FL2-B). 1 and FO-4, sh I)	a. 120 V ac	a. If 120 V ac not present, refer to TM 11-5895-898-12. If 120 V ac is present, perform sub step b. (See fig. 3-6, sh

Table 3-4. Receiver Gain Monitor HTA-3A6 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
			b. Connect multifunction meter from FL2-B to both sides of circuit breakers CBI, CB2, and CB3.	b. 120 V ac	b. If 120 V ac not present at both sides of circuit breaker, refer to paragraph 3-29 for instructions to replace appropriate circuit breaker. If 120 V ac is present, perform step 4.
3	Meter circuit	On multifunction meter, press DC FUNCTION switch	a. Place black multifunction meter lead on POWER SUPPLY MONITOR meter- terminal, and red lead on + terminal.	a. 54 *5 mV indication with POWER SUPPLY MONITOR selector switch S5 in each of its three positions.	a. If multifunction meter indicates 54 -5 mV, but POWER SUPPLY MONITOR meter does not indicate in green area, replace meter M2. If voltmeter does not indicate 54 ±5 mV, proceed to substep b.
			b. Make three sets of connections on POWER SUPPLY MONITOR selector switch S5 as indicated below: Red lead / Black lead S5-7 / S5-1 S5-8 / S5-2 S5-9 / S5-2	b. 54 *5 mV for each set of connections when S5 is in the -28V (S5-7 and S5-1), +5V (S5-8 and S5-2), and +15V (S5-9 and S5-3) positions.	b. If multifunction indicates 54 45 mV but POWER SUPPLY MONITOR meter does not indicate in green area, replace POWER SUPPLY MONITOR selector switch S5. If voltmeter does not indicate 54 *5 mV, proceed to substep c.
			c. Make three sets of connections as indicated below: Red lead / Black lead S3-C1 / TP2 A1P4-7 / TP2 Y1+ / TP2	c. As indicated below. -28 ±1.4 V dc +5 ±0.25 V dc +15±0.75 V dc	c. If indicated voltage is not p sent proceed to step 4. If indi cated voltage is present, check connector J5 on detect and qualification monitor subassembly.
4	Power supplies	On multifunction meter, prees AC FUNCTION switch.	a. Black multifunction meter lead on filter FL2-B and red lead on circuit breaker CB2 (for -28 V de power supply) or on circuit breaker CB3 (for 5 and 15 V dc power supplies).	a. 120 V ac	a. If 120 V ac i present, proceed to substep b. If 120 ac is not present return to step 2.
			b. Make three sets of connections on POWER SUPPLY MONITOR selector switch SS as indicated below: Red lead / Black lead SS-7 / SS-1 S5-8 / SS-2 S5-9 / SS-3	b. 54* 5 mV for each set of connections when S5 is in the -28V (S5-7 and S5-1), +5V (S5-8 and S5-2), and +15V (S5-9 and S5-3) positions.	b. If indicated voltage is not p sent refer to paragraph 3-47 for removal and replacement of appropriate power supply.
5	Low pilot oscillator Y1 (fig 34, sh 3)	Set LOW PILOT FREQUENCY control in the maximum DECR position.	a. Connect power meter through 20 dB attenuator (H8491A) to output of low pilot oscillator.	a. -4 t2 dBm indication on power meter.	a. If output abnormal, proceed to substep b.

Table 3-4. Receiver Gain Monitor HTA-3A6 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
			b. Connect multifunction meter black lead to test - point TP2 (black) and red lead to low pilot oscillator Y1+ terminal. form step 4.	b. 15 *0.75 V dc	b. If input voltage is present, r- fer to paragraph 3-42 for moval and replacement procedures for pilot oscillator. If input voltage is not present, per-
6	RF isolator AT4 (fig. 3-6, sh 6)	Low pilot oscillator Y1 checked good in step 5	a. Connect power meter to output of rf isolator AT4 (fig. 3-6, sh 6) through 20 dB attenuator. b.-6 42 dBm in- b. Disconnect W14P1 from IN connector of A7DC1. Using adapter 217, check output of W14PI (output of AT1 3).	a. -5 *2 dBm indication on power meter AT4 or rf capacitor assembly dication on power meter	If normal indication is not obtained, use power meter to check output of cable W1S before replacing rf isolator ATI3. Refer to paragraph 55 or 3-56 for removal and replacement instructions for rf isolator .T4 and rf capacitor assembly ATI 3, respectively.
7	Directional coupler A7DCI (fig. 3-6. sh 5)	Rf isolator AT4 checked good in step 6.	a. Using adapter 219, connect power meter through 20 dB attenua - tor to MAIN output of directional coupler A7D(t1 (fig. 3-6, sh 5). b. Remove W13PI from A7Z2. Using adapter 217, connect power meter through 20 dB attenuator to WI 3P1 (COUP output of directional coupler A7DC1).	a. -8 13 dBm Indication on power meter b.-17.5 t3dBm- indication on power meter	If normal indication is not obtained, use power meter to check output of cable W14 before replacing directional coupler A7DCI. Refer to paragraph 3-53 for replacement Instructions.
8	Low pilot monitoring output signal	Rf isolator AT4 checked good in step 6.	On front panel connect power meter to LOW PILOT connector.	-23 +5 dBm indication on J8. power meter	If normal indication is not obtained, power divider A7Z2 or directional coupler A7DCI is defective.
9	Detector CRI and auto switch control card	Directional coupler A7DCI, and power divider A7Z2 checked good in step 8. Remove angle bracket on electronic components chassis. Set multifunction meter for DC.	Connect red lead from multifunction meter to output of detector CRI (fig. 3-6, sh 5) and black test lead to TP2.	150 mV minimum	If normal indication is not obtamined, detector CRI is defective If normal indication is obtained, replace autoswitch control card.
10	High pilot oscillator Y2 (fig. 3-6, sh 3)	Set HIGH PILOT FREQUENCY control to the maximum DECR position.	Using adapter 219, connect power meter through 20 dB attenuator to output of high pilot oscillator Y2.	4 +2 dBm indication on power meter	If output power abnormal, check for +15 V dc input. If +15 V dc is present, refer to paragraph 3-42 for replacement procedures for high pilot oscillator.
11	Rf isolator ATS (fig. 3-6, sh 6)	High pilot oscillator checked good in step 10.	a. Connect power meter through 20 dB attenuator to output of rf isolator AT5.	a. -5 +2 dBm indication on power meter	If normal indication is not ob tained, use power meter to

Table 3-4. Receiver Gain Monitor HTA-3A6 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
			b. Remove W27P2 from IN connector of A7DC2. Using adapter 217, connect power meter through 20 dB attenuator to W27P2 (output of AT14).	b. -6 ±2 dBm indication on power meter	check output of cable W28 before replacing rf isolator AT5 or rf capacitor assembly AT14. Refer to paragraph 3-55 or 3-56 for replacement instructions.
12	Directional coupler DC2 (fig. 3-6, sh 5)	Rf isolator AT5 checked good in step 10.	a. Disconnect W29P2 on IN connector of A7DC4. Using adapter 217, connect power meter through 20 dB attenuator to W29P2 (MAIN output of directional coupler A7DC2). b. Disconnect W26P1 from input to A7Z3. Connect power meter through 20 dB attenuator to W26P1 (COUP output of directional coupler A7DC2).	a. -8±3 dBm indication on power meter b. -17.5 +3 dBm indication on power meter	If normal indication is not obtained, use power meter to check output of cable W27 before replacing directional coupler A7DC2. Refer to paragraph 3-53 for replacement instructions.
13	High pilot monitoring output signal	Rf isolator AT5 checked good in step 6.	Connect power meter through 20 dB attenuator to HIGH PILOT connector J9.	-23 ±5 dBm indicated on power meter.	If normal indication is not obtained, power divider A7Z3 directional coupler A7DC2 is defective.
14	Detector CR2 and autoswitch control	Directional coupler A7DC2 and power divider A7Z3 checked good m step 13	Connect red test lead of multifunction meter to output of detector CR2 (fig. 3-6, sh 5) and black test lead to TP2.	150 mV minimum	If normal indication is not obtained, detector CR2 is defective. If normal indication is obtained, replace autoswitch control card.
15	MIN and/or MAJ portion of FAULT THRESHOLDS ALARM			MIN and/or MAJ portions of indicator DS1)I are lit.	If MIN/MAJ lamps are good, perform linear detect and threshold card trouble isolation procedures. (Refer to
16	MIN and/or MAJ portion of FAULT THRESHOLDS ALARM indicator DS8			MIN and/or MAI portions of indicator DS8 are lit.	If MIN/MAJ lamps are good, perform linear detect and threshold card trouble isoation procedures.
17	GAIN BALANCE meter	Use GAIN BALANCE meter and selector switch to observe DOWNLINK 1 and DOWNLINK 2 P1-LOTS.		O dB	If DOWNLINK 1 PILOT 2 and DOWNLINK 2 PILOT 2 meters indicate a fault, adjust associated PILOT 2 potentiometer. Replace power divider Z7 if not successful. If DOWNLINK 1 PILOT 1 and DOWNLINK 2 PILOT 1 meter indicate a fault, adjust associated PILOT 1 potentiometer. Replace power divider Z8

Table 3-4. Receiver Gain Monitor HTA-3A6 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					if not successful
18	GAIN BALANCE meter	Use GAIN BALANCE meter and selector switch to observe DOWNLINK 1 PILOT 2 and DOWN-LINK I PILOT 1.		0 dB	If both DOWNLINK I PILOT 2 and DOWNLINK 1 PILOT 1 show gain fault, adjust associ-ated DOWNLINK 1 poten-tiometer. Replace rf trans-mission line switch S8 and power divider Z 10 if not successful If DOWNLINK 1 PILOT 2 is bad, replace mixer Z13. If DOWNLINK 1 PILOT 1 is bad, replace mixer Z14. If trouble is not corrected, re-place linear detect and thresh-old card in detect and quali-fication monitor subassembly Al (detect and qualification module).
19	GAIN BALANCE meter	Use GAIN BALANCE meter and selector switch to observe DOWNLINK 2 PILOT 2 and DOWN-LINK 2 PILOT 1.		0 dB	If both DOWNLINK 2 PILOT 2 and DOWNLINK 2 PILOT 1 show gain fault, adjust as-sociated DOWNLINK 2 po-tentiometer. Replace rf transmission line switch S7 and power divider Z9 if not successful If DOWNLINK 2 PILOT 2 is bad, replace mixer ZI 1. If DOWNLINK 2 PILOT 1 is bad, replace mixer Z12. If trouble is not corrected, re-place linear detect and thresh-old card in detect and auto-switch monitor subassembly A2. (Detect and autoswitch module). If DOWNLINK I PILOT I and 2 as well as DOWNLINK 2 PILOTS 1 and 2 are bad in both bypass and normal mode, replace A6ZI and A6Z 18 as a matched set.
			WARNING		

120 V ac present on terminals of switches A8S1, S2.

Table 3-4. Receiver Gain Monitor HTA-3A6 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
20	Electric blanket heater switches	a. FAN circuit breaker set to ON.	a. Tape thermometer to electric blanket heater near switch S 1 and switch S2. (See figure 3-5.)	a. If temperature remains between +110 deg F and +160 deg F (+43.3 to+71.1 deg C), electric blanket heater is operating normally.	a. Temperature may vary between 110 deg F and 160 deg F. Perform substeps b through f if temperature exceeds these limits.
		b. Turn blower on (Thermofit mini-gun) to raise temperature of blanket heater.	b. Clamp ammeter around white wire connected to swtich Si1.	b. Ammeter indicates no current flow (O A) at+135 i3 deg F (+57.2 deg C).	b. Replace electric blanket heater if current does not stop flowing.
		c. Use blower (heat off) to lower temperature to +120 deg F (+49 deg C).		c. Ammeter indicates current flow (0.25 A to 1 A) at +125 ±3 deg F (+51.6 deg C).	c. Replace electric blanket heater if current does not start flowing.
		d. Use blower (heat on) to raise temperature.	d. Clamp ammeter around yellow wire connected to swtich S2.	d. Ammeter indicates no current flow (0 A) at +140 ±3 deg F (+60 deg C).	d. Replace electric blanket heater if current does not stop flowing.
		e. Use blower (heat off) to lower temperature. (0.25 A to 1A) at +120 ±3 deg F (+48.8 deg C).		e. Ammeter indicates current flow	e. Replace electric blanket heater if current does not start flowing.
		f. Remove ammeter and thermometer at completion of test.			

SECTION IV. TROUBLESHOOTING OF 28 V DC POWER SUPPLY HTA-3A6PS1

3-15. General. This section contains preliminary procedures and troubleshooting procedures for localizing a fault to a malfunctioning piece part of the 28 V dc power supply. Preliminary procedures consist of obtaining listed test equipment, making prescribed test connections, and initially setting equipment controls to specified settings. These settings, and all subsequent settings given in the troubleshooting chart, must be made carefully to ensure accurate test results. When a troubleshooting procedure specifies replacement or adjustment of a malfunctioning component, refer to section X in this chapter.

3-16. Test Equipment and Materials. Table 3-5 lists the test equipment required for troubleshooting the 28 V dc power supply.

Table 3-5. Test Equipment Required for 28 V DC Power Supply HTA-3A6PS1 Troubleshooting

Common name	Part/model no.	Qty	Manufacturer
AC Line Cord	17449-5	1	Belden
Adapter, AC, 3-Wire to 2-Wire	785-0419	1	Allied
Adapter, Banana Jack to Spade Lag	3744	3	Pomona
Adapter, BNC Plug to Dual Binding Pat	103354)	1	Tektronix
Adapter, Single Banana Plug to Binding Pat	294	2	Poona
Meter. Multifunction	3450B OPT 001, 002	1	Hewlett-Pc
Milliammeter, Volt-Ohm	260-6	1	Simpson
Oscilloscope, DSI-Trace	475	1	Tektronix
Test Lead, Banana Plug to Alligator Clip	1166-36-B	2	Pomona
Test Lead, Banana Plug to Alligator Clip	1166-36-R	1	Pomona
Test Lead, Banana Plug to Banana Plug	B-4S-B	2	Pomona
Test Lead, Banana Plug to Banana Plug	B-48-R	1	Pomona
Test Lead, Banana Plug to Test Probe	1986-6B	1	Pomona
Test Lead, Banana Plug to Test Probe	198636R	1	Pomona
Transformer, Variable	3PN2210	1	Staco

3-17. Test Connections and Conditions (fig. FO 12). Troubleshooting of the power supply is accomplished in a bench test setup**.**
Troubleshooting of the power supply is accomplished in a bench in a bench test setup. Prior to performing the troubleshooting procedure, prepare equipment for test as

a. Connect variable transformer to power source. Set power switch to on (up) and observe that indicator lights.

b. Set volt-ohm-milliammeter (vom) function switch to AC and range switch to 250 V. Connect vom to variable transformer output plug and adjust variable transformer for 115 V ac indication on vom. Set variable transformer power switch to off (down). Disconnect vom.

c. On 28 V dc power supply, verify jumper wires are connected between terminals 3 and 4 and between terminals 6 and 7.

d. Remove power supply cover (para 3-67).

e. Connect test equipment as shown in figure FO-12.

318. Initial Control Settings. Initial test equipment settings for the troubleshooting procedures are as follows:

Control	Position
Multifunction Meter	
LINE	On (up)
FUNCTION	AC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Oscilloscope	
POWER	On (pull)
VERT MODE	CH1
CH 1 VOLTS/DIV	As required to observe signal
CH 1 AC-GNDDC	AC
HORIZ DISPLAY	A
TRIG MODE	NORMAL
COUPLING	AC
SOURCE	NORM

Control	Position
Oscilloscope	
TIME/DIV	As required to observe signal
A TRIGGER - SLOPE and LEVEL	As required for stable display
Variable Transformer	
POWER	On (up)

3-19. Troubleshooting Procedure. Table 3-6 provides a step-by-step troubleshooting procedure to isolate malfunction to a faulty part. Perform procedure in sequence given until malfunctioning part is found. When faulty part is found, replace part as directed and test power supply as specified in section XI of this chapter. Use the schematic diagram (fig. FO-8) as an aid to locating trouble causes and figure 3-2 for location of parts.

WARNING

Hazardous voltages may be encountered in performing the following troubleshooting procedure. Use caution at all times to prevent injury.

Table 3-6. 28 V DC Power Supply HTA-3A6PS1 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
1	Power transformer TI auxiliary rectifier secondary.	As specified in paragraph 3-17.	As specified in paragraph 3-17 with multifunction meter connected between terminals B13 and B17 on PC board B.	20.8 :2 V ac	Check C1 for a short; replace as necessary. If indication is 0, check thermostat SI with ohmmeter for open condition. If thermostat is open, allow unit to cool and recheck with ohm meter. If S1 is still open, replace thermostat. If thermostat S1 is closed, check TI for open or shorted condition. Replace faulty item as directed in section X of this chapter.
2	Power transformer TI main rectifier secondary.		Connect multifunction meter between anode of CR9 and anode of CR 11.	34.4 $\pm$3.4 V ac	Check C9 for open or shorted condition. Replace faulty item as directed in section X of this chapter.
3	Main rectifier circuit.	Multifunction meter: press DC FUNCTION switch.	Connect multifunction meter leads to power supply as follows: Test leads / Power supply -(blk) / TBI-6 +(red) / Term B5 on pcb B	20.6$\pm$2 V dc	Check C9, CR8 thru CRI 1, and C8 for a shorted or open condittoing. Replace faulty item as directed in section X of this chapter.
4	Bias supply		Connect multifunction meter test leads to power supply as follows: Test leads / Power supply -(blk) / Junction +(red) / of RO10 and R6 (outboard side of RIO)	9.1 $\pm$.1 V de	Check CR7, C7 and CR6 for a shorted or open component. Replace faulty item as directed in section X of this chapter.

Table 34 28 V DC Power Supply HTA-3A6PS1 Troubleshooting Procedure -Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
5	Bias supply		Connect multifunction meter test leads to power supply as follows: Test leads / Power supply -(blk) / TBI- +(red) / Junction of R3 and R4 (inboard side of R3)	6.1 $\pm$0.5 V de	Check CR1, R5, R4, and R3 for a shorted or open component. Replace faulty item as directed in section X of this chapter.
6	Series voltage regulator circuit		Connect multifunction meter test leads to power supply as follows: Meter leads / Power supply -(blk) / TB1-4 +(red) / TB1-6	28 1.4 V dc	a. If voltage is present but not within tolerance, adjust VDC control R1. If voltage cannot be adjusted with RI, check RI with ohmmeter for shorted or open condition. Replacel, if faulty, as directed in section X of this chapter. b. If RI is not faulty, per supply may be operating a constant current source at current limit value Check adjustment of overcurrent control R17 (para 3-74) and check series regulator circuit with ohmmeter for shorted components. Replace faulty item s directed in section X of this chapter. c. If output voltage is too high. check R1 with ohmmeter for open condition. Replace, i faulty, s directed in section X of this chapter. Chock Qs thru QI3, Q5, Q1, and Q6 for shorted condition. Check CR1 for an open condition. d. If output voltage is too low. check Q2 and Q3 with ohm meter for shorted condition and check R25 and R17 for open condition. Replace faulty item as directed in section X of this chapter.
7	Filter circuits	Twist oscilloscope test leads to cancel external noise signals when masuring ripple voltage.	Connect oscilloscope test lead to power supply as follows: Oscilloscope leads / Power supply {blk) / TBI-3 +(red) / TBI-7	Equal to or lea than 3 mV p-p ripple.	a. If ripple is at the line frequency or twice the line frequency, check CR7, and CR8 thru CR I for a shorted or open condition. Check C1, C7, and C8 for open condition. Check C1, C7, and C8 for open conditions. Replace faulty item as directed in section X this chapter.

Table 34   28 V DC Power Supply HTA-3A6PS1 Troubleshooting Procedure -Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					b. If large spikes are present, check C2 and C3 for n open condition. Replace faulty item as directed in section X of this chapter.

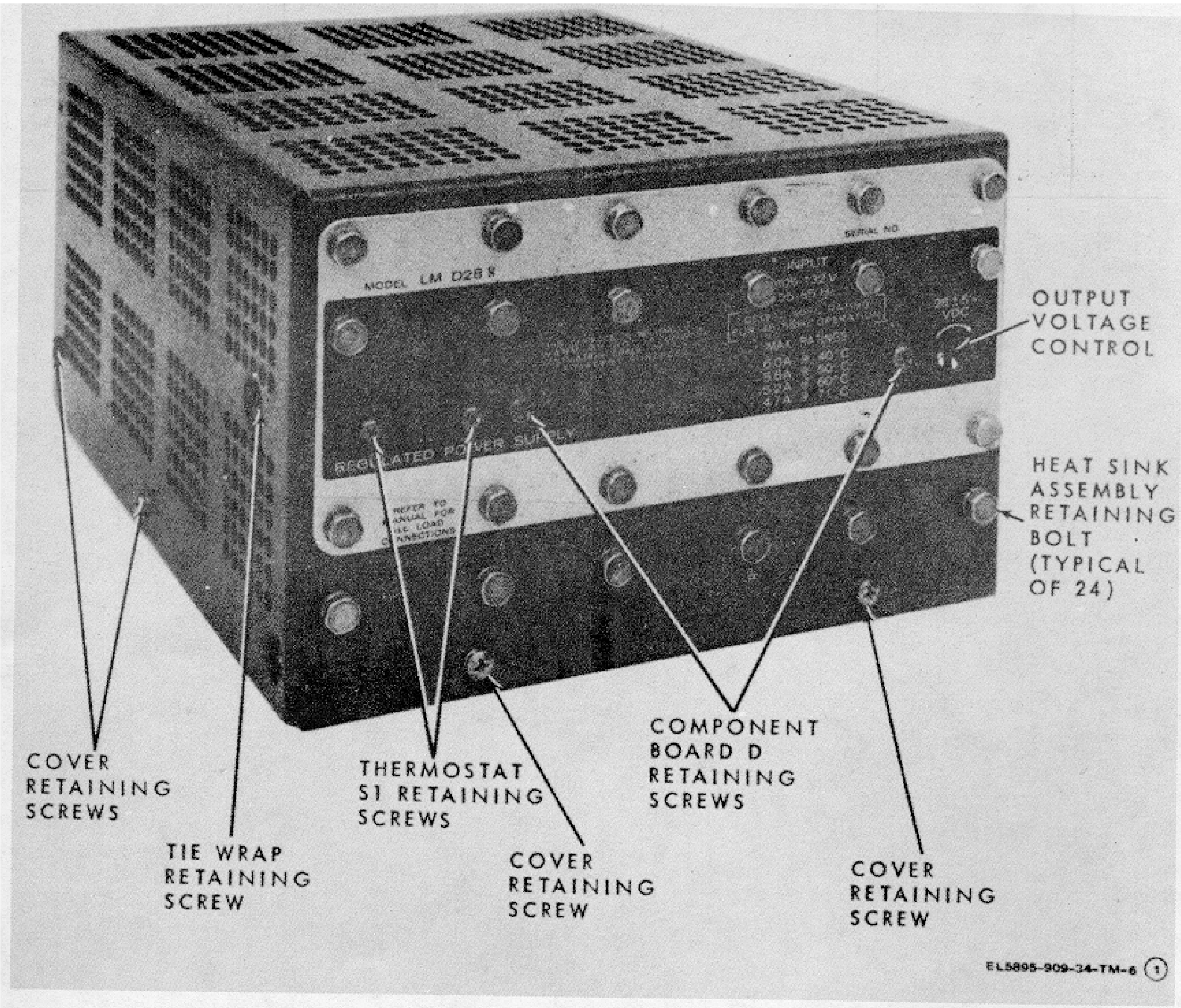


Figure 3-2. 28 V dc power supply HTA-3A6PS1, parts location (sheet 1 of 5

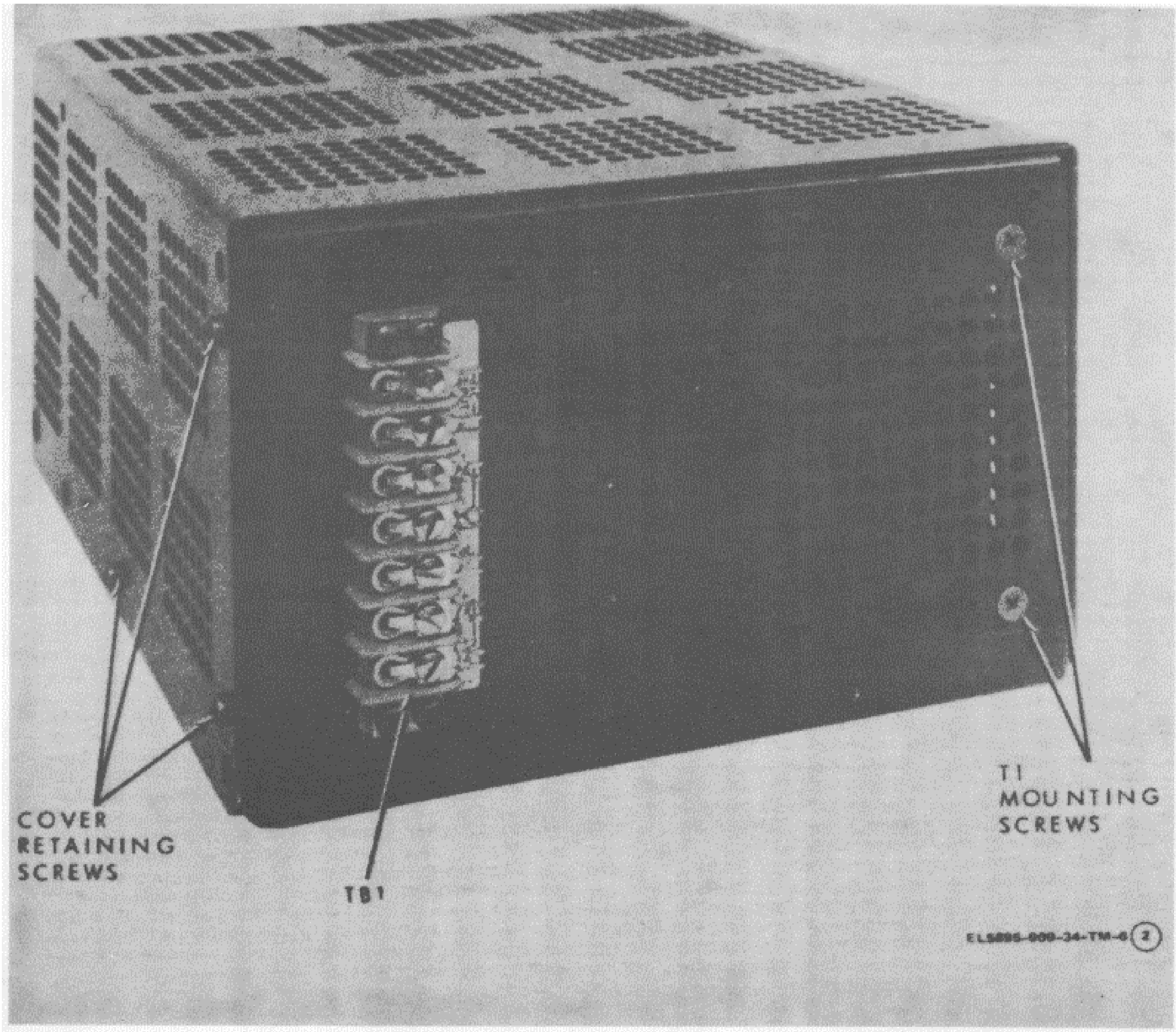


Figure 3-2. 28 V dc power supply HTA-3A6PS1, parts location (sheet 2 of.5

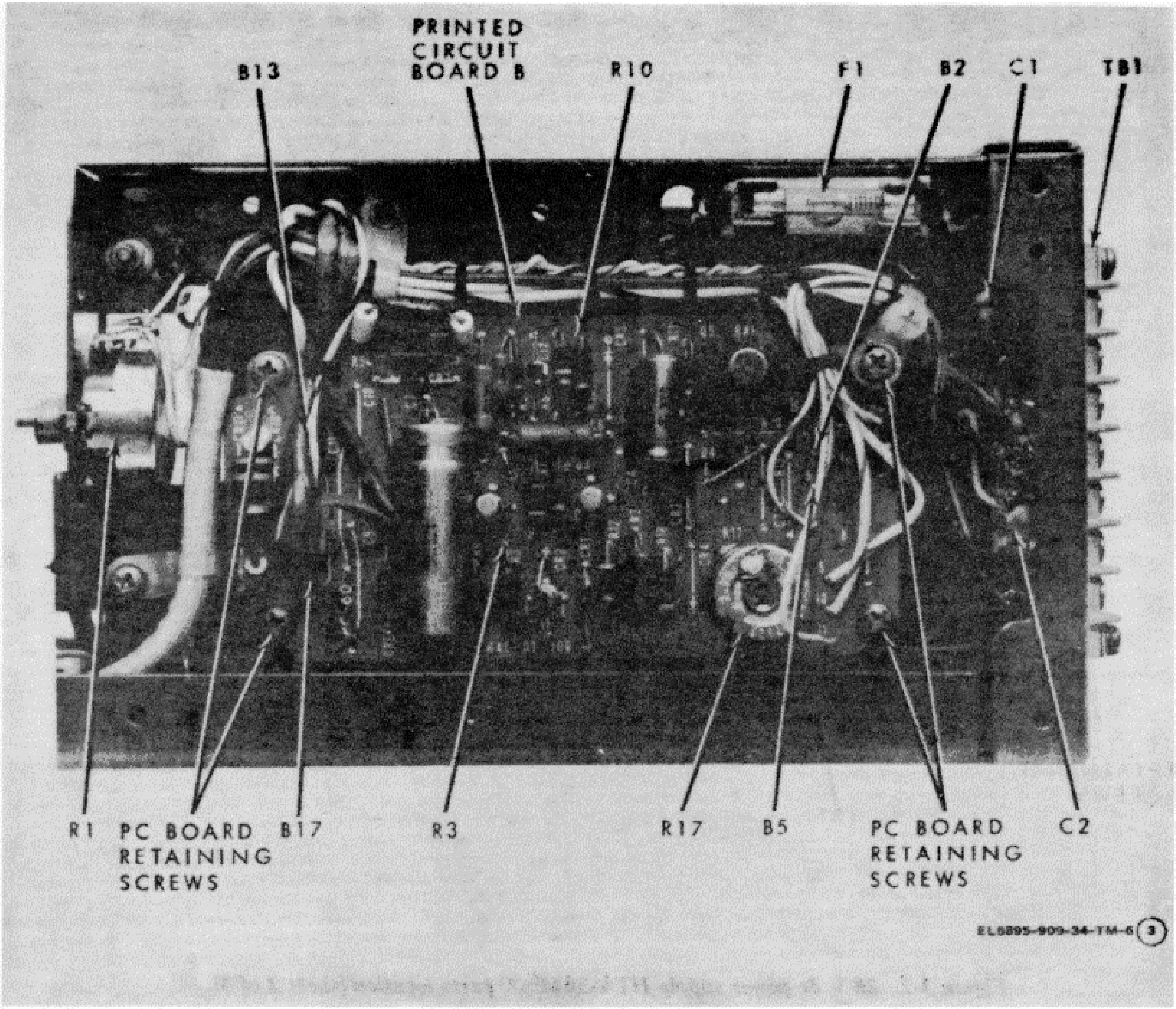


Figure 3-2. 28 V dc power supply HTA-3A6PS1, parts location (sheet 3 of.5

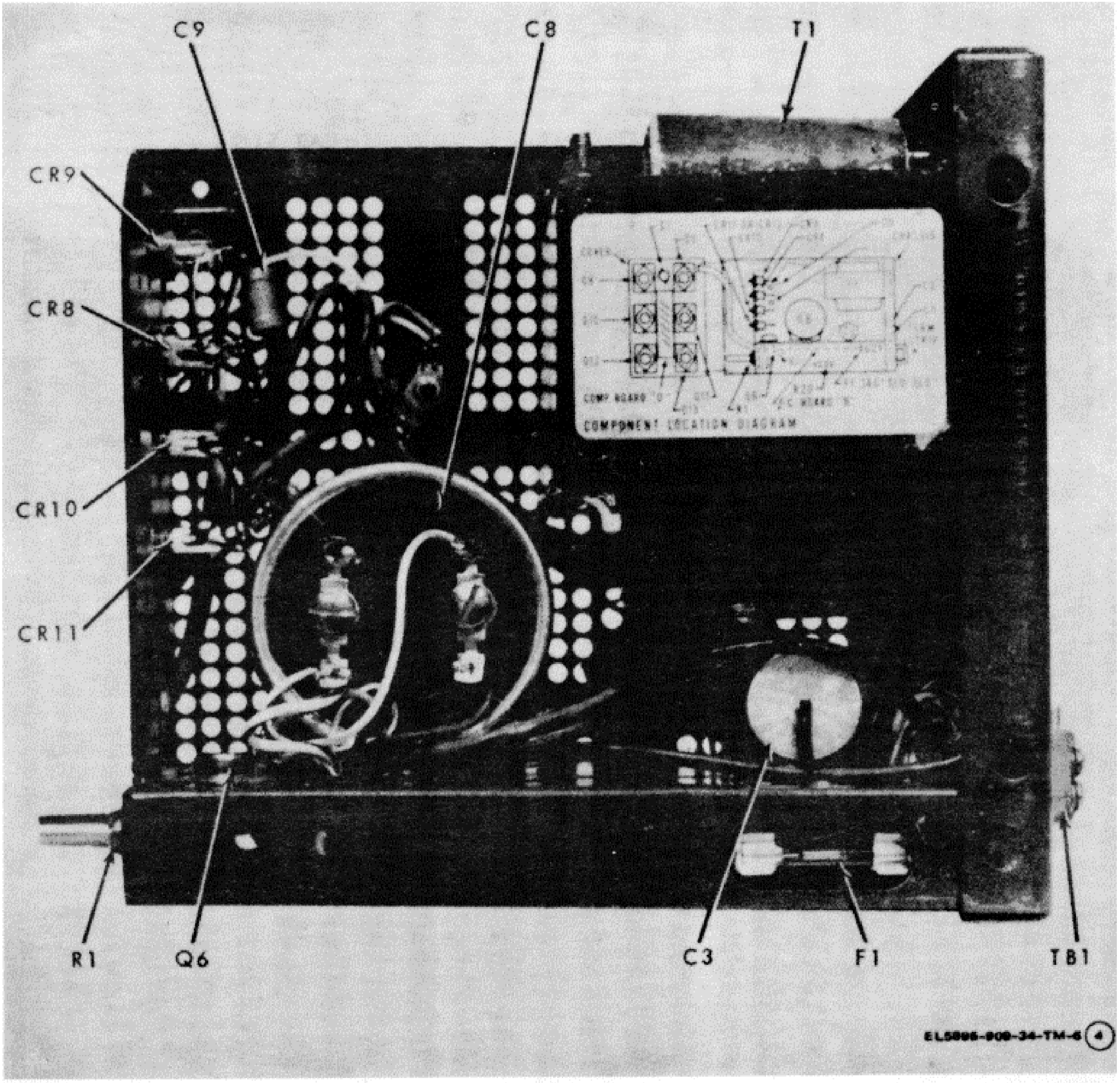


Figure 3-2. 28 V dc power supply HTA-3A6PS1, parts location (sheet 4 of 5)

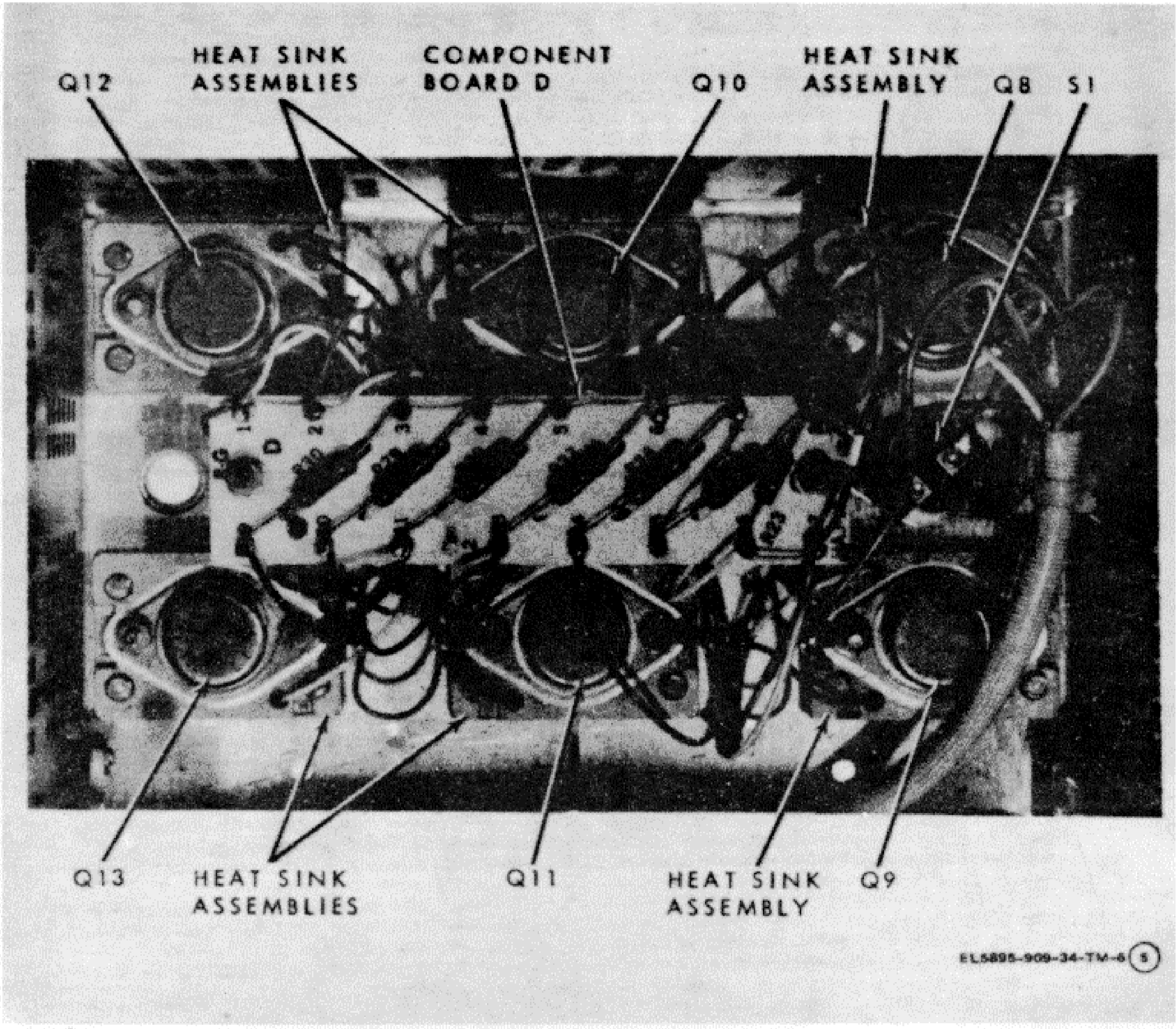


Figure 3-2. 28 V dc power supply HTA-3A6PS1, parts location (sheet 5 of 5)

SECTION V. TROUBLESHOOTING OF15 V DC POWER SUPPLY HTA-3A6PS2

3-20. General. This section contains preliminary pro cedures and troubleshooting procedures for localizing fault to a malfunctioning part of the 15 V dc power supply. The preliminary procedure consists of obtaining listed test equipment, making prescribed test connections and initially setting equipment controls to specified settings. These settings, and all subsequent settings given i; the troubleshooting chart, must be made carefully to en sure accurate test results. When a troubleshooting procedure specifies replacement or adjustment of a malfunctioning component, refer to section XII in this chapter.

3-21. Test Equipment and Materials. Table 3-7 lists test equipment required for troubleshooting the 15 V dc power supply.

Table 3-7. Test Equipment Required for 28 V DC Power Supply HTA-3A6PS1 Troubleshooting

Common name	Part/model no.	Qty	Manufacturer
AC Line Cord	17449	1	Belden
Adapter. AC. 3-Wire to 2-Wire	784519	I	Allied
Adapter, Banana Jack to Spade Lug	3744	3	Pomona
Adapter. BNC Plug to Dual Binding P	103003500	1	Tektronix
Adapter. Single Banana Plug to Binding Pot	2394	2	Pomona
Meter, Multifunction	3450B OPT 001, 002	1	Hewlett-Packard
Milliammeter, Volt-Ohm	260-6	I	Simpson
Osilloscope Dual-Trace	475	1	Tektronix
Test Lead. Banana Plug to Alligator Clip	11666-I B	2	Pomona
Teat Lead. Banana Plug to Alligator Clip	1166-36-R	I	Pomona
Test Lied, Banana Plug to Banana Plug	4-B	2	Pomona
Test Lead. Banana Plug to Banana Plug	B4--R	I	Pomona
Test Lead, Banana Plug to Test Probe	1986-36-B	I	Pomona
Test Lead, Banana Plug to Test Probe	196-36--R	I	Pomona
Transformer, Variable	3PN2210	I	Staco

3-22. Test Connections and Conditions. Troubleshooting of the power supply is accomplished in a bench test setup. Prior to performing the troubleshooting procedure, prepare the equipment for test as follows:

a. Connect variable transformer to power source. Set power switch to on and observe that indicator lights.

b. Set volt-ohm-milliammeter (vom) function switch to AC and range switch to 250 V. Connect vom to variable transformer output plug and adjust variable transformer for 115 V ac indication on vom. Set variable transformer power switch to off. Disconnect vom.

c. On 15 V dc power supply, verify jumper wires are connected between terminals 3 and 4 and between terminals 6 and 7.

d. Remove power supply cover (para 3-82).

e. Connect test equipment as shown in figure FO- 12.

3-23. Initial Control Settings. Initial test equipment settings for the troubleshooting procedures are as follows:

Control	Position
Multifunction meter	
FUNCTION	AC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Oscilloscope	
POWER	On
VERT MODE	CH1
CH 1 VOLTS/DIV	As required to observe signal
CH 1 AC-GND-DC	AC
HORIZ DISPLAY	A
TRIG MODE	NORMAL
COUPLING	AC
SOURCE	NORM
TIME/DIV	As required to observe signal

Control	**Position**
Oscilloscope	
A TRIGGER - SLOPE and LEVEL	As required for stable display
Variable Transformer	
POWER	on

3-24. Troubleshooting Procedure. Table 3-8 provides a step-by-step troubleshooting procedure to isolate malfunction to a faulty part. Perform procedure in sequence given until malfunction is found. If a faulty part found replace part as directed and test power supply as specified in section XIII of this chapter. Use the schematic diagram (fig. FO-9) as an aid to locating trouble and figure 3-3 for location of parts.

WARNING

Hazardous voltages may be encountered in performing the following troubleshooting procedure. Use caution at all times to prevent injury

Table 3-8. V dc Power Supply HTA-3A6PS2 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
1	Power transformer TI auxiliary rectifier secondary	As specified in paragraph 3-22.	As specified in paragraph 3-22 with multifunction meter connected between terminals B13 and and B17 on PC board B.	23.4 ±2 V ac or shorted condition.	Check C1 for a necessary. Check TI for open Replace faulty item us directed in section XII of this chapter. Check C7 for shorted condition
2	Power transformer TI main rectifier seondary		Connect multifunction meter between anode of CR9 and anode of CR11.	27.3 ±3 V ac	Check T1 and C9 for open or shorted condition. Replace faulty item as directed in section XII of this chapter.
3	Main rectifier circuit	Multifunction meter: press DC FUNCTION switch. Test	Connect multifunction meter leads to power supply as followings: Power leads supply -blk) TBI-6 +(red) Term B5 on PC board B	23.6 2 V dc	Check C9. CR8 thru CR11, and C8 for a shorted or open condition. Rcplace directed in section XII of this chapter.
4	Bias supply		Connect multifunction meter test leads to power supply as follows: Test leads -(blk)	9.1 ±0.1 V de Power supply TB1 6	Check CR7, C7 and CR6 for a shorted or open component. Replace faulty item as directed in section XII of this chat tar

Table 3-8. 15 V dc Power Supply HTA-3A6PS2 Troubleshooting Procedure -Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
			+(red) junction of R10 & R6 (out-board side of R10)		
5	Bias supply		Connect multifunction meter test leads to power supply as follows: Test leads — Power supply -(blk) — TB1-6 +(red) — Junction of R3 and R4 (in-board side of R3)	6.1 0O.5 V dc	Check CR1, R5, R4, and R3 for a shorted or open component. Replace faulty item as directed in section XII of this chapter
6	Series voltage regulator circuit		Connect multifunction meter test leads to power supply as follows: Meter leads — Power supply -(blk) — TB1-4 +(red) — TBI-6	15 ±075 V dc RI.	a. If voltage is present but not within tolerance, adjust VDC control R1. be adjusted with check RI with ohmmeter for shorted or open condition. Replace, if faulty, as directed in section XII of this chapter. b. If RI is not faulty, power supply may be operating as constant current source at cur rent limit value. Check adjustment of overcurrent control R17 (para 3-87) and check series regulator circuit with ohmmeter for shorted components. Replace faulty item as directed in section XI] of this chapter. c. If output voltage is too high, check RI with ohmmeter for open condition. Replace, if faulty, as directed in section XII of this chapter. Check QS, Q9, Q5, Q6, and Q1 for shorted condition. Check CRI for an open condition. d. If output voltage is too low, check Q2 and Q3 with ohmmeter for shorted condition and check R28 and R17 for open condition. Replace faulty item as directed in section XII of this chapter.
7	Filter circuits	Twist oscilloscope test lads to cancel external noise signals when measuring ripple voltage.	Connect oscilloscope test lead to power supply as follows: Oscillo-	Equal to or less than 3 mV ripple.	a. If ripple is at line frequency or twice line frequency, check CR7 and CR8 thru CR I1 for a shorted or open condition.

Table 3-8. 15 V dc Power Supply HTA-3A6PS2 Troubleshooting Procedure -Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
			scope leads -(blk) +(red) / Power supply TBI-3 TBI-7		Check C1, C7 and C8 for open conditions. Replace faulty item as directed in section XII of this chapter b. If large spikes are present, check C2 and C3 for an open condition. Replace faulty item as directed in section XII of this chapter.

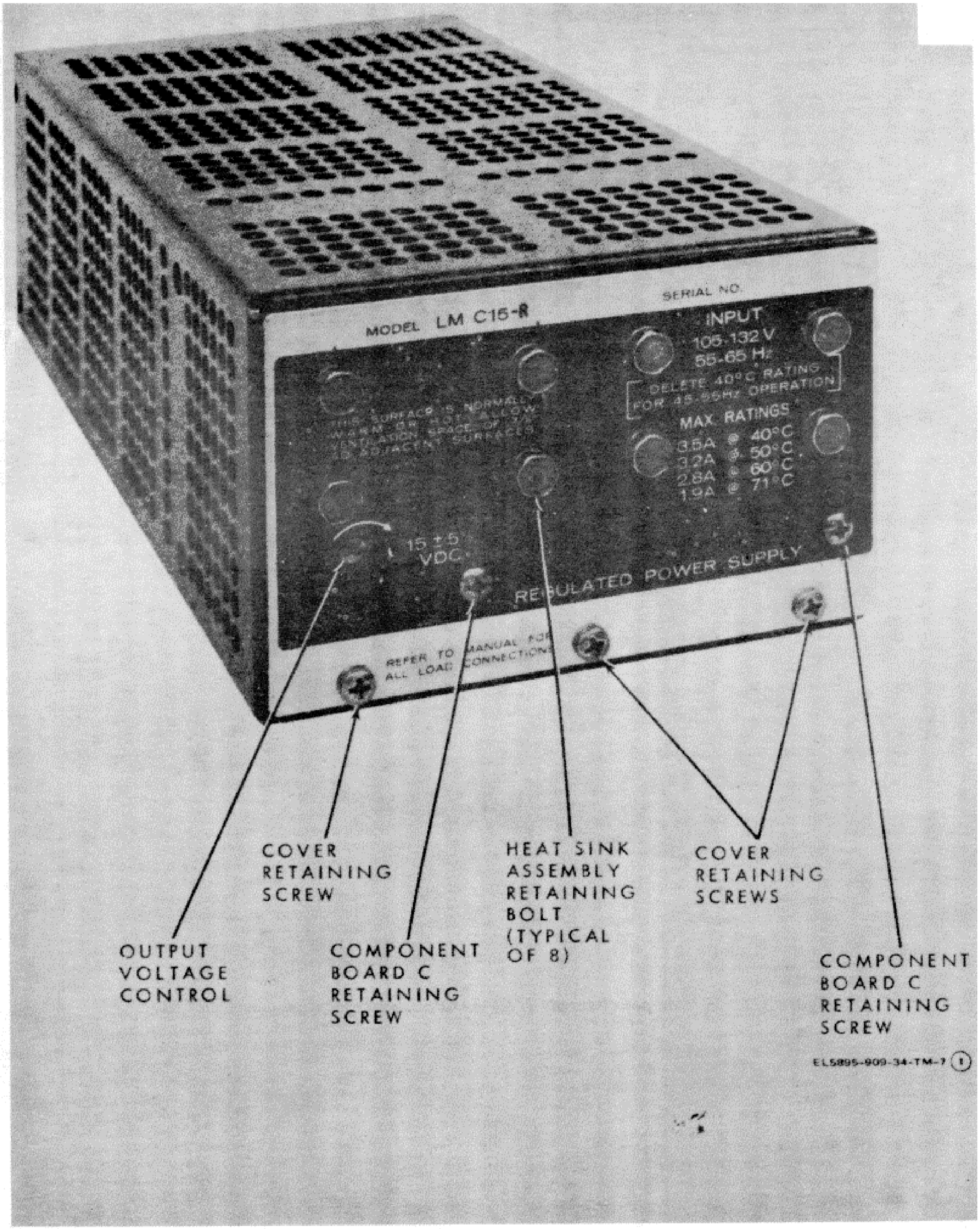


Figure 3-3. 15 V dc power supply HTA-3A6PS2, parts location (sheet 1 of.6

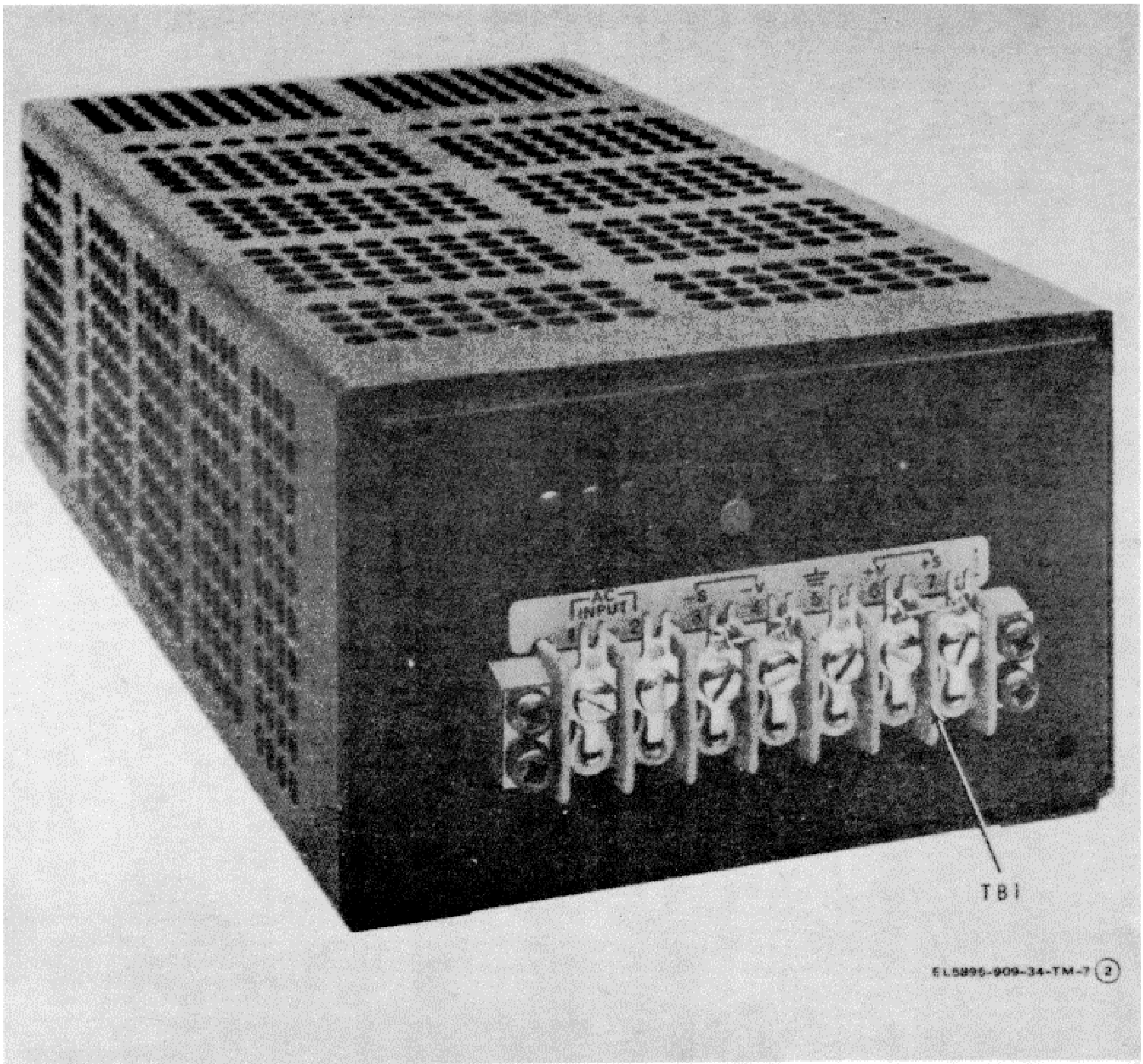


Figure 3-3. 15 V dc power supply HTA-3A6PS2, parts location (sheet 1 of.6

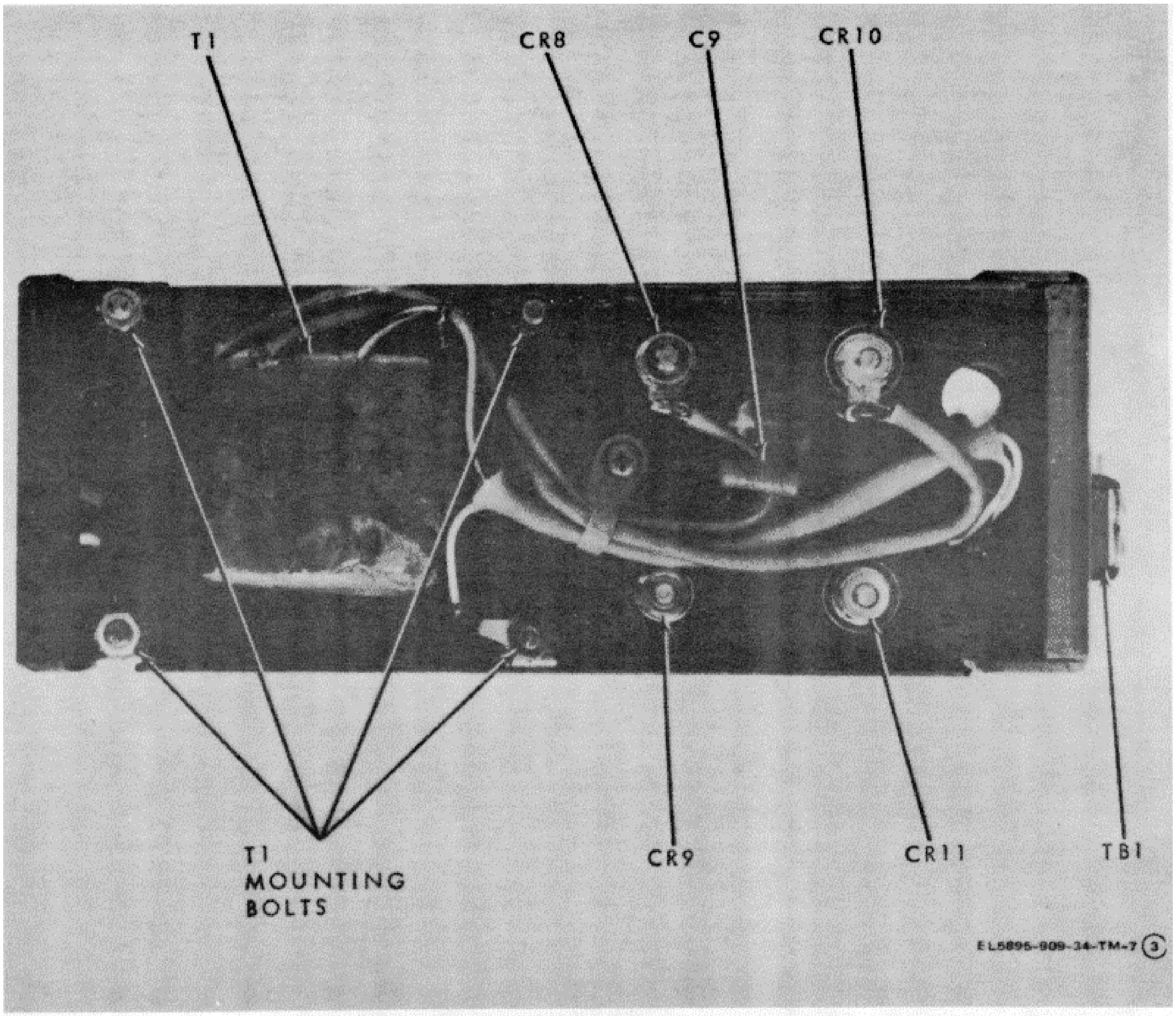


Figure 3-3. 15 V dc power supply HTA-3A6PS2, parts location (sheet 3 of 6).

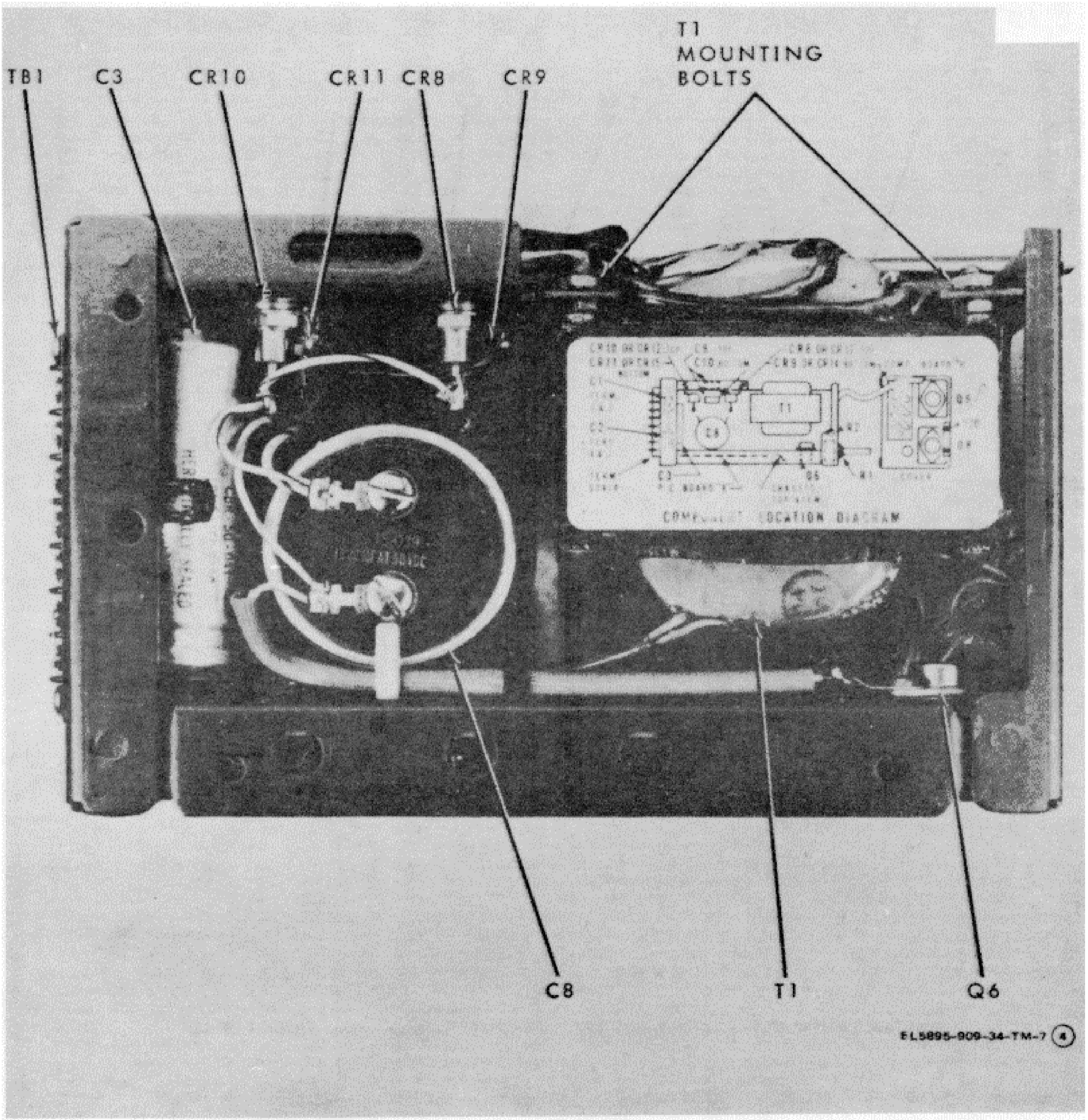


Figure 3-3. 15 V dc power supply HTA-3A6PS2, parts location (sheet 4 of 6).

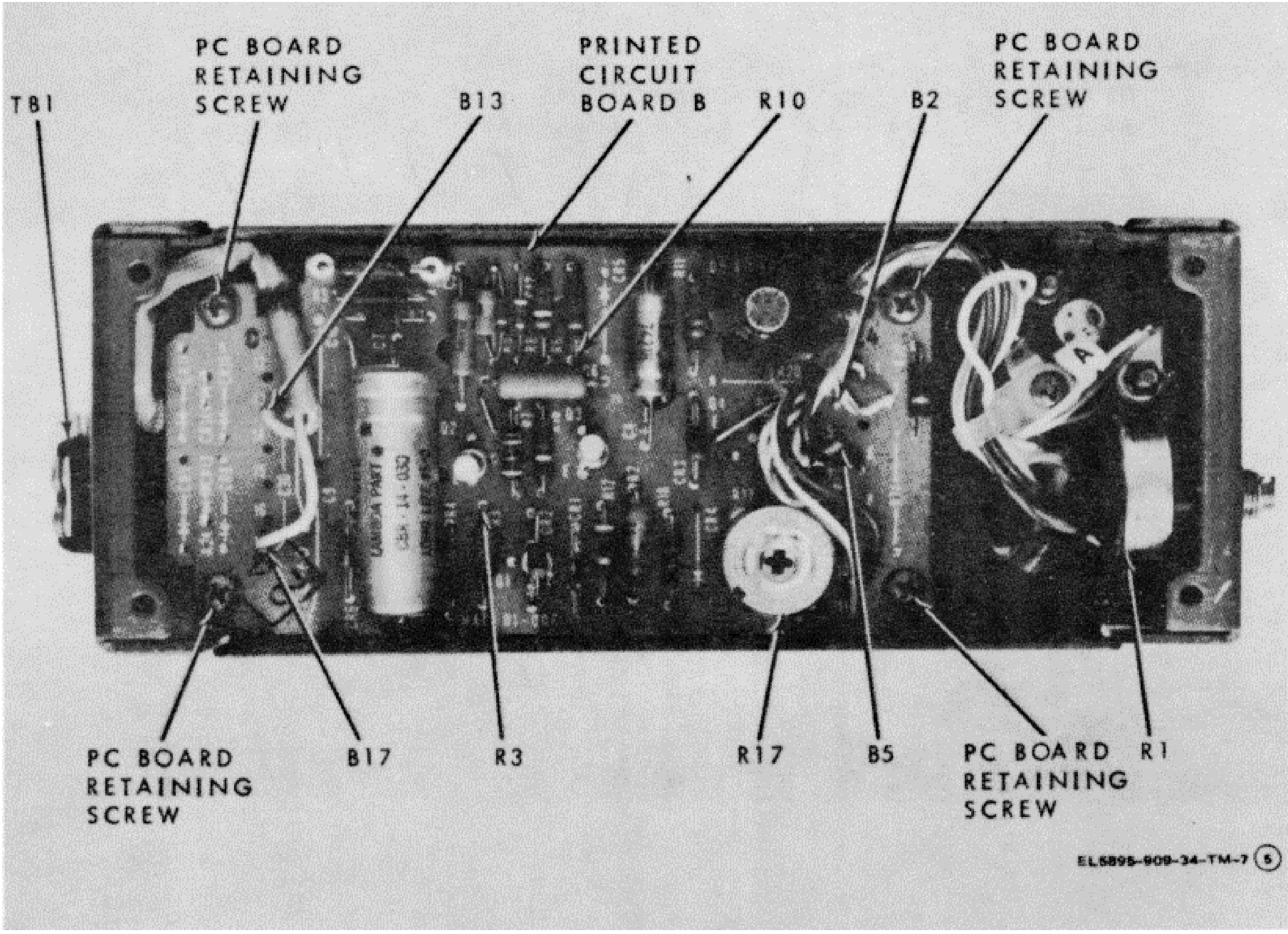


Figure 3-3. 15 V dc power supply HTA-3A6PS2, parts location (sheet 5 of 6)

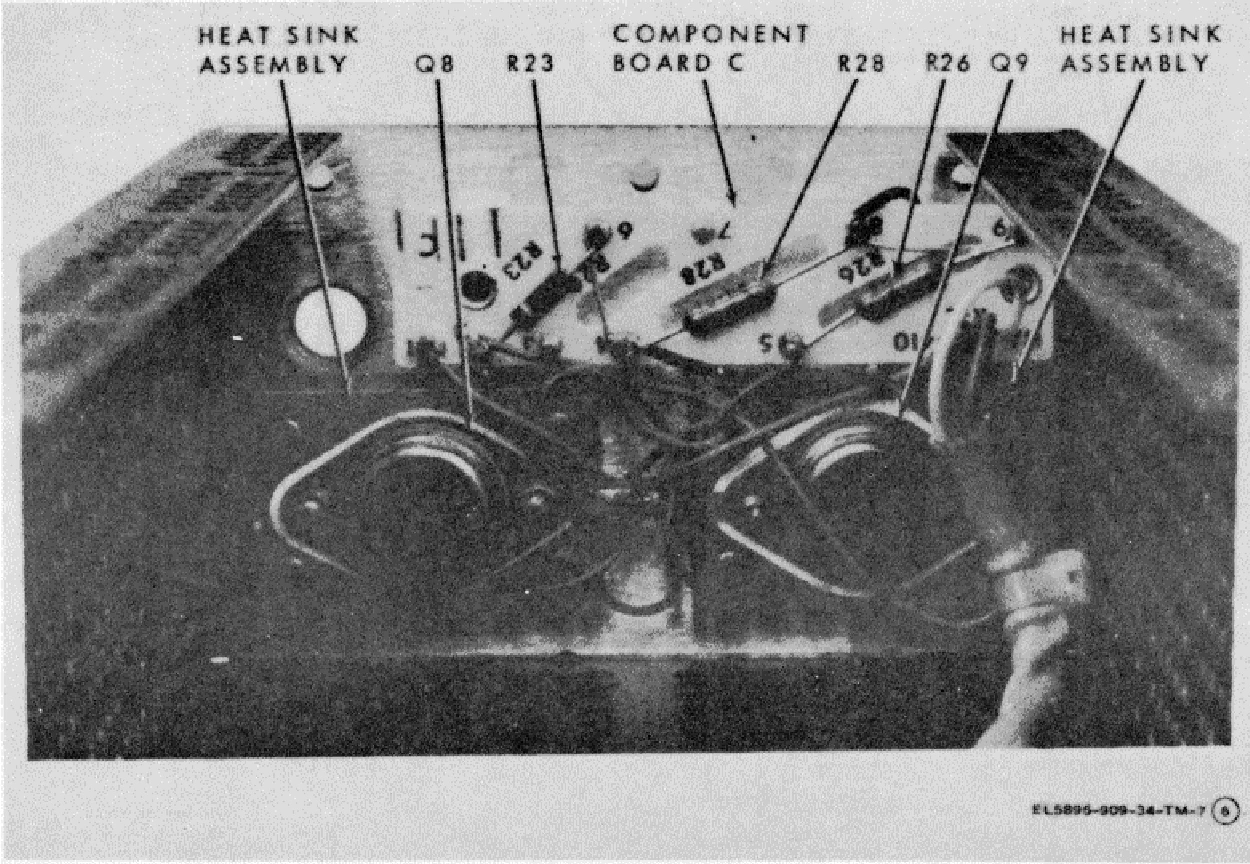


Figure 3-3. 15 V dc power supply HTA-3A6PS2, parts location (sheet 6 of 6)

SECTION VI. TROUBLESHOOTING OF 5 V DC POWER SUPPLY HTA-3A6PS83

3-25. General. This section contains preliminary procedures and troubleshooting procedures for localizing a fault to a malfunctioning piece part of the 5 V dc power supply. The preliminary procedure consists of obtaining listed test equipment, making prescribed test connections, and initially setting equipment controls to specified settings. These settings and all subsequent settings given in the troubleshooting chart, must be made carefully to ensure accurate test results. Wen a troubleshooting procedure specifies replacement or adjustment of a malfunctioning component, refer to section XIV in this chapter.

3-26. Test Equipment and materials. Table 3-9 lists the test equipment required for troubleshooting the 5 V dc power supply.

Table 3-9. Test Equipment Required for 5 V DC Power Supply HTA-3A6PS3 Troubleshooting

Common name.	Part/model no	Qty	Manufacturer
AC Line Cord	17449	1	Belden
Adapter, AC, 3-Wire to 2-Wire	785-0419	1	Allied
Adapter, Banana Jack to Spade Lug	3744	3	Pomona
Adapter, BNC Plug to Dual Binding Post	103-0035-00	1	Tektronix
Adapter, Single Banana Plug to Binding Post	2894	2	Pomona
Meter. Multifunction	3450B OPT 001, 002	1	Hewlett-Packard
Milliammeter, Volt-Ohm-	2606	1	Simpson
Oscilloscope, Dual-Trace	475	1	Tektronix
Test Lead, Banana Plug to Alligator Clip	1166-36-B	2	Pomona
Test Lead, Banana Plug to Alligator Clip	1166-36-R	1	Pomona
Test Lead, Banana Plug to Banana Plug	B-48-B	2	Pomona
Test Leas, Banana Plug to Banana Plug	B-48-R	1	Pomona
Test Lead, Banana Plug to Test Probe	1986-36-B	1	Pomona
Test Lead, Banana Plug to Test Probe	1986-36R	1	Pomona
Transformer. Variable	3PN2210	1	Staco

3-27. Test Connections and Conditions. Troubleshooting of the power supply is accomplished in a bench test setup. Prior to performing the troubleshooting procedure, prepare the equipment for test as follows:

a. Connect variable transformer to power source. Set power switch to on an \d observe that indicator lights.

b. Set volt-ohm-milliammeter (vom) function switch to AC and range switch to 250 V. Connect vom to variable transformer output plug and adjust variable transformer for 115 V ac indication on vom. Set variable transformer power switch to off. Disconnect vom.

c. On 5 V dc power supply , verify jumper wires are connected between terminals 3 and 4 and between terminals 6 and 7.

d*.* Remove power supply cover (para 3-95).

e*.* Connect test equipment as shown in figure FO-12.

3-28. Initial Control Settings. Initial test equipment settings for the troubleshooting procedures are as follows:

Control	Position
Multifunction meter	
LINE	On (up)
FUNCTION	AC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Oscilloscope	
POWER	On (pull)
VERT MODE	CH 1
CH 1 VOLTS/DIV	As required to observe signal
CH 1 AC-GND-DC	AC
HORIZ DISPLAY	A
TRIG MODE	NORMAL
COUPLING	AC
SOURCE	NORM
TIME/DIV	As required to observe signal
A TRIGGER - SLOPE and LEVEL	As required for stable display
Variable transformer	
POWER	On

3-29. Troubleshooting Procedure. Table 3-10 provides a step-by-step troubleshooting procedure to isolate a malfunction to a faulty part. Perform procedure in sequence given until malfunction is found. If a faulty part is found, replace part as directed and test power supply as specified in section XV of this chapter. Use the schematic diagram (fig. FO-10) as an aid to locating trouble causes and figure 3-4 for location of parts.

WARNING

Hazardous voltages may be encountered in performing the following troubleshooting procedure. Use caution at all times to prevent injury.

Table 3-10. 5 V DC Power Supply HTA-3A6PS3 Troubleshooting Procedure -Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
1	Power transformer T1 auxiliary rectifier secondary	As specified in paragraph 3-27.	As specified in paragraph 3-27 with multifunction meter connected between terminals B13 and B17 on PC board B.	21.8 ±2 V ac	Check C1 for a short; replace as necessary. Check T1 for open or shorted condition. Replace faulty item as directed in section XIV of this chapter.
2	Power transformer T1 main rectifier secondary		Connect multifunction meter between terminal B2 on PC board B and cathode of CR8, then between terminal B2 and cathode of CR10.	15 ±1.5 V ac	Check T1 for open or shorted condition. Check C9 and C10 for shorted condition. Replace faulty item as directed in section XIV of this chapter.
3	Main rectifier circuit	Multifunction meter: press DC FUNCTION switch.	Connect multifunction meter leads to power supply as follows: Test leads / Power supply -(blk) / TB1-6 +(red) / Term B5 on PC board B	16.3 ±1.5 V dc	Check C9, CR8, CR10, C10, and CS for a shorted or open condition. Replace faulty item as directed in section XIV of this chapter.
4	Bias supply		Connect multifunction meter test leads to power supply as follows: Test leads / Power supply -(blk) / TB 1-6	9.1 ±0.1 V dc	Check CR7, C7 and CR6 for a shorted or open condition. Replace faulty item as directed in section XIV of this chapter.

Table 3-10. 5 V DC Power Supply HTA-3A6PS3 Troubleshooting Procedure -Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
			+(red) Junction of R10 and R6 (outboard side of R10)		
5	Bias supply		Connect multifunction meter test leads to power supply as follows: Test leads / Power supply -(blk) TB-6 +(red) Junction of R3 and R4 (inboard side of R3)	6.1 -±0.5 V de	Check CRI, RS, R4, and R3 for a shorted or open component. Replace faulty item as directed in section XIV of this chapter.
6	Series voltage regulator circuit		Connect multifunction meter test leads to power supply as follows: Test leads / Power supply -(blk) TBI-4 +(red) TBI-6	5 ±0.25 V dc	a. If voltage is present but not within tolerance, adjust VDC control R1. If voltage cannot be adjusted with R1, check R1 with ohmmeter for shorted or open condition. Replace faulty item as directed in section XIV of this chapter. b. If R1 is not faulty, power supply may be operating as constant current source at cur rent limit value. Check adjustment of overcurrent control R17 (para 3-100) and check series regulator circuit with ohmmeter for shorted components. Replace faulty item as directed in section XIV of this chapter. c. If output voltage is too high, check R1 with ohmmeter for open condition. Replace, if faulty, as directed in section XIV of this chapter. Check Q8, Q9, Q5, 6, and Q1 for shorted condition. Check CR1 for an open condition. Replace faulty item as directed in section XIV of this chapter. d. If output voltage is too low, check Q2 and Q3 with ohmmeter for shorted condition, and check R28 and R17 for open condition. Replace faulty item as directed in section XIV of this chapter
7	Filter circuits	Twist oscilloscope to cancel external noise	Connect oscilloscope test lead to power supply as follows:	Equal to or less than 3	a. If ripple is at the frequency or twice the line frequency, check

Table 3-10. 5 V DC Power Supply HTA-3A6PS3 Troubleshooting Procedure -Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
condition. leads -(blk) +(red)	supply TBI-3 TBI-7	signals when measuring ripple voltage	Osclllo- scope Check C1, C7 and CB for open conditions. Replace faulty item as directed in sec-	mV pp ripple. Power	CR7, CR8 and CR10 for a shorted or open tion XIV of this chapter. b. If large spikes are present, check C2, C9 and C10 for an open condition. Replace faulty item as directed in section XIV of this chapter.

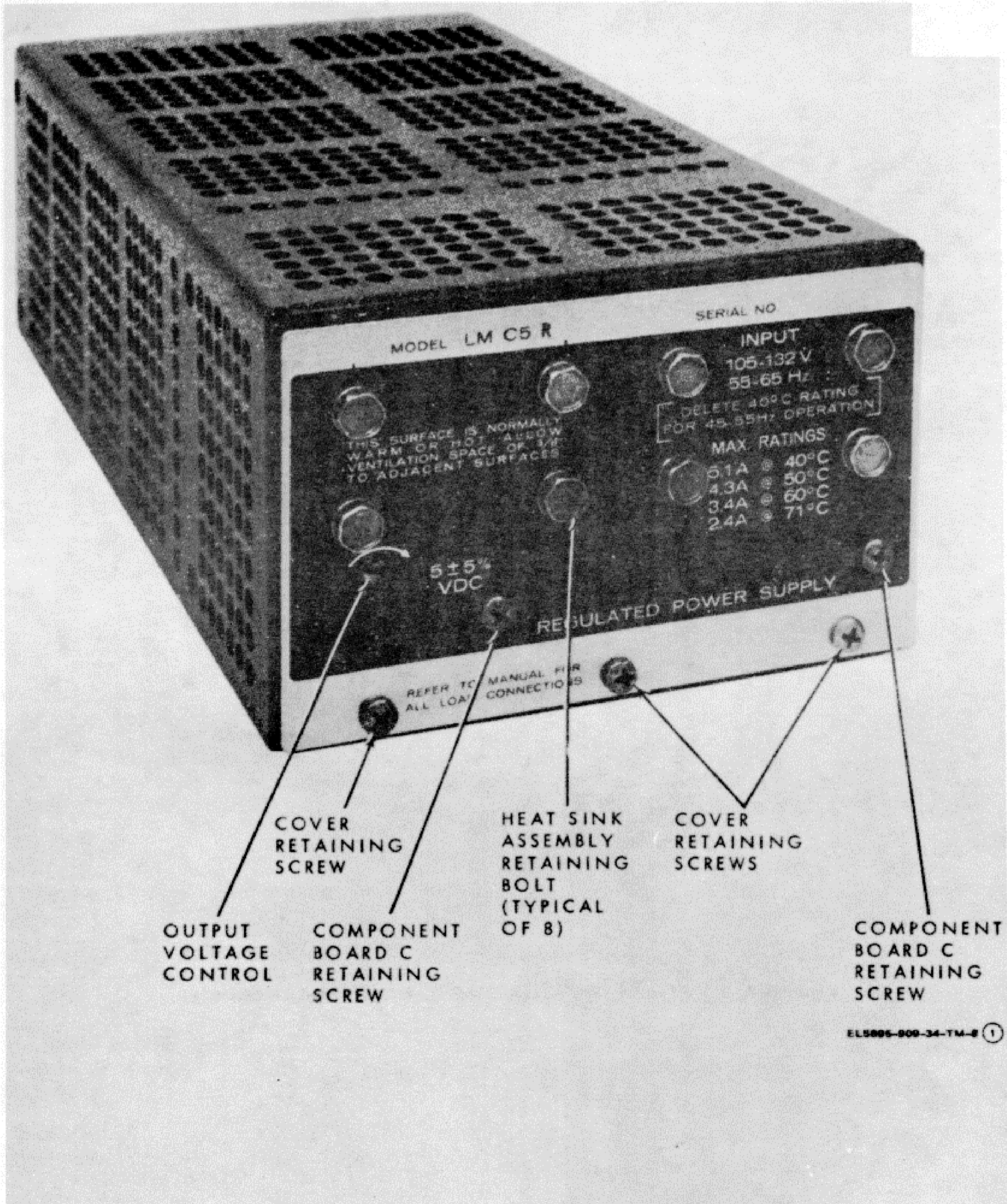


Figure 3-4. 5 V dc power supply HTA-3A6PS3, parts location (sheet 1 of 6).

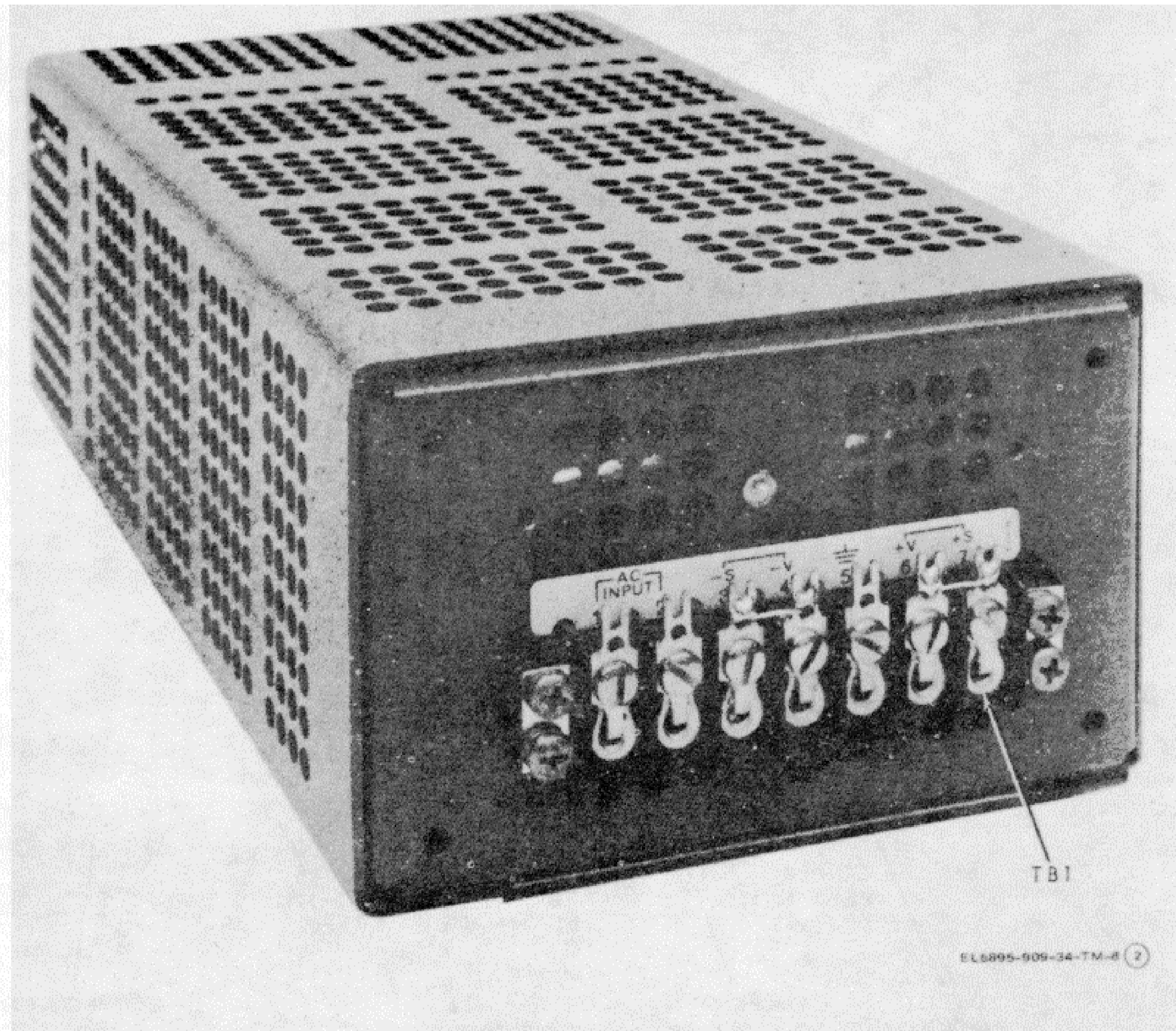


Figure 3-4. 5 V dc power supply HTA-3A6PS3, parts location (sheet 2 of 6).

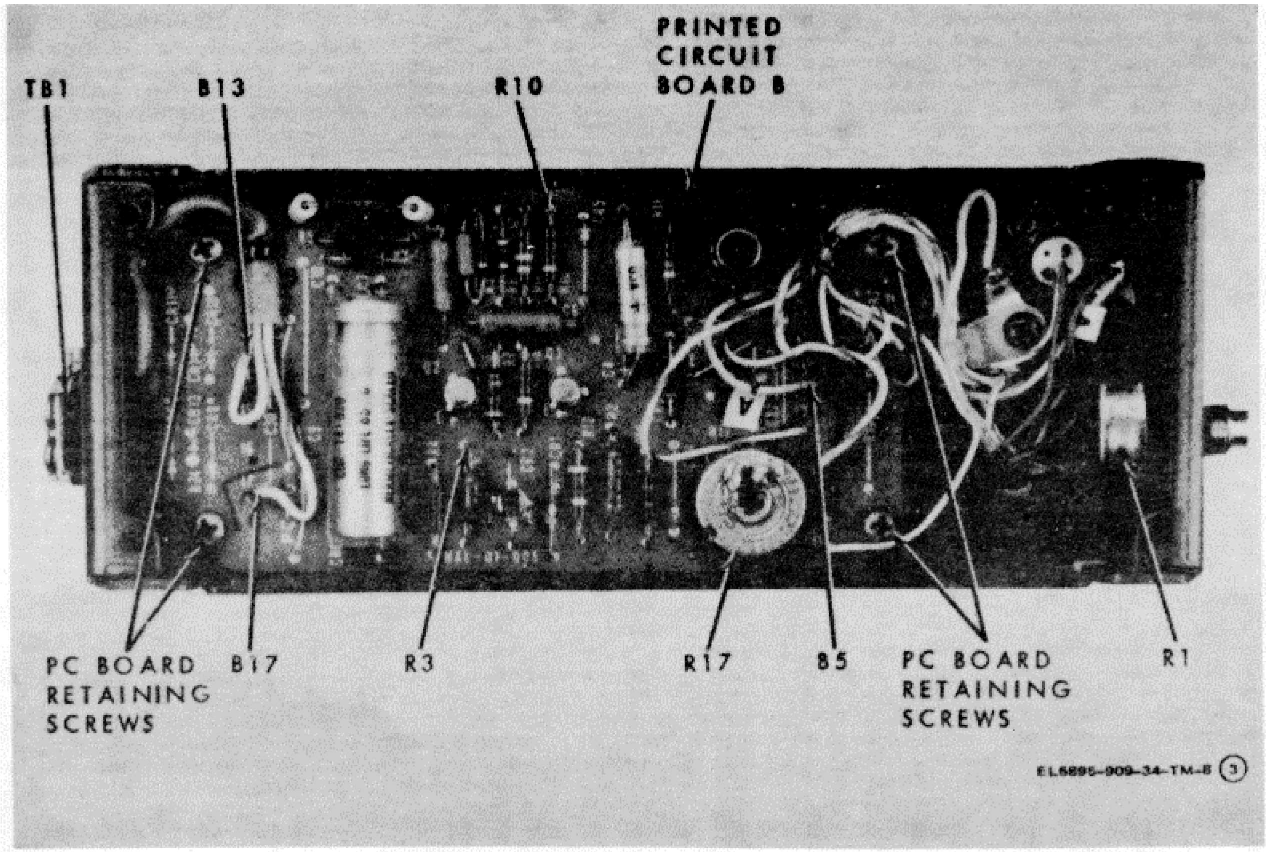


Figure 3-4. 5 V dc power supply HTA-3A6PS3, parts location (sheet 3 of 6).

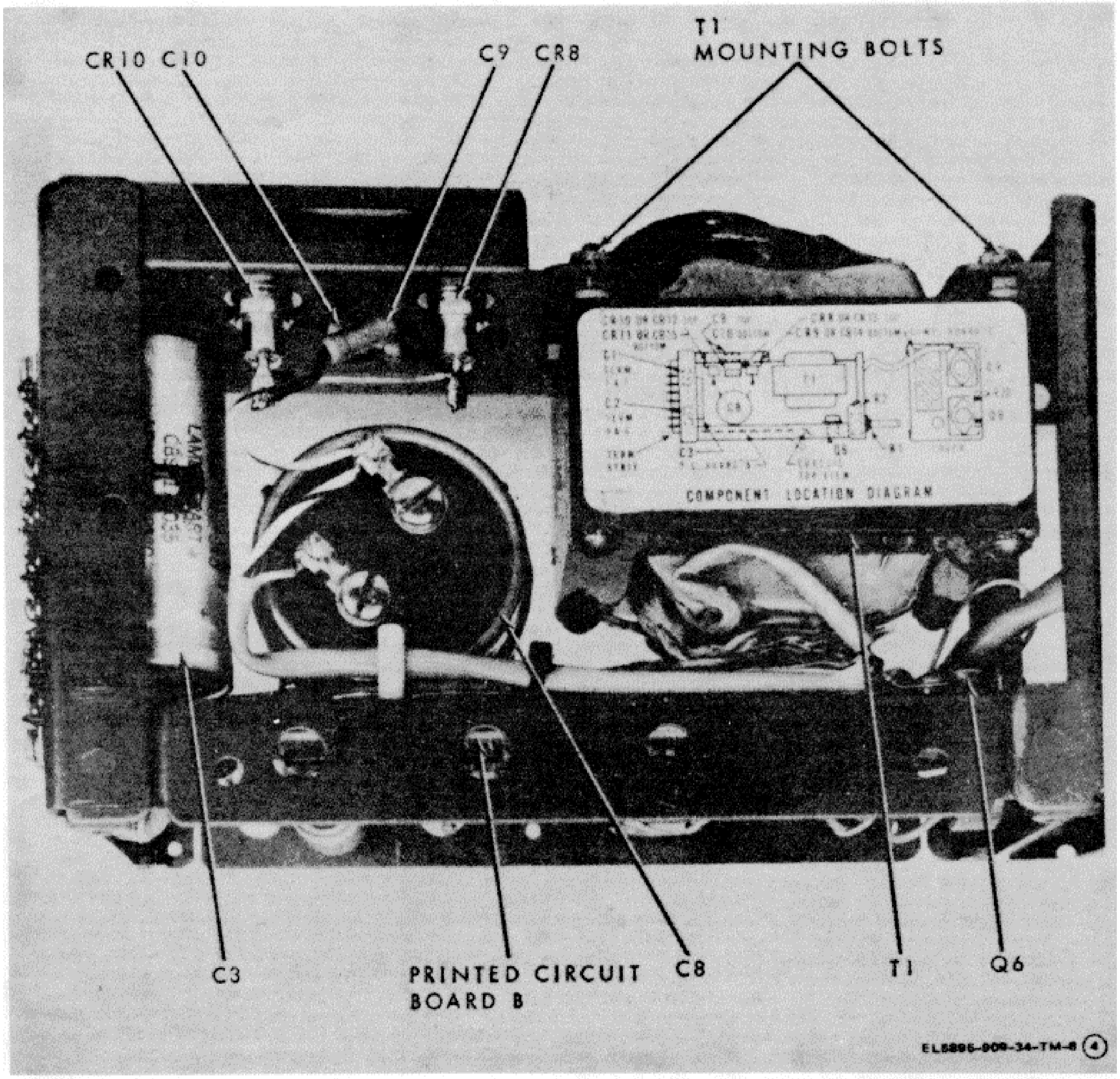


Figure 3-4. 5 V dc power supply HTA-3A6PS3, parts location (sheet 4 of 6).

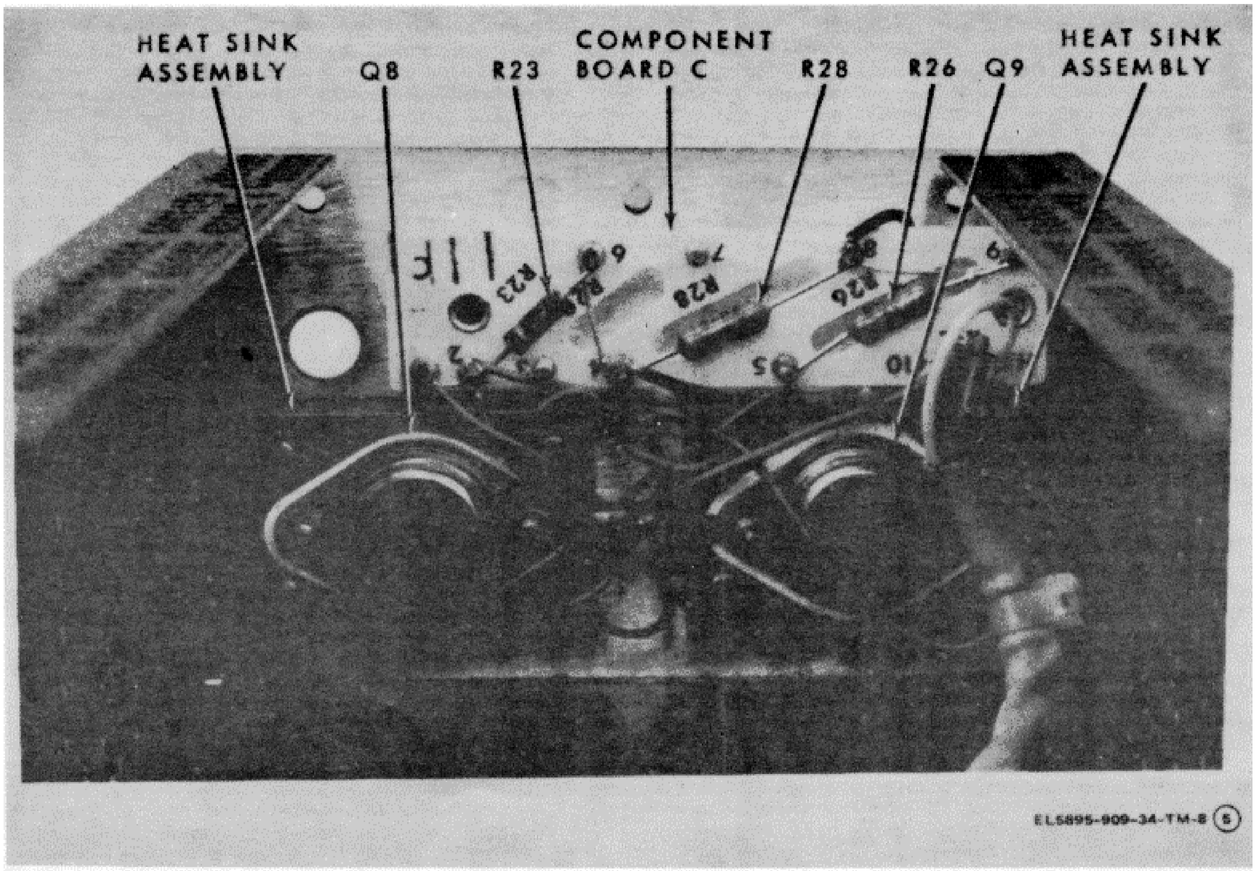


Figure 3-4. 5 V dc power supply HTA-3A6PS3, parts location (sheet 5 of 6).

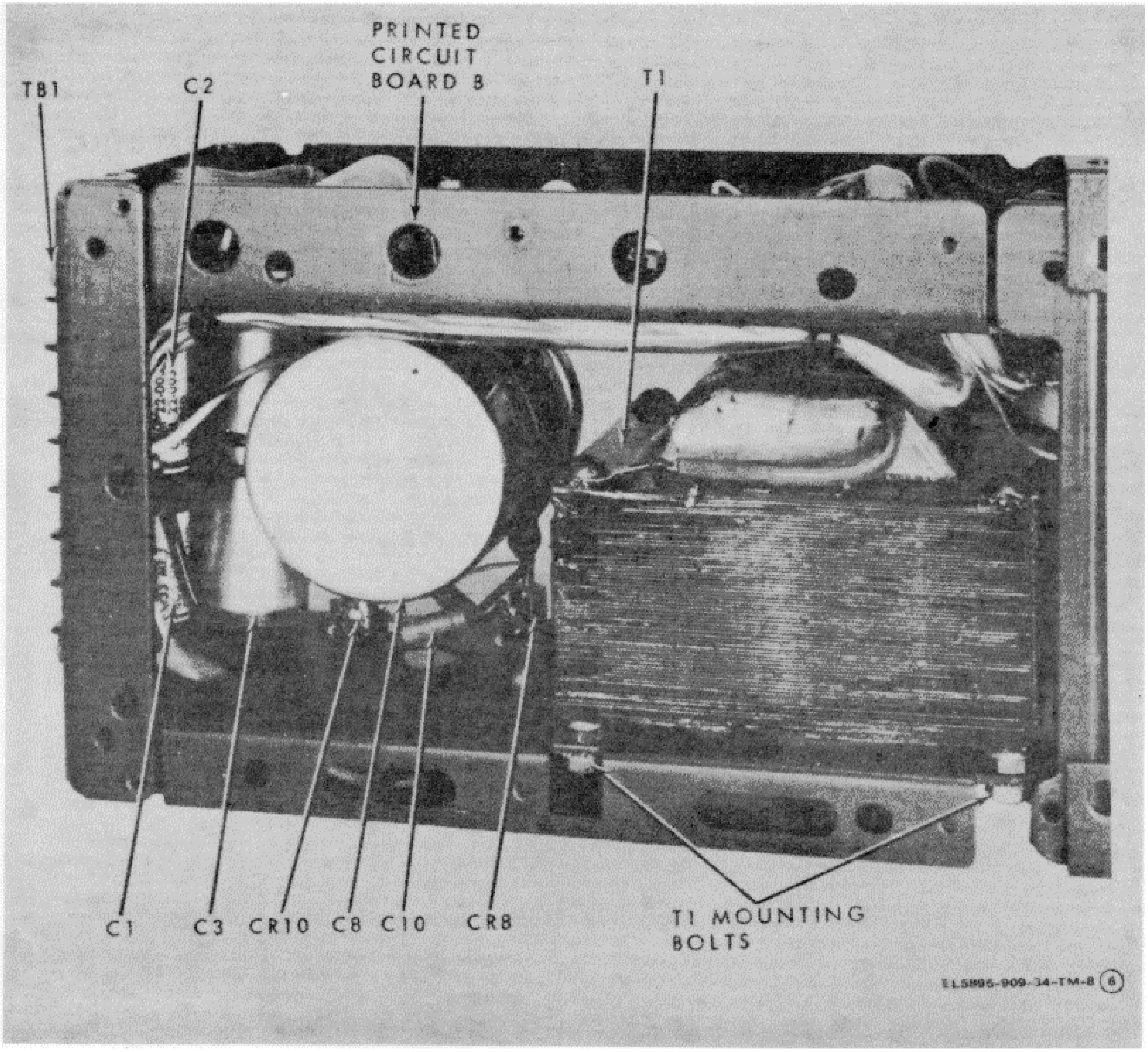


Figure 3-4. 5 V dc power supply HTA-3A6PS3, parts location (sheet 6 of 6)

SECTION VII. TROUBLESHOOTING OF ELECTRICAL BLANKET HEATER HTA-3A6A8

3-30. General. This section contains preliminary procedures and troubleshooting procedures for confirming that a malfunction exists in the electrical blanket heater The preliminary procedure consists of obtaining listed test equipment, making prescribed test connections, and initially setting equipment controls to specified setting Disposition of any faulty item replaced by direct support maintenance shall be made in accordance with the main tenance allocation chart in TM 11-5895-898-12.

3-31. Test Equipment. Test equipment required for testing the electric blanket heater consists of thermometer 19385-1 and clip-on ammeter 749-2901001.

3-32. Test Connections and Conditions. Troubleshooting of the electric blanket heater is performed while the heater is installed in the receiver gain monitor HTA-3A5. Care should be exercised when the thermometer is inserted into the vicinity of switches S1 and S2, as 120 V ac is present at the switch terminals. Test connections are given in the troubleshooting procedure. Remove receiver gain monitor HTA-3A6 cover, and open front panel.

3-33. Initial Control Settings. The only control setting to be concerned with is to set the FAN circuit breaker to ON.

WARNING

120 V ac is present on switch S1 and S2 terminals.

3-34. Troubleshooting Procedure (fig. 3-5). Place thermometer in vicinity of electric blanket heater switches S1 and S2 and monitor thermometer for fifteen minutes after temperature has stabilized. If temperature remains between 110 deg F and 160 deg F, electric blanket heater is operating normally. If temperature stays above or below these limits, or varies above or below these limits, connect clip on ammeter to one of the wires on switch S1. Using table I on figure 3-5 and clip-on ammeter, determine if switch S1 is opening and closing within correct temperature limits. With switch open, ammeter indicates no current flow. With switch closed, ammeter indicates current flow between 0.25 to 1 A. Move clip-on ammeter to one of the wires on switch S2. Determine, as above, the proper operation of switch S2. If electric blanket heater is not operating properly, refer to paragraph 3-61 for removal and replacement procedures.

SECTION VIII. MAINTENANCE OF PILOT CARRIER MONITOR PANEL 14A26

3-35. General. This section provides instructions for re moval and replacement of the pilot carrier monitor pane 14A26, and replacing line replaceable units in accordance with the maintenance allocation chart in TM 11-5895-89812. The line replaceable units of the pilot carrier monitor panel 14A26 consist of four meters mounted on the front panel, and a connector mounted on the bracket at the rear of the panel.

3-36. Removal and Replacement of Gain Balance Meter (fig. 1-2). To remove and replace a gain balance meter proceed as follows:

a. Unscrew the four captive screws securing the pilot carrier monitor panel 14A26 to control console unit 14.

b. Carefully lift the panel from control console unit 14 and disconnect cable from connector J1 and disconnect ground wire from GND terminal.

c. Place pilot carrier monitor panel 14A26 on workbench. Tag and unsolder wires on rear of defective gain balance meter.

d. Remove two nuts, lock washers, flat washers and screws securing the gain balance meter to the panel.

e. Remove meter from panel.

f. Install replacement meter in panel.

g. Install and tighten two screws, flat washers, lock washers, and nuts securing meter to panel.

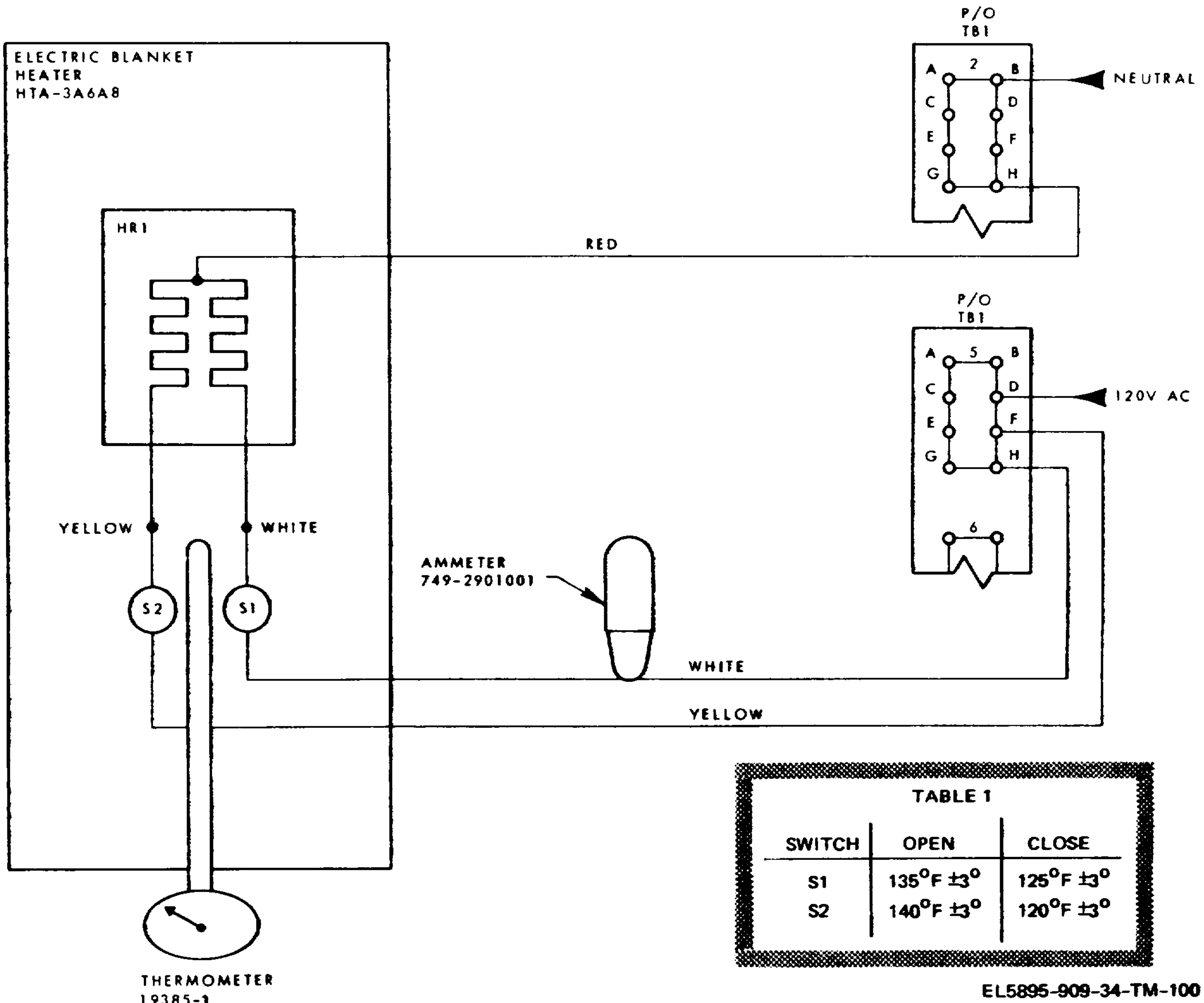


TABLE 1

SWITCH	OPEN	CLOSE
S1	135°F ±3°	125°F ±3°
S2	140°F ±3°	120°F ±3°

Figure 3-5. Electric blanket heater HTA-3A6A8, test setup diagram.

h. Observing tags, resolder the two wires to the proper meter terminals.

i. Complete performance test of pilot carrier monitor panel 14A26 as directed in section XVI of this chapter.

j. Return pilot carrier monitor panel 14A26 to control console unit 14 and attach cable to connector J1 and attach ground wire to GND terminal.

k. Place pilot carrier monitor panel 14A26 in control console unit 14 and tighten the four captive screws.

3-37. Removal and Replacement of Connector J1. To remove and replace the connector, proceed as follows:

a. Unscrew the four captive screws securing the pilot carrier monitor panel 14A26 to control console unit 14.

b. Carefully lift the panel from control console unit 14 and disconnect cable from connector J1 (fig. 1-2) and disconnect ground wire from GND terminal.

c. Place pilot carrier monitor panel 14A26 on workbench and refer to paragraph 3-4d for instructions on removal and replacement of connector.

d. Complete performance test of pilot carrier monitor panel 14A26 as directed in section XVI of this chapter.

e. Return pilot carrier monitor panel 14A26 to control console unit 14 and attach cable to connector J1 to attach ground wire to GND terminal.

f. Secure pilot carrier monitor panel 14A26 into control console with the four captive screws.

SECTION IX. MAINTENANCE OF RECEIVER GAIN MONITOR HTA-3A6

3-38. General. This section provides removal and replacement instructions for receiver gain monitor HTA3A6, the detect and qualification monitor subassembly A1 (detect and qualification module), detect and autoswitch monitor subassembly A2 (detect and autoswitch module), the electric blanket heater, and the power supplies. Replacement instructions are also provided for chassis mounted items such as switches, control knobs, connectors and electronic components. Adjustment procedures are also provided, when required, after replacement of a defective item. Figure 3-6 shows location of the various components of the receiver gain monitor unit.

3-39. Removal and Replacement of Receiver Gain Monitor HTA-3A6 (fig. 3-6, sh 1). To remove and replace the receiver gain monitor from rf plate HTA-3, proceed as follows:

a. Loosen two clips holding receiver gain monitor HTA-3A6 cover to case and hold cover open while performing step b.

b. Place receiver gain monitor HTA-3A6 in maintenance mode by pressing MAINT switch. Set FAN, 28VPS, and 5/15VPS circuit breakers to OFF.

c. Secure cover on receiver gain monitor HTA-3A6, disconnect external cables to the receiver gain monitor at connectors J1 through J7 (fig. 1-3), and remove nut and washer securing grounding strap to receiver gain monitor.

WARNING

Receiver gain monitor HTA-3A6 weighs 102 lb.

d. Remove six nuts and washers holding receiver gain monitor HTA-3A6 to rf plate HTA-3, and transport receiver gain monitor to work bench.

e. Remove cover from receiver gain monitor HTA3A6. Remove 6 screws and 12 washers around connector panel, being careful of the rfi gasket. Remove six screws holding receiver gain monitor chassis in case, and remove chassis from case.

f. When ready to replace receiver gain monitor in case, close and secure front panel, then set receiver gain monitor HTA-3A6 chassis in case. Carefully place rfi gasket around connector panel and tighten 6 screws and 12 washers on side of receiver gain monitor case. Tighten the six screws around front panel holding the chassis in case. Secure cover on the receiver gain monitor.

g. At rf plate HTA-3 make sure that spacers are on the six mounting bolts, and mount receiver gain monitor HTA-3A6 on rf plate HTA-3.

h. Tighten the six nuts and washers holding the receiver gain monitor HTA-3A6 to rf plate HTA-3, and attach ground wire to the receiver gain monitor mounting flange.

i. Connect external cables to connectors J1 through J7 on side of receiver gain monitor HTA-3A6.

3-40. Removal and Replacement of Detect and Qualification Module A1, and Detect and Autoswitch Module A2 (fig. 3-6, sh 1). To remove and replace the modules from receiver gain monitor HTA3A6, proceed as follows:

a. Refer to paragraph 3-39 for instructions for removing receiver gain monitor HTA-3A6 from the rf plate HTA-3 to the workbench.

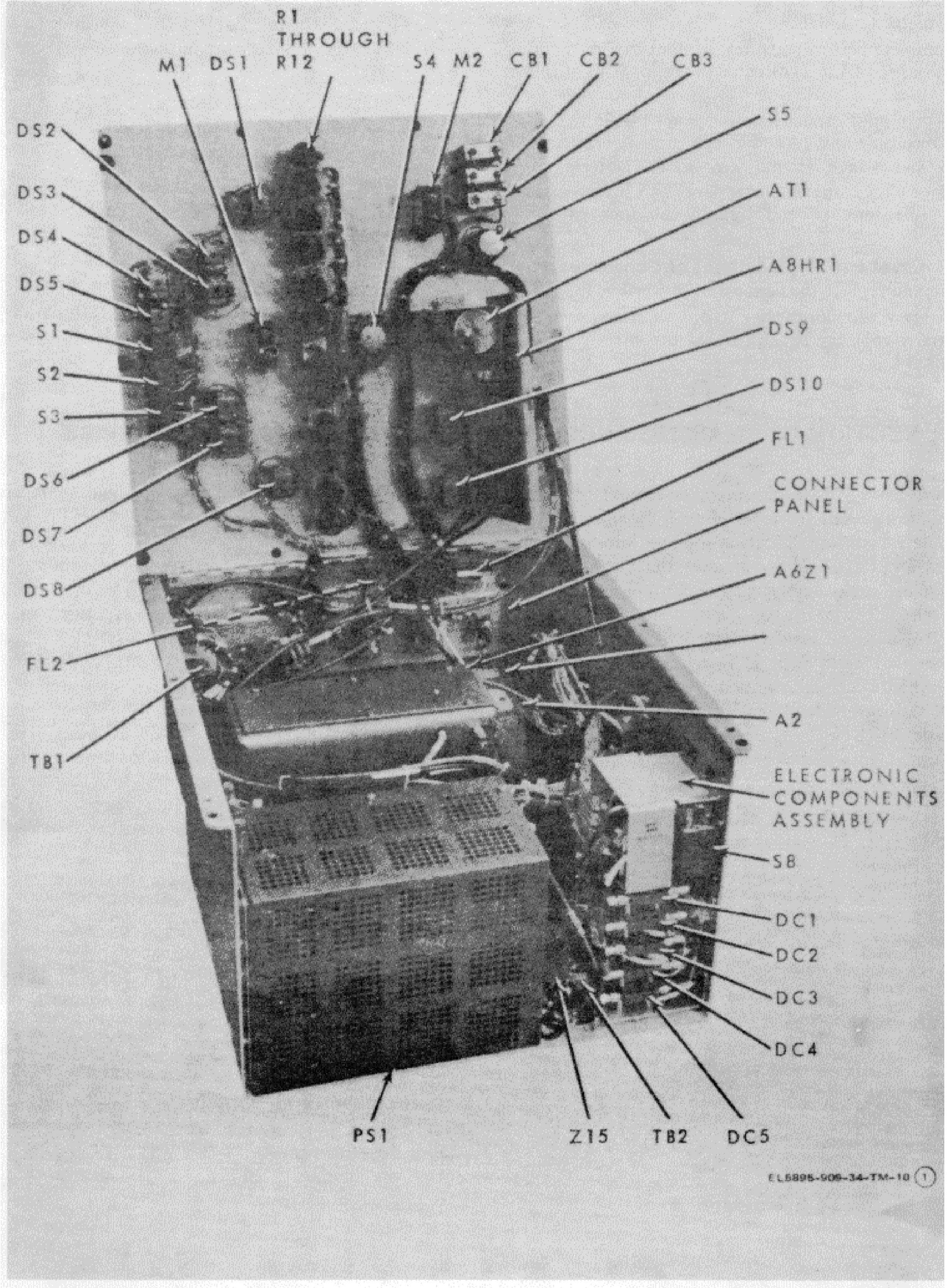


Figure 3-6. Receiver gain monitor unit HTA-3A6, parts location (sheet 1 of 6).

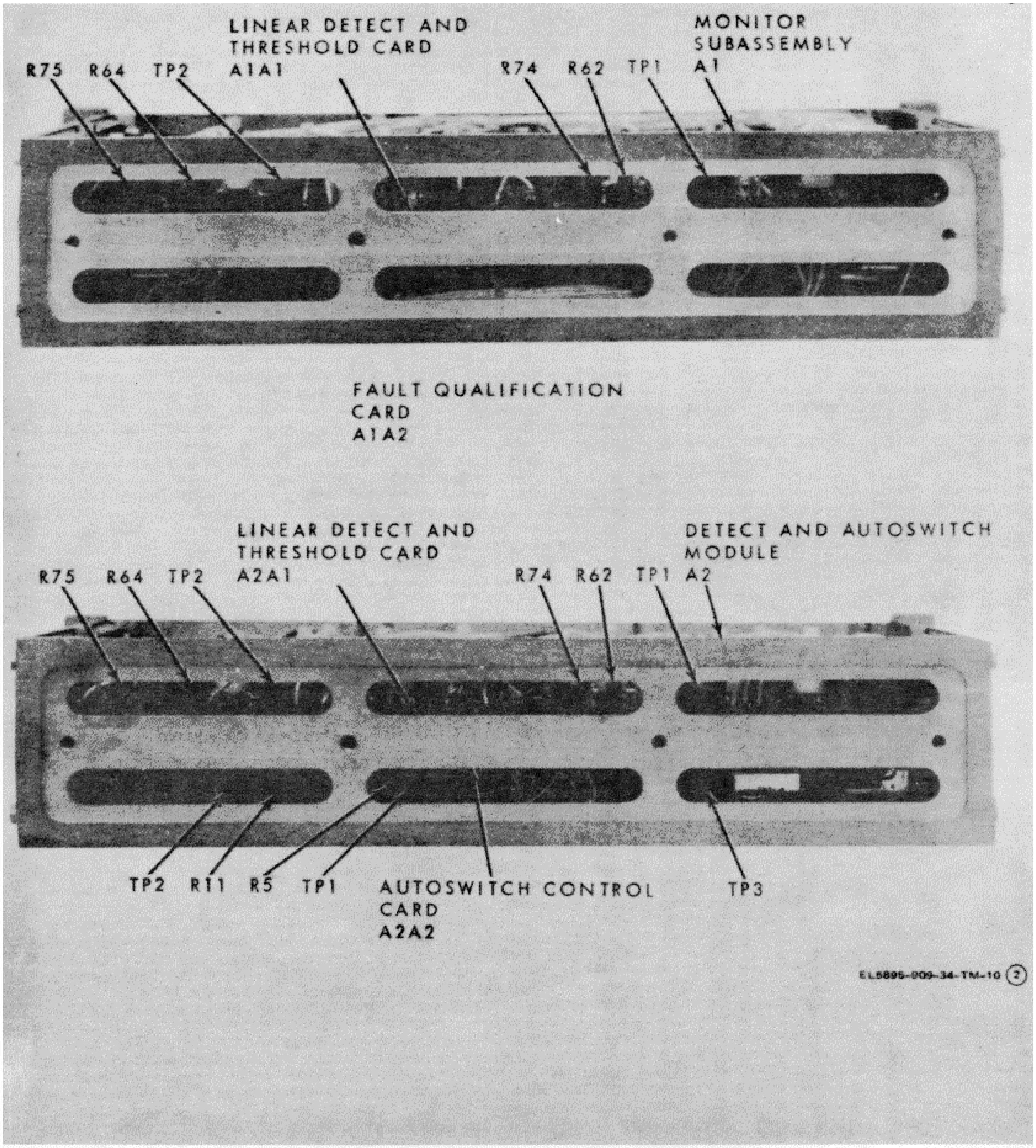


Figure 3-6. Receiver gain monitor unit HTA-3A6, parts location (sheet 2 of 6).

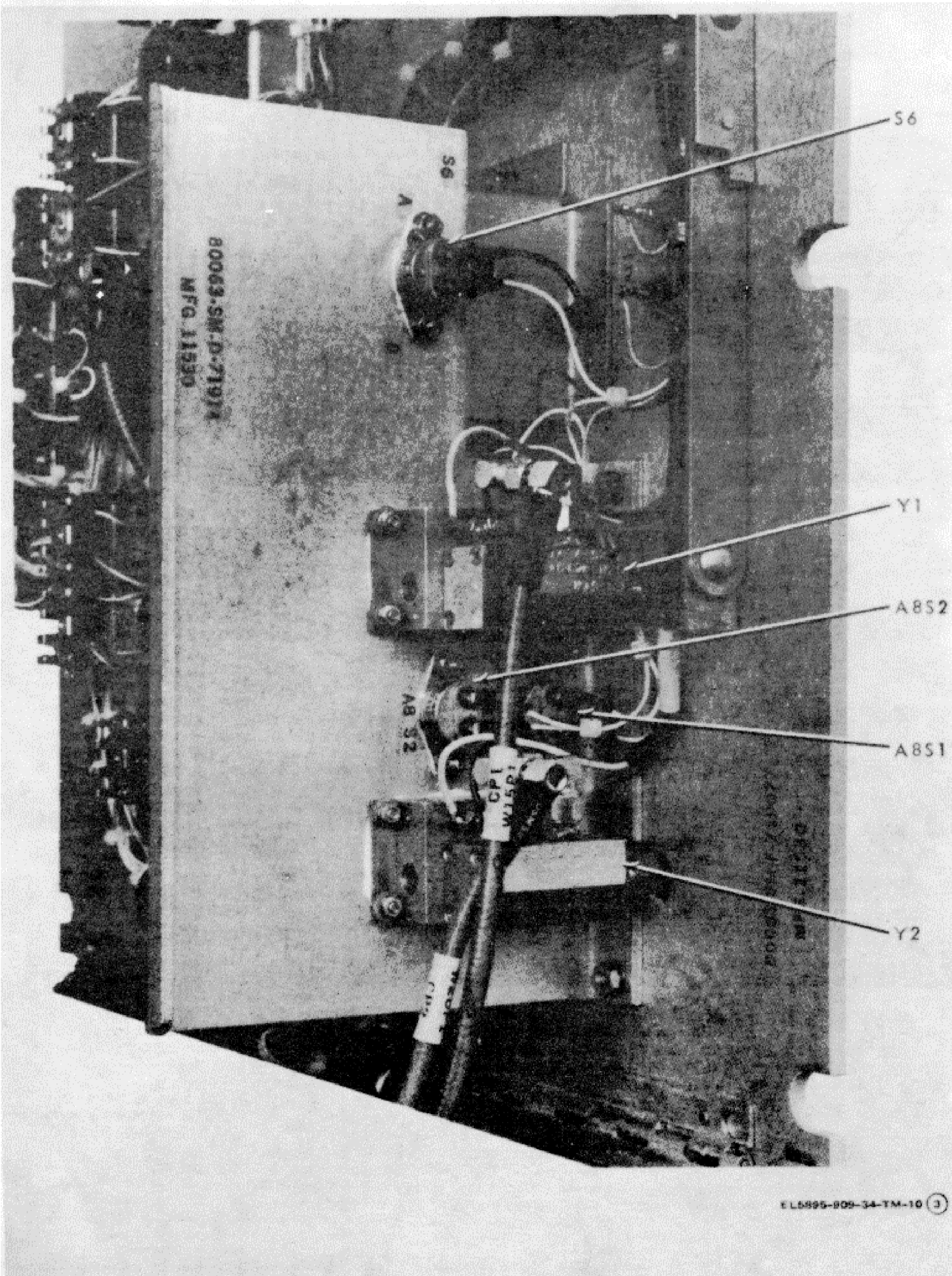


Figure 3-6. Receiver gain monitor unit HTA-3A6, parts location (sheet3 of 6).

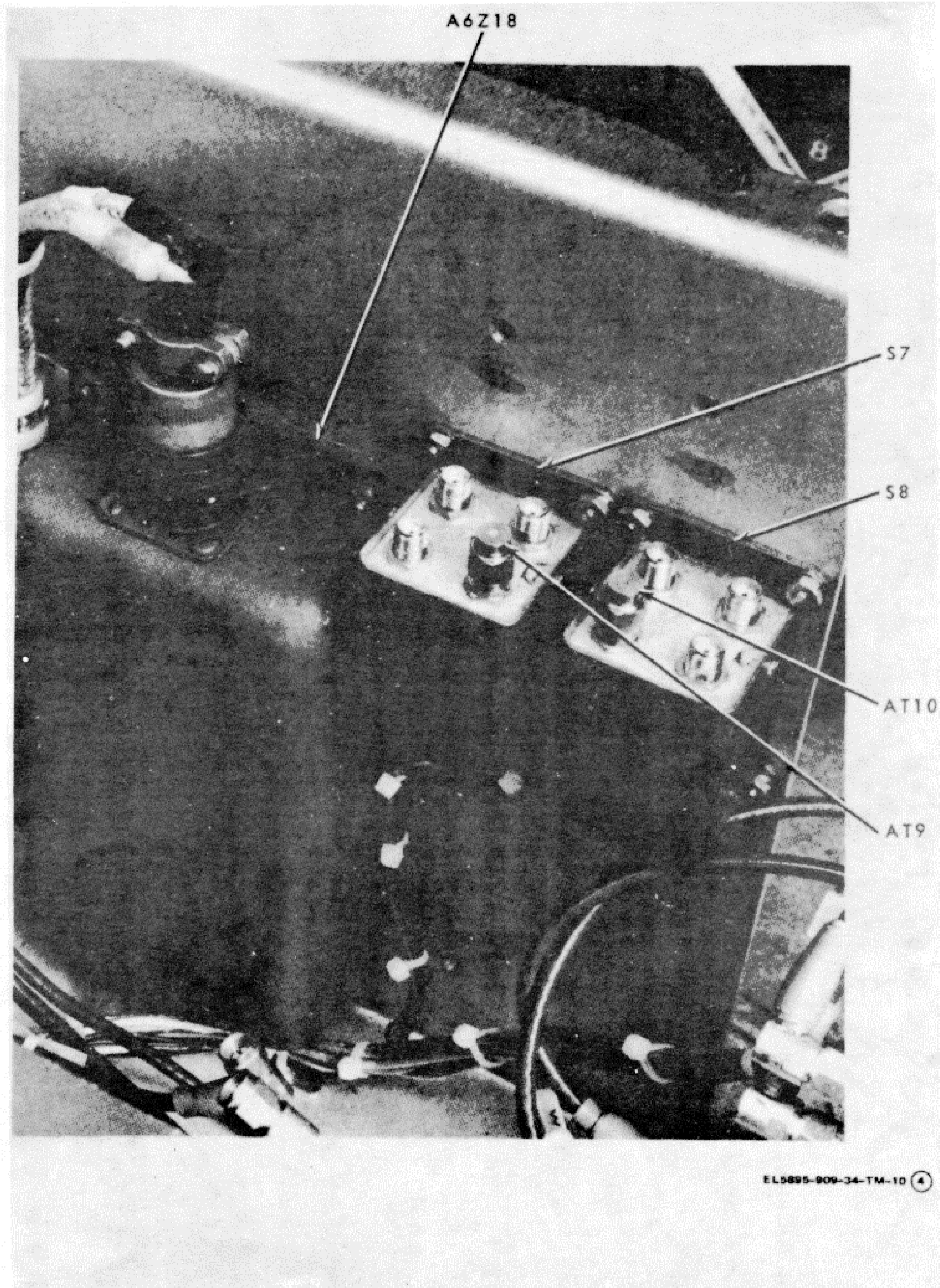


Figure 3-6. Receiver gain monitor unit HTA-3A6, parts location (sheet 4 of 6).

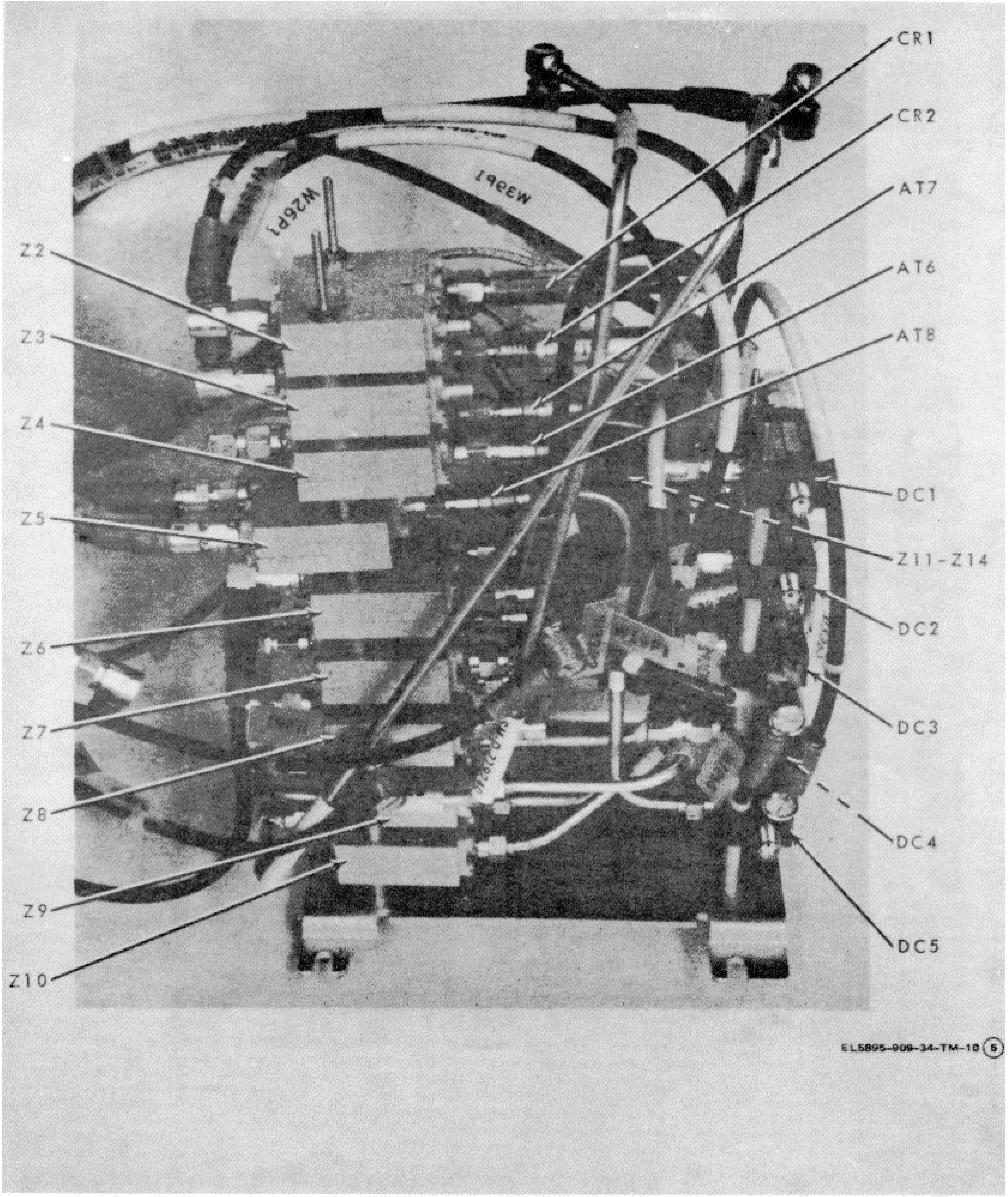


Figure 3-6. Receiver gain monitor unit HTA-3A6, parts location (sheet 5 of 6).

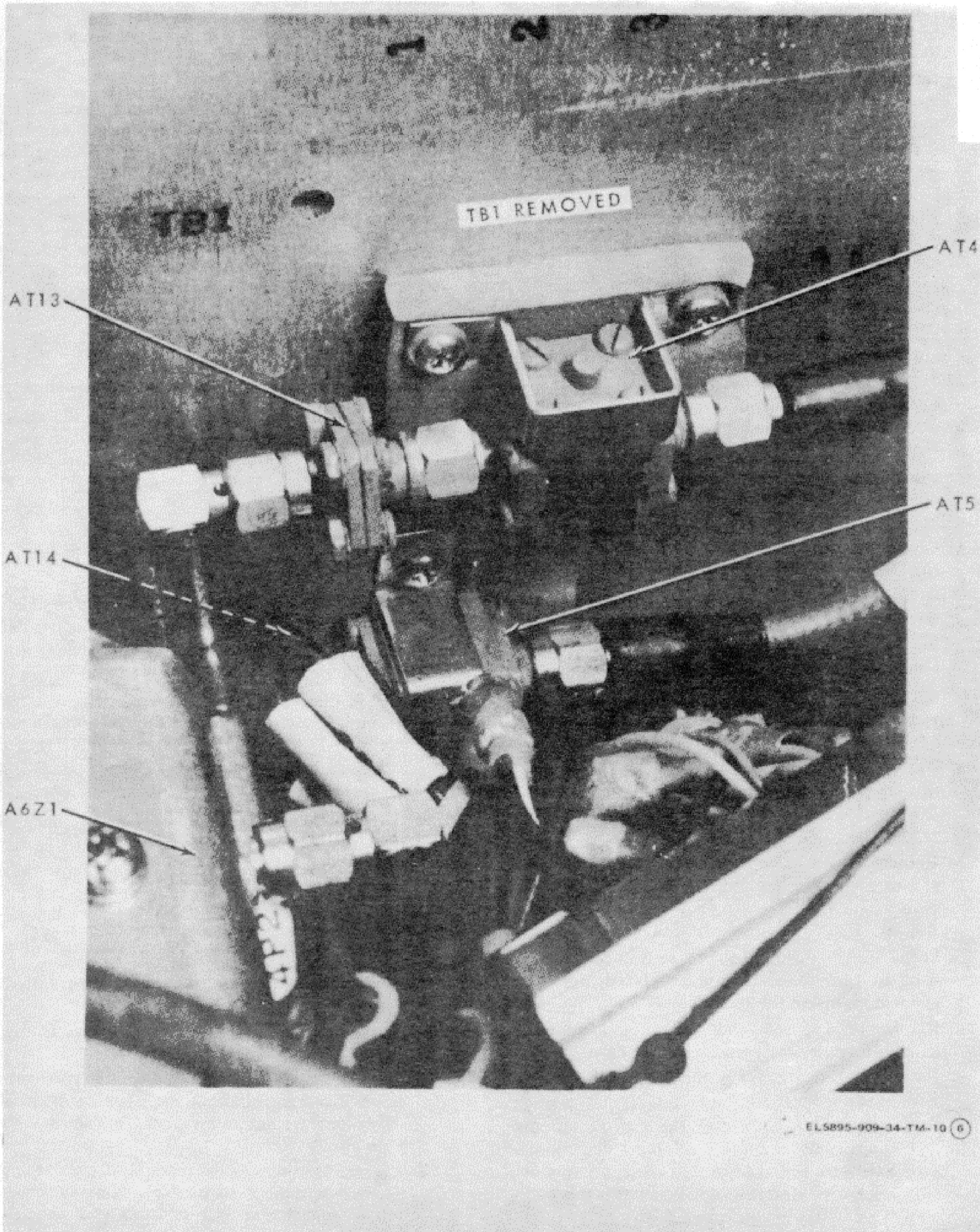


Figure 3-6. Receiver gain monitor unit HTA-3A6, parts location (sheet 6 of 6).

b. Loosen two captive screws holding front panel closed, and swing front panel open.
c. Remove four captive screws securing detect and qualification module A1 to bottom of receiver gain monitor HTA-3A6 chassis If detect and auto-switch module A2 is to be removed, remove the four captive screws holding it to the receiver gain monitor chassis. Close and loosely secure the two captive screws on front panel.
d. Remove four screws holding connector panel to receiver gain monitor chassis and lift connector panel just enough to allow module A1 or modules A1 and A2 to be removed through opening below the connector panel. Tag and remove six connectors to module to be replaced.
e. Observing tags on the connectors, attach the six connectors to the module. Lift connector panel enough to allow the module to be replaced into the receiver gain monitor.
f. Secure connector panel to receiver gain monitor with four screws and associated hardware removed in step d.
g. Loosen two captive screws and swing front panel open Secure module(s) to bottom of receiver gain monitor with four captive screws.
h. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.
i. Refer to paragraph 3-39 for instructions for replacing in the receiver gain monitor HTA3A6 on the rf plate HTA-3.

3-41. Circuit Card Removal and Replacement (fig. 3-6, sh 2). To remove and replace a circuit card, proceed as follows:
a. Refer to paragraph 3-40 for instructions for removing the module containing the affected circuit card from receiver gain monitor HTA-3A6 Place module on work bench.
b. Remove 10 screws and washers holding cover over circuit card to be repaired/replaced, and remove cover.
c. Remove two connector retainers and associated hardware from each of the three connectors attached to card to be repaired/replaced, and pull connectors inside the module.
d. Remove the 11 screws and washers holding circuit card to module, and remove circuit card.
e. Place replacement card in the module and secure with hardware removed in step d.
f. Place repaired/new card in the module cutouts and secure with connector retainers and associated hardware removed in step c Secure module side cover with 10 screws and washers removed in step b.
g. Refer to paragraph 3-40 for instructions for replacing the modules into receiver gain monitor HTA-3A6.

3-42. Pilot Oscillator Y1 and Y2 Removal and Replacement (fig-3-6, sh 3) To remove and replace a pilot oscillator, proceed as follows:
a. Remove receiver gain monitor HTA3A6 front cover. Place receiver gain monitor in mA1ntenance mode by pressing MAINT switch, and set FAN, 28VPS, and 5/15VPS circuit breakers to OFF.
b. Loosen two captive screws holding front panel closed, and swing front panel open.
c. Tag and unsolder the ground (-) and +15 V dc input (+) power lines at the pilot oscillator.
d. Disconnect the rf coaxial cable at RF OUT connector on pilot oscillator.
e. Loosen two set screws and remove control knob from shaft of the pilot oscillator.
f. Remove four screws, washers and nuts securing pilot oscillator and remove pilot oscillator from front panel.
g. Replace new pilot oscillator on mounting bracket on back side of receiver gain-monitor HTA-3A6 panel and secure with four screws, washers and nuts removed in step ***f.***
h. Place control knob on shaft of oscillator, align pointer and tighten two set screws.
i. Observing tags, resolder ground and +15 V dc input wires to correct terminals on pilot oscillator.
j. Connect rf coaxial cable to RF OUT connector on pilot oscillator, close front panel, and secure with two captive screws.
k. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

3-43. Variable Attenuator AT1 Removal and Replacement (fig-3-6, sh 1). To remove and replace variable attenuator AT1, proceed as follows:
a. Remove cover from receiver gain monitor HTA-3A6 case. Place receiver gain monitor in maintenance mode by pressing MAINT switch, and set FAN 28VPS, and 5/15VPS circuit breakers to OFF.
b. Loosen two captive screws and swing front panel open.
c. Tag and disconnect the two rf cables from the variable attenuator.
d. Loosen set screws and remove the two control knobs from the shaft of the variable attenuator AT1. Remove nut and washer from shaft of variable attenuator.
e. Loosen four screws, washers, and nuts securing attenuator clamps to double angle bracket and remove variable attenuator from front panel.

f. Being careful with the rubber insulation on the attenuator clamps, slide the new variable attenuator into the double angle bracket. Align detent springs with cutout in bottom of double angle bracket and tighten the four screws, washers, and nuts loosened in step e.

g. Secure locking nut and washer on shaft of variable attenuator and replace control knobs making certain that the knobs of the variable attenuator are set correctly.

h. Observing the tags, reconnect the rf coaxial cable removed in step c to the variable attenuator.

i. Complete performance test of the receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

3-44. Gain Balance Meter M1 and Power Supply Monitor Meter M2 Removal and Replacement (fig. 3-4, sh 1). To remove and replace one of the front panel meters, proceed as follows:

a. Remove front cover from receiver gain monitor HTA-3A6. Place receiver gain monitor in maintenance mode by pressing MAINT switch, and set FAN 28VPS, and 5/15VPS circuit breakers to OFF.

b. Loosen two captive screws on receiver gain monitor HTA-3A6 front panel and swing front panel open.

c. Tag and unsolder leads to the meter to be replaced.

d. Remove two screws, washers, and nuts holding meter in front panel, and remove meter from front side of receiver gain monitor HTA-3A6.

e. Place new meter through front of receiver gain monitor HTA-3A6 panel and secure with two screws, washers, and nuts removed in step d.

f. Identify leads by tags, and resolder leads to meter terminals.

g. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

3-45. Gain Balance S4 and Power Supply Monitor S5 Selector Switches Removal and Replacement (fig. 3-6, sh 1). To remove and replace one of the front panel selector switches, proceed as follows:

a. Remove front cover from receiver gain monitor HTA3A6. Place receiver gain monitor in maintenance mode by pressing MAINT switch, and set FAN, 28VPS, and 5/15VPS circuit breakers to OFF.

b. Loosen two captive screws on receiver gain monitor HTA3A6 front panel and swing front panel open.

c. Tag and unsolder leads to the rotary switch to be replaced.

d. Loosen two set screws and remove control knob from shaft of rotary switch.

e. Remove rotary switch retaining nut and washer from switch shaft and remove switch from front panel.

f. Place shaft of new rotary switch through front panel of receiver gain monitor HTA-3A6 and secure with retaining nut and washer removed in step e. Place control knob on switch shaft, make sure control knob reading corresponds with switch setting and tighten set screws.

g. Identify switch leads by tags and resolder to switch terminals. Close and secure front panel with two captive screws.

h. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

3-46. RF Monitor Subassembly A6 Removal and Replacement (fig. 1-3). Rf monitor subassembly A6 is composed of a modulator chassis containing phase modulator Z1, modulator driver Z18, and an interconnecting cable assembly. To remove and replace rf monitor subassembly A6, proceed as follows:

a. Refer to paragraph 3-39 for instructions for removing receiver gain monitor HTA-3A6 from rf plate HTA3 and removing receiver gain monitor chassis from case.

b. Loosen two captive screws holding receiver gain monitor HTA3A6 front panel closed and swing front panel open.

NOTE

Phase modulator Z1 and driver Z18 are parts of a matched set (notice serial numbers) and must be replaced as a set. When either the phase modulator or driver malfunctions, the complete matched set must be replaced with another matched set.

c. Disconnect interconnecting cable assembly from modulator driver Z18 connector J1.

d. Remove cable tie wrap to free entire interconnecting cable assembly from cable route.

e. Trace and disconnect interconnecting cable assembly wires terminating at ground post E (two wires) and terminal block TB2IH (one wire).

f. Tag and disconnect rf cable assemblies from modulator chassis connectors CP3 and CP4.

g. Tilt receiver gain monitor and locate hardware holding modulator chassis mounting bracket to bottom of unit. Remove hardware (four screws and flat washers).

h. Remove two screws and flat washers holding demodulator chassis to side panel of receiver gain monitor.

i. Lift modulator chassis and interconnecting cat assembly from receiver gain monitor.

j. Remove four nuts. flat washers. and lock wash holding modulator driver Z18 to receiver gain monitor side panel. Remove Z18 from unit.

***k*.** Install replacement modulator driver Z18 using hardware removed in step j.

l. Install replacement modulator chassis using hardware removed In steps h and *i.*

***m*.** Install interconnecting cable assembly wiring follows.

(1) Remove six screws holding modulator chassis cover. Remove cover

(2) Insert cable (tag identification 23) through hole in modulator chassis and connect to phase me ulator Z1 terminal board TB11 and TB12 Cable wires may be connected to either terminal.)

(3) Reinstall modulator chassis cover plate and sec with hardware removed In step (1) above.

(4) Trim cable assembly shields. Install lugs supplied, and connect shields to ground post E1.

(5) Connect cable (tag Identification 24B) to terminal block TB21(H). Install lug supplied on cable 24A and connect to ground post E1.

n. Reconnect interconnecting cable assembly to modulator driver Z18 connector J1.

o. Place interconnecting cable assembly in cable route between modulator chassis and modulator driver Z18 Secure to cable route with new tie wrap.

p. Reconnect rf cable assemblies to modulator chassis connectors CP3 and CP4 Torque to 79 inch ounces

q. Complete performance test of receiver gain monitor HTA3A6 as outlined in section XVII of this chapter.

r. Perform instructions in paragraph 3-39 to restore receiver gain monitor to operational configuration.

3-47. Power Supply HTA-3A6PS1, HTA-3A6P1 and HTA-3A6PS3 Removal and Replacement (fig. 1-3). To remove and replace a power supply, proceed follows:

a. Refer to paragraph 3-39 for instructions for moving receiver gain monitor HTA3A6 from plate HTA3 and removing receiver gain monitor chassis from case.

NOTE

Removal of power supply PS2 requires removal of power supply PS1. Removal of power supply PS3 requires removal of power supplies PSI and PS2.

b. Place receiver gain monitor chassis on end a remove four screws and washers holding power supply to bottom of receiver gain monitor chassis. Remove power supply from chassis far enough tag and disconnect the wires from the terminal board of the power supply. Complete removal of power supply.

c. With receiver gain monitor chassis standing on end, hold power supply in place, identify by tag and replace wires removed in step b.

d. Secure power supply to bottom of receiver gain monitor chassis with screws and washers removed in step b.

e. Perform power supply adjustment procedures as outlined in paragraph 3-62 of this section.

f. Complete performance test of receiver gain monitor as outlined in section XVII of this chapter.

g. Perform instructions in paragraph 3-39 to restore receiver gain monitor HTA3A6 to operational configuration.

3-48. Overvoltage Protectors Removal and Replacement (fig. 1-3). To remove and replace an overvoltage protector, proceed as follows:

a. Refer to paragraph 3-47 for removal instructions for power supplies.

***b*.** Tag wires to power supply terminal board and remove the two wires from overvoltage protector.

c. Loosen two captive screws holding overvoltage protector to power supply, and remove overvoltage protector.

d. Place new overvoltage protector in position and tighten the two captive screws.

e. Identify by tags and replace the two overvoltage protector leads to the power supply terminal board.

f. Perform overvoltage protector adjustment procedures as outlined in paragraph 3-75 (28VPS), 3-88 (15 VPS), or 3101 (5VPS).

g. Refer to paragraph 3-47 for instructions for replacing power supply into receiver gain monitor HTA3A6 chassis.

3-49. Circuit Breaker Removal and Replacement (fig. 1-3). To remove and replace a circuit breaker, proceed as follows:

a. Remove cover from receiver gain monitor HTA3A6, place receiver gain monitor in maintenance mode, by pressing MAINT switch, and set FAN 28VPS, and 5/1 5VPS circuit breaker to OFF and disconnect ac input cable at connector J1 on side of receiver gain monitor HTA3A6.

b. Tag and unsolder the two wires attached to the circuit breaker to be removed.

c. At front of receiver gain monitor HTA3A6 re move nut and washer from circuit breaker and remove circuit breaker from front panel.

d. Place lever of new circuit breaker through hole in receiver gain monitor HTA3A6 panel, making sure that lever positions correspond to markings on front panel. Secure circuit breaker with nut and washers removed in step c.

e. Identify by tag and solder the two leads to the circuit breaker terminals.

f. Complete performance test of receiver gain monitor HTA3A6 as outlined in section XVII of this chapter.

3-50. Tubeaxial Fan Removal and Replacement (fig. 1-3). To remove and replace tubeaxial fan, proceed as follows:

a. Refer to paragraph 3-39 for instructions for removing receiver gain monitor from rf equipment group mounting plate, and for removing receiver gain monitor chassis from case.

b. Remove screw, lock washer and flat washer securing capacitor C1 clamp to receiver gain monitor HTA-3A6 chassis.

NOTE

Before removing fan, notice direction of airflow. If direction of airflow is not marked on fan, notice the position of the fan blades with respect to the motor supports to enable installation of new tubeaxial fan in same position.

c. Tag and remove red and green fan leads from capacitor C1 and yellow fan lead at splice in lead to terminal board TB1-2G.

d. Remove one of the three washers, screws and fan clamps holding the fan to the receiver gain monitor chassis. Loosen the two remaining fan clamps and remove the tubeaxial fan BI and capacitor C1 from chassis.

e. Solder red and green leads of new fan to capacitor C1 and splice yellow fan lead to lead from terminal board TB1-2G.

f. Replace tubeaxial fan B1. Assure that fan is oriented for proper direction of airflow.

g. Place ridge of fan under the two fan clamps and secure third fan clamp with washer and screw removed in step **d.** Tighten the three fan clamps.

h. Perform instructions in paragraph 3-39 to restore receiver gain monitor HTA-3A6 to operational configuration.

i. Check fan for proper airflow.

3-51. Electronic Components Assembly Removal and Replacement (fig. 3-6, sh 1). To remove and replace the electronic components assembly, proceed as follows:

a. Refer to paragraph 3-39 for instructions for removing receiver gain monitor HTA-3A6 from rf plate HTA-3, and removing receiver gain monitor chassis from case.

b. Remove nuts, lock washers, and flat washers from four threaded rods attached to upper double angle bracket.

c. Remove two screws holding upper double angle bracket to receiver gain monitor chassis, and remove bracket from chassis.

d. Tag and disconnect rf cables that are connected to components not located on electronic components chassis.

e. Remove two screws and washers holding lower double angle bracket to bottom of receiver gain monitor HTA-3A6 chassis. Remove four screws, washers and nuts holding lower double angle bracket to side of receiver gain monitor chassis.

f. Being very careful not to apply undue pressure to coaxial connectors, carefully remove electronic components assembly from receiver gain monitor chassis.

g. Carefully place electronic components chassis into receiver gain monitor. Secure with hardware removed in step ***e***.

h. Observing tags, reconnect the rf cables to components of the electronic components assembly.

i. Place upper double angle bracket on the four threaded rods and secure with hardware removed in step ***b***.

j. Secure upper double angle bracket to receiver gain monitor chassis with hardware removed in step ***c***.

k. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

l. Refer to paragraph 339 for instructions to restore receiver gain monitor HTA-3A6 to operational configuration.

3-52. Crystal Mixers Z11 through Z14 Removal and Replacement (fig. 3-6, sh 5). To remove and replace a crystal mixer, proceed as follows:

a. Refer to paragraph 3-51 for instructions for removing electronic components assembly.

b. Tag and remove two remaining coaxial cables connected to the mixer to be replaced.

c. Remove two nuts, washers and screws securing double angle bracket which is holding the mixers in place.

d. Place new crystal mixer in its proper place and secure double angle Z2-Z10 bracket with the two flat head screws, washers and nuts removed in step ***c***.

e. Identify by tag and replace coaxial cables removed in step ***b.***

f. Perform instructions in paragraph 3-51 to restore receiver gain monitor HTA-3A6 to operational configuration.

3-53. Directional Couplers DC1-DC5 and Power Dividers Z2-Z10 Removal and Replacement (fig. 3-6, sh 5). To remove and replace a directional coupler or power divider, proceed as follows:

a. Refer to paragraph 3-51 for instructions for removing electronic components assembly.

b. Tag and remove any coaxial cable still connected to the directional coupler or power divider to replaced.

c. Remove two nuts and flat washers securing either the directional couplers, or the power dividers, depending upon which is to be replaced.

d. Remove one of the threaded rods from the bottom until it clears the component to be replaced. Do not remove the other rod at this time.

e. Rotate the component to be replaced 180 degrees about the remaining rod.

f. Place the appropriate hole of the new component over the partially removed rod and slowly push this rod back in place, placing the spacers on the rod and making sure that the rod passes through the other components properly.

g. Place a flat washer and nut on the end of the rod Just installed, but leave them loose.

h. Slowly extract second rod until component to be replaced falls free.

i. Rotate new component until the empty hole is aligned with rod and slowly push rod up, while placing spacers and aligning other components on the rod.

j. Place flat washer and nut on threaded rod and tighten nuts on both threaded rods at this time.

k. Replace any coaxial cable removed in step ***b.***

l. Perform instructions in paragraph 3151 to restore receiver gain monitor HTA-3A6 to operational configuration.

3-54. RF Transmission Line Switches S7 and S8 Removal and Replacement (fig. 3-6, sh 1 and 4). To remove and replace an rf transmission line switch, proceed as follows'

a. Refer to paragraph 3-39 for instructions for removing receiver gain monitor HTA-3A6 from rf plate HTA-3, and removing receiver gain monitor chassis from case.

b. Remove nuts, lock washers, and flat washers from four shafts attached to the upper double angle bracket.

c. Remove two screws holding upper double angle bracket to receiver gain monitor chassis and remove bracket from chassis.

d. Tag and remove rf cables attached to rf transmission line switch to be replaced.

e. Remove four nuts, lock washers, flat washers and screws holding rf transmission line switch to receiver gain monitor chassis and remove switch from chassis far enough to tag and unsolder control lines to switch.

f. Resolder control lines to switch, and place new rf transmission line switch in position on receiver gain monitor chassis and secure with hardware removed in step ***e.***

g. Observing tags, reconnect rf cables to rf transmission line switch.

h. Place upper double angle bracket on four threaded rods and secure with hardware removed in step ***b.***

i. Secure upper double angle bracket to receiver gain monitor chassis with hardware removed in step ***c.***

j. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

k. Refer to paragraph 339 for instructions to restore receiver gain monitor HTA-3A6 to operational configuration.

3-55. RF Isolator AT4 and AT5 Removal and Replacement (fig. 3-6, sh 6). To remove and replace rf isolator AT4 or AT5. proceed as follows:

a. Place receiver gain monitor in maintenance mode by pressing MAINT switch S1. Set FAN, 28VPS, and 5/15VPS circuit breakers to OFF Remove power cable at connector J1.

b. Remove receiver gain monitor from case (refer to paragraph 3-39).

c. Loosen two captive screws and swing front panel full) open.

d. Remove two screws and associated hardware holding terminal board TB1 to side of receiver gain monitor chassis, and expose rf isolators AT4 and AT5.

e. Tag and remove rf cable from oscillator at rf isolator to be replaced Tag and remove rf capacitor assembly attached to rf isolator to be replaced.

f. Remove three screws securing double angle bracket which holds rf isolator to be replaced.

g. Remove rf isolator.

h. Place new rf isolator in double angle bracket and secure to receiver gain monitor chassis with hardware removed in step ***f***

i. Reconnect cable and rf capacitor assembly removed in step e to new rf isolator.

j. Secure terminal board TB1 to side of receiver gain monitor chassis with hardware removed in step ***d.***

k. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

3-56. RF Capacitor Assembly AT13 and AT14 Removal and Replacement (fig. 3-6, sh 6). To remove and replace rf capacitor assembly AT13 or AT 14. proceed as follows:

a. Place receiver gain monitor in maintenance mode by pressing MAINT switch S1. Set FAN, 28VPS, and 5/15VPS circuit breakers to OFF. Remove power cable at connector J1.
b. Remove receiver gain monitor from case (refer to paragraph 3-39).
c. Loosen two captive screws and swing front panel fully open.
d. Remove two screws and associated hard holding terminal board TB1 to side of receiver gain monitor chassis and expose rf capacitor assemblies AT13 and AT14.
e. Tag and remove rf cable to directional coupler at rf capacitor assembly to be replaced. Remove rf capacitor assembly to be replaced from rf isolator (AT4 or AT5) affixed to receiver gain monitor chassis.
f. Connect new rf capacitor assembly to rf isolator (AT4 or AT5) affixed to receiver gain monitor chassis and connect rf cable from directional coupler.
g. Secure terminal board TB1 to side of receiver monitor chassis and secure with hardware moved in step ***d.***
h. Complete performance test of receiver gain monitor tor as outlined in section XVII of this chapter.

3-57. Tunnel Diode Detectors CR1 and Removal and Replacement (fig. 3-6, sh 5). To move and replace tunnel diode detector CR1 or CR2, proceed as follows:
a. Place receiver gain monitor HTA-3A6 in maintenance mode by pressing MAINT switch S1, and set FAN, 28VPS, and 5/15VPS circuit breakers; to OFF.
b. Loosen two captive screws and swing front panel fully open.

NOTE

Removal of tunnel diode detector CR2 may require removal of rf cable W1 from power divider Z2, and rf cable W2 from power divider Z3.

c. Tag and remove rf cable connected to tunnel diode detector to be replaced. Remove tunnel diode detector from power divider to which it is attached.
d. Attach new tunnel diode detector to power divider, and attach rf cable to tunnel diode detector e.
Complete performance test of receiver gain monitor as outlined in section XVII of this chapter.

3-58. Potentiometers R1 through R12 Removal Replacement (fig. 3-8, sh 1). To remove and replace one of the potentiometers R1 through R12, proceed as follows:
a. Place receiver gain monitor HTA-3A6 in maintenance mode by pressing MAINT switch S1, and set FAN, 28VPS, and 5/15VPS circuit breakers to OFF.
b. Loosen two captive screws and swing front panel fully open.
c. Tag and unsolder the wires on the three terminals of the potentiometer to be removed.
d. Remove three nuts, lock washers, and flat washers holding the double angle bracket to front panel and rotate double angle enough to access the nut and washer securing potentiometer to be removed.
e. Remove nut and washer securing potentiometer to double angle bracket.
f. Place new potentiometer in the double angle bracket and secure with hardware removed in step ***e.***
g. Secure double angle bracket to front panel with hardware removed in step ***d.***
h. Observing tags, resolder wires to the terminals of the new potentiometer.
i. If one of FAULT THRESHOLD potentiometers R1 through R4 or R9 through R12 was replaced, complete adjustment of downlinks 1 and 2 fault threshold as outlined in paragraph 3-65. If one of GAIN BALANCE potentiometers R5 through R8 was replaced, complete adjustment of downlinks I and 2 gain balance as outlined in paragraph 3-64.
j. Complete performance test of receiver gain monitor HTA-3A6 as outlined in section XVII of this chapter.

3-59. Indicators and Indicator Switches Removal and Replacement (fig. 3-7). To remove and replace indicators and indicator switches, proceed as follows:
a. Remove cover from receiver gain monitor HTA-3A6, place receiver gain monitor in maintenance mode by pressing MAINT switch S1, and set FAN, 28VPS and 5/15VPS circuit breakers to OFF.
b. Loosen two captive screws holding front panel closed and swing front panel fully open.
c. Pull front lens of unit to be replaced forward to stop. Rotate lens one quarter turn counterclockwise to release lamp holder. Push, then pull, front end assembly from housing.
d. Tag and unsolder leads from indicator switch unit to be replaced.
e. Rotate captive mounting screws, located inside the housing, until locking cams rotate 180 degrees, freeing housing from mounting sleeve, and push unit from rear through mounting sleeve until free of front panel.

f. Insert new indicator switch unit into front panel, slip mounting sleeve fully onto the unit, and tighten captive mounting screws until unit is secure in front panel.

g. Resolder the tagged leads to the new unit. Align notch in bulb board with metal tab in side of housing, then push front end assembly into housing.

Rotate lens one-quarter turn clockwise to horizontal position Press lens into final position.

h. Secure front panel with two captive screws.

i. Complete performance test of receiver gain monitor HTA3A6 as outlined in section XVII of this chapter.

3-60. Low Pass Filters FL1, FL2 Removal and Replacement (fig. 3-6, sh 1). To remove and replace the low pass filter FL1 or FL2, proceed as follows:

a. Remove receiver gain monitor HTA3A6 front cover. Place receiver gain monitor in maintenance mode by pressing MAINT switch, and set FAN, 28VPS, and 5/15VPS circuit breakers to OFF.

b. Remove input power cable at connector J1.

c. Loosen two captive screws and swing front panel open.

d. Tag and unsolder the two leads and resistor to the. low pass filter to be replaced.

e. Remove hex nut and lock washer securing low pass filter to mounting bracket.

f. Place new low pass filter in mounting bracket and secure with lock washer and hex nut removed in step ***e.***

g. Identify leads removed in step d and resolder to low pass filter terminals.

h. Close front panel and reconnect input power cable to connector J1.

i. Complete performance test of receiver gain monitor HTA3A6 as outlined in section XVII of this chapter.

3-61. Electric Blanket Heater A8 Removal and Replacement (fig. 3-6, sh 1 and 3). Electric blanket heater A8 consists of a heating element A8HR1 (sh 1), and switches A8S1 and A8S2 (sh 3). To remove and replace electric blanket heater A8, proceed as follows:

a. Remove cover from receiver gain monitor HTA3A6. Place receiver gain monitor HTA3A6 in maintenance mode by pressing MAINT switch, and set FAN, 28VPS, and 5/15VPS circuit breakers to OFF.

b. Loosen two captive screws on receiver gain monitor HTA3A6 front panel and swing front panel open.

c. Loosen four setscrews and remove control knob from shaft of pilot oscillators Y1 and Y2.

d. Tag and disconnect the rf coaxial cable at RF OUT connector of pilot oscillators Y1 and Y2.

e. Tag and unsolder the two wires at pilot oscillators Y1 and Y2 and at switches S6, A8S2 and A8S1.

f. Remove three screws, lock washers, and flat washers that secure double angle bracket to rear of front panel. Place double angle bracket on workbench.

g. With knife, or other suitable tool, scrape heater HR 1 from double angle bracket. Take care not to mar double angle bracket.

h. Remove two screws, flat washers, and lock washers securing switches A8SI and A8S2 to double angle bracket.

i. Bond new heating element to double angle bracket using Silicone Adhesive Compound SMA7202381.

j. Secure switches A8SI (white leads attached) and A8S2 (yellow leads attached) to appropriate mounting spot on double angle bracket using hardware removed in step ***h.***

k. Using hardware removed in step ***f,*** secure double angle bracket to rear of front panel.

l. Place control knobs on pilot oscillator shafts and tighten four setscrews.

m. Observing tags, resolder wires to switch S6 and pilot oscillators Y1 and Y2.

n. Unsolder loose white wire from switch A8S1 and solder white wire (removed from switch A8S1 in step e) in its place. Unsolder loose yellow wire from switch A8S2 and solder yellow wire (removed from switch A8S2 in step e) in its place.

o. Perform electric blanket heater troubleshooting procedure as outlined in section VII to verify that electric blanket heater is operating normally.

3-62. 28, +5, and +15 V dc Power Supplies, Adjustment of Output Voltage (fig. 3-8).

a. ***Test Equipment***. Test equipment required for adjustment of receiver gain monitor HTA3A6 power supplies consists of a Hewlett Packard multifunction meter 3450B and one each 198636R and B48B test lead.

b. ***Test Connections***. Connect black lead to black X input, and red lead to red X input. The metering points for the individual Dower supplies are given in the adjustment procedures.

c. ***Initial Control Settings***. On the front panel of the multifunction meter, connect shorting bar to black X input, select DC FUNCTION, select AUTO RANGE, select LOCAL CONTROL and select INT TRIGGER. Control settings of receiver gain monitor HTA3A6 are given in the adjustment procedures.

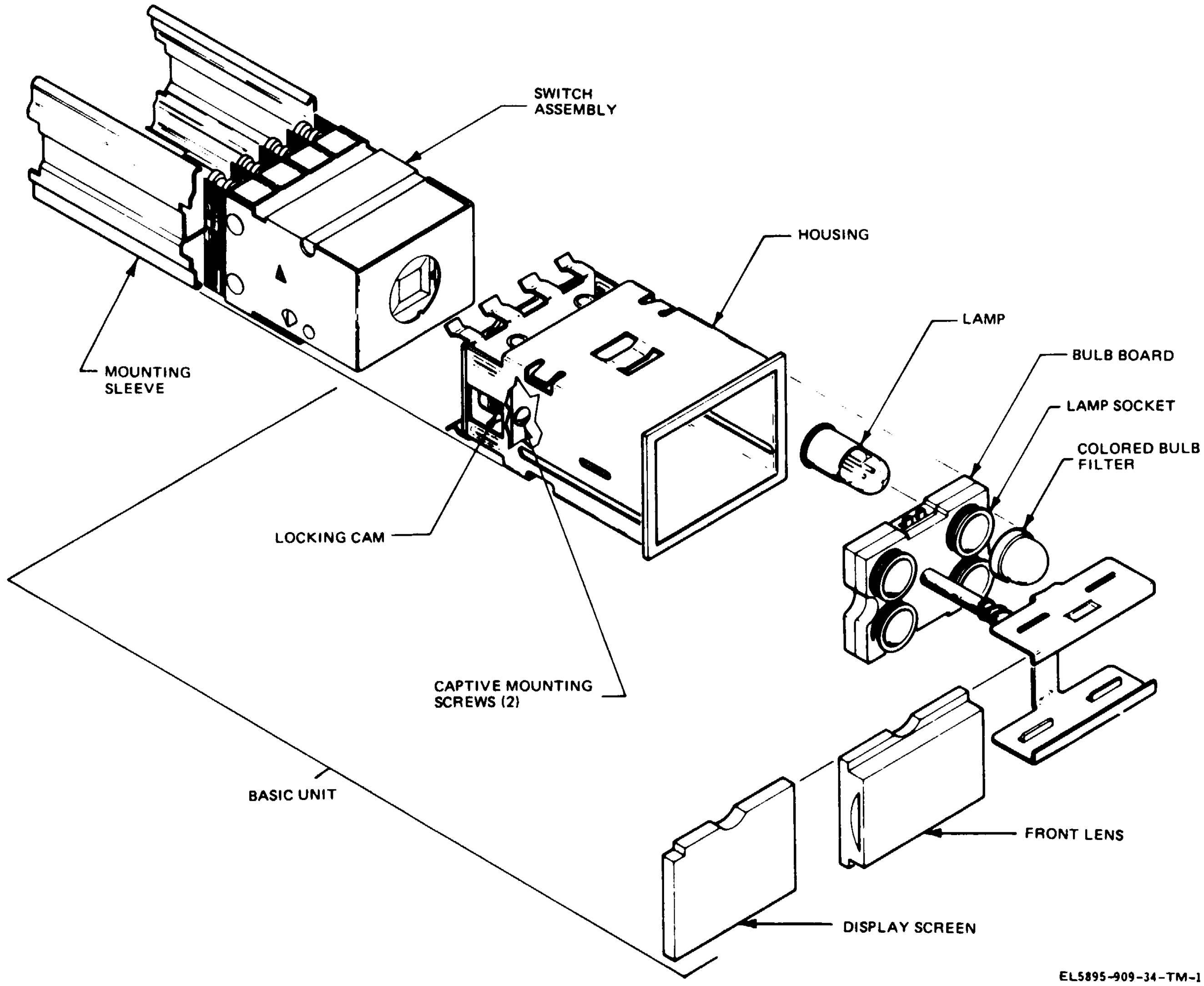


Figure 3-7. Indicator switch, exploded view.

d. Adjustment Procedures *(fig. 3-8).* To adjust output voltage of 28, +5, and +15 V dc power supplies, proceed as follows:

(1) Refer to paragraph 3-39 for instructions for removing the receiver gain monitor HTA-3A6 from the rf plate HTA-3 and removing the receiver gain monitor chassis from case.

(2) Reconnect power cable at connector J1.

(3) Set FAN, 28VPS, and 5/15VPS CIRCUIT BREAKERS to ON. Allow receiver gain monitor and multifunction meter a 10minute warmup period.

(4) Loosen the two captive screws and swing front panel open.

(5) Connect black lead from black X input connector on multifunction meter to black test point on front panel of receiver gain monitor HTA3A6.

(6) Connect the red lead from the red X input connector on multifunction meter to power supply selector switch S5 terminal listed below to check the power supplies output voltage.

Set meter selector switch S5 to voltage other than that being checked.

Power supply	Meter selector switch	Multifunction meter reading
PS1	S5-1	-28 ± 1.40 V dc
PS2	S5-9	15 ± 0.75 V dc
PS3	S5-8	5 ± 0.25 V dc

(7) If the multifunction meter does not indicate the correct voltage for a particular power supply, adjust that power supply using the appropriate adjustment potentiometer shown in figure 38. If the power supply cannot be adjusted, see paragraph 3-47 for replacement procedures.

(8) Complete adjustment procedures for pilot fault threshold, downlinks 1 and 2 gain balance, and downlinks 1 and 2 fault threshold levels as outlined in following paragraphs 363, 364 and 365.

(9) Refer to paragraph 3-39 for instructions to restore the receiver gain monitor HTA3A6 to operational configuration.

3-63. Pilot Fault Threshold Adjustment (fig. 3-6, sh 2).

a. Test Equipment. Test equipment required for adjustment of the pilot fault threshold consists of a Hewlett-Packard multifunction meter 3450B; and one each 198636R and B48(B) test lead.

b. *Test* ***Connections.*** Test connections are called out in the adjustment procedures as needed.

c. Initial Control Settings. On the front panel of the multifunction meter, connect shorting bar to black X input, select DC FUNCTION, select AUTO RANGE, select LOCAL CONTROL and select INT TRIGGER.

d. Adjustment Procedures. To adjust the level of the pilot fault threshold, proceed as follows:

(1) Refer to paragraph 3-39 for instructions for removing receiver gain monitor HTA-3A6 from rf plate HTA-3 and for removing receiver gain monitor chassis from case.

(2) Remove top cover plate from the detect and autoswitch module A2 (sh 1) to expose the adjustment potentiometers and test points.

(3) On receiver gain monitor front panel, set FAN, 28 VPS, and 5/15 VPS circuit breakers to ON position.

(4) Connect black test lead from black X terminal of multifunction meter to black test point on front panel of receiver gain monitor HTA-3A6. Connect red test lead from red X terminal of multifunction meter to test point TP1 on autoswitch control card A2A2 (sh 2) in detect and autoswitch module A2.

(5) Adjust potentiometer R5 for 110 410 mV indication on multifunction meter.

(6) Move red test lead to test point TP2 on autoswitch control card, and adjust potentiometer R1 for 110 ±10 mV indication on multifunction meter.

(7) Replace top cover on detect and autoswitch module A2 with hardware removed in step (2).

(8) Refer to paragraph 3-39 for instructions to replace receiver gain monitor HTA-3A6 to operational configuration.

3-64. Downlinks 1 and 2 Gain Balance Adjustment (fig. 3-6, sh 2).

a. Test Equipment. The test equipment required for adjustment of downlinks 1 and 2 gain balance consists of a Hewlett-Packard multifunction meter 3450B, test leads B48(R) and B48(B) and attenuators PRD H 101 (2 ea.).

b. Test Connections. Test connections are called out in the adjustment procedures as needed.

c. Initial Control Settings. Set the test equipment controls as follows:

Control	Position
Multifunction meter	
GUARD	Connect to black X
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL

Control	Position
Multifunction meter	
TRIGGER	INT
Oscilloscope	
POWER	Pull out
VERT MODE	CHI
VOLTS/DIV	2
AC-GND-DC	AC
HORIZ DISPLAY	A LOCK KNOBS
TRIG MODE	AUTO
A TRIGGER - SLOPE and LEVEL	For stable trace
COUPLING	AC
SOURCE	NORM
A & B TIME/DIV DELAY TIME	50us
A TRIGGER HOLDOFF	NORM
Intensity and Focus	As required

d. Adjustment Procedure. To adjust downlink 1 and 2 gain balance, proceed as follows:

(1) Refer to paragraph 3-39 for instructions for removing receiver gain monitor HTA-3A6 from rf plate HTA-3, and for removing receiver gain monitor chassis from case.

(2) Keeping cables connected to detect and qualification module A1, remove module from receiver gain monitor HTA-3A6 (refer to para 3-40).

(3) Connect test equipment as shown in A, figure FO11, sheet 2.

(4) Remove top cover plates from module A1 and A2.

(5) On receiver gain monitor front panel, set FAN, 28VPS, and 5/15VPS circuit breakers to ON, press MAINT switch, and set ATTENUATION dial to 0 dB.

NOTE

Correct operation of the H101 attenuators is critical in this procedure. To avoid back- lash errors inherent in the attenuator, al- ways approach the required setting from a point approximately 3 dB higher on the dial. For example, to set the attenuator at 12 dB, first tune to 15 dB then slowly ad- just to 12 dB. Monitor sighting alignment to the dial closely to avoid parallax errors; a very slight offset in the dB setting will prevent repeatable adjustments.

(6) Set attenuator 1 to 0 dB.

(7) Set DOWNLINK 1 GAIN BALANCE switch to PILOT 2.

(8) Turn LOW PILOT FREQUENCY control fully clockwise.

(9) Connect red lead of multifunction meter to red test point on receiver gain monitor front panel. Connect black lead of multifunction meter to black test point.

(10) Adjust LOW PILOT FREQUENCY control counterclockwise for highest reading on multifunction meter (less than 1 turn).

(11) Set attenuator 1 to 6 dB.

(12) At detect and qualification module A1 (fig. 3-6, sh 2) set potentiometers R62 and R74 to center of range (12 turns from stop).

(13) Set DOWNLINK 1 GAIN BALANCE PILOT 2 potentiometer to midrange (5 turns from stop).

(14) Readjust DOWNLINK 1 GAIN BALANCE PILOT 2 potentiometer as required to bring GAIN BALANCE meter pointer on scale.

(15) Adjust the LOW PILOT FREQUENCY control for highest position peak indication on the GAIN BALANCE meter.

(16) Adjust DOWNLINK 1GAIN BALANCE PILOT 2 potentiometer for 0 ±100 mV indication on multifunction meter.

(17) Set attenuator 1 for 0 dB.

(18) Adjust potentiometer R62 as close as possible to +5 V indication on multifunction meter. If stop is reached, back off one turn on potentiometer R62 and adjust DOWNLINK 1 GAIN BALANCE PILOT 2 potentiometer for approximately +4 V indication.

(19) Set attenuator 1 to 6 dB.

(20) Adjust potentiometer R62 for 0 ± 100 mV indication on multifunction meter.

(21) Set attenuator 1 to 0 dB.

(22) Adjust DOWNLINK 1 GAIN BALANCE PILOT 2 potentiometer for +4.9 V indication on multifunction meter.

(23) Set attenuator 1 to 6 dB.

(24) Adjust potentiometers R74 thru R62, then DOWNLINK 1 GAIN BALANCE PILOT 2 (if required) for 0 ±100 mV indication on multifunction meter.

(25) Set attenuator 1 to 0 dB.

(26) Adjust DOWNLINK 1 GAIN BALANCE PILOT 2 potentiometer for 5 ± 0.1 V indication on multifunction meter.

(27) Set attenuator 1 to 6 dB.

(28) Adjust R74 counterclockwise for 0 +100 mV indication.

(29) Set attenuator 1 to 0 dB.

(30) Adjust R62 for +5 ± 0.1 V indication.

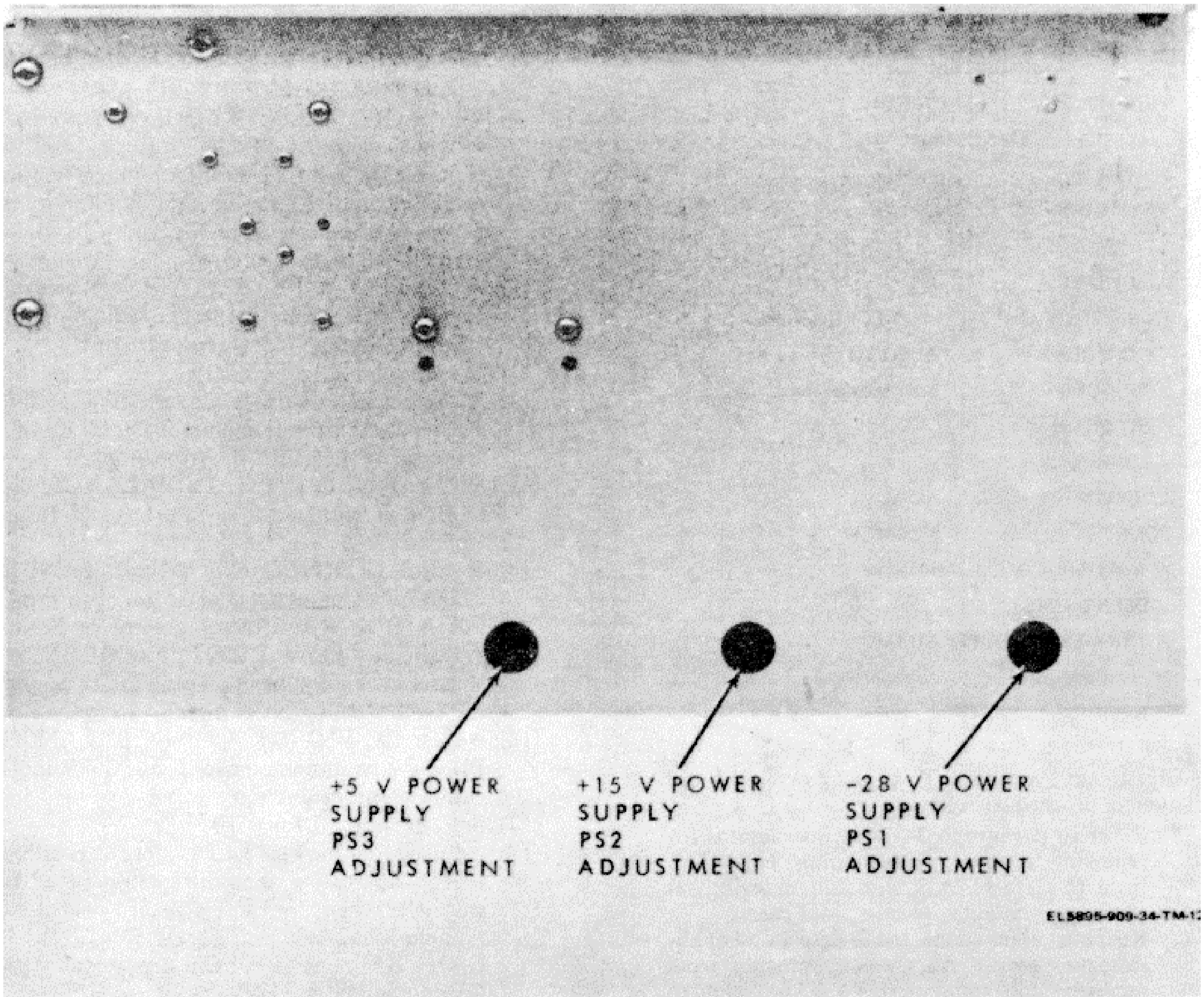


Figure 3-8. Receiver gain monitor HTA-3A6 power supplies adjustment location.

(31) Set attenuator 1 to 12 dB.

(32) Check for 2.5 + 1.0 V indication on multifunction meter.

(33) Steps (1) through (32) above have adjusted downlink I pilot 2 gain balance. To adjust downlink I pilot 1, perform steps 6 through 32 again, but select DOWNLINK 1 PILOT 1 when directed to select DOWNLINK 1 PILOT 2, adjust HIGH PILOT FREQUENCY rather than LOW PILOT FREQUENCY, adjust potentiometer R64 rather than R62, and select potentiometer R75 rather than R74 (fig. FO5).

(34) Steps (1) through (33) above have adjusted downlink 1 gain balance. To adjust downlink 2 pilot 2 gain balance, perform steps (6) through (32) again, but select attenuator 2 when directed to select attenuator 1, select DOWNLINK 2 PILOT 2 when directed to select DOWNLINK 1 PILOT 2, and adjust potentiometer on detect and autoswitch module A2 rather than detect and qualification module A1.

(35) Steps (1) through (34) above have adjusted downlink 1, and downlink 2 pilot 2 gain balance. To adjust downlink 2 pilot 1, perform steps (6) through (32) again but select attenuator 2 when directed to select attenuator 1, adjust HIGH PILOT FREQUENCY rather than LOW PILOT FREQUENCY, adjust potentiometers on detect and autoswitch module A2 rather than detect and qualification module A1, adjust potentiometers R64 rather than R62, and select potentiometer R75 rath er than R74.

3-65. Adjustment of Downlinks 1 and 2 Fault Threshold.

a. ***Test Equipment.*** The test equipment require for adjustment of downlinks 1 and 2 fault thresholds consists of a Tektronix oscilloscope 475.

b. ***Test Connections****.* Test connections are called out in the adjustment procedures as needed.

c. Initial Control Settings*.* Set the oscilloscope controls as follows:

Control	Position
POWER	PULL ON (out)
VERT MODE	CHI
VOLTS/DIV	2
AGC-GND-DC	AC
HORIZONTAL DISPLAY	A LOCK KNOBS
TRIG MODE	AUTO
A TRIGGER - SLOPE and LEVEL	As required
COUPLING	AC
SOURCE	NORM
A AND B TIME/ DIV DELAY TIME	50 us
A TRIGGER HOLDOFF	NORM
INTENSITY	As required
FOCUS	As required

d. Adjustment Procedure. To adjust downlink 1 and 2 fault threshold, proceed as follows:

(1) Refer to paragraph 339 for instructions for removing receiver gain monitor HTA-3A6 from rf plate HTA-3, and for removing receiver gain monitor chassis from case.

(2) Keeping cable connected to detect and qualification module A1, remove module receiver gain monitor HTA-3A6 (refer to para 3-40).

(3) Connect test equipment as shown in A, figure FO11, sheet 2.

(4) Remove top cover plates from module A1 and A2.

(5) On receiver gain monitor front panel, set FAN, 28VPS, and 5/15VPS circuit breakers to ON, press MAIN switch, and set ATTENUATION dial to 0 dB.

(6) Set attenuators 1 and 2 at 6 dB.

(7) Connect oscilloscope to test point TP1 on detect and qualification module A1 and adjust LOW PILOT FREQUENCY control for 8 $\pm$ 0.5 V ac on oscilloscope. Move oscilloscope to test point TP2 and adjust HIGH PILOT FREQUENCY control for 8 0.5 V ac on oscilloscope.

(8) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1 and adjust PILOT 1 potentiometer for 0 dB indication on GAIN BALANCE meter. Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2 and adjust PILOT 2 potentiometer for 0 dB indication on GAIN BALANCE meter.

(9) Adjust attenuator 1 for 6 dBm on GAIN BALANCE meter.

(10) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(11) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(12) Adjust DOWNLINK 1 LOW MAJOR FAULT THRESHOLDS potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until it goes out.

(13) Set attenuator 1 for 3 dB on GAIN BALANCE meter.

(14) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(15) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(16) Adjust DOWNLINK 1 LOW MINOR FAULT THRESHOLDS potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until it goes out.

(17) Set attenuator 1 for 2 dB on GAIN BALANCE meter.

(18) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(19) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(20) Adjust DOWNLINK 1 LOW MAJOR FAULT THRESHOLDS potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until it goes out.

(21) Set attenuator 1 to 1 dB on GAIN BALANCE meter.

(22) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(23) Adjust DOWNLINK 1 LOW MINOR FAULT THRESHOLDS potentiometer counterclockwise until MIN ALARM flickers, then clockwise until it goes out.

(24) Set attenuator 1 for 2 dB on GAIN BALANCE meter.

(25) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(26) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(27) Adjust DOWNLINK 1 LOW MINOR FAULT THRESHOLDS potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until it goes out.

(28) Set attenuator I for 4 dB on GAIN BALANCE meter.

(29) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(30) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(31) Adjust DOWNLINK 1 LOW MAJOR FAULT THRESHOLDS potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until it goes out.

(32) Set attenuator 1 for +6 dB on GAIN BALANCE meter.

(33) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(34) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(35) Adjust DOWNLINK 1 HIGH MAJOR FAULT THRESHOLDS potentiometer counterclockwise until MAJOR ALARM flickers, then clockwise until it goes out.

(36) Set attenuator for +3 dB on GAIN BALANCE meter.

(37) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(38) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(39) Adjust DOWNLINK 1 HIGH MINOR FAULT THRESHOLDS potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until it goes out.

(40) Set attenuator 1 for +2 dB on GAIN BALANCE meter.

(41) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(42) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(43) Adjust DOWNLINK 1 HIGH MAJOR FAULT THRESHOLDS potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until it goes out.

(44) Set attenuator 1 to +1 dB on GAIN BALANCE meter.

(45) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(46) Adjust DOWNLINK 1 HIGH MINOR FAULT THRESHOLDS potentiometer counterclockwise until MIN ALARM flickers, then clockwise until it goes out.

(47) Set attenuator 1 for +2 dB on GAIN BALANCE meter.

(48) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(49) Set selector switch to DOWNLINK 1GAIN BALANCE PILOT 2.

(50) Adjust DOWNLINK 1 HIGH MINOR FAULT THRESHOLDS potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until it goes out.

(51) Set attenuator 1 for +4 dB on GAIN BALANCE meter.

(52) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(53) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 2.

(54) Adjust DOWNLINK HIGH MAJOR FAULT THRESHOLDS potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until it goes out.

(55) Set attenuator 1 for 0 dB on GAIN BALANCE meter.

(56) Set selector switch to DOWNLINK 1 GAIN BALANCE PILOT 1. Readjust PILOT 1 potentiometer for 0 dB on GAIN BALANCE meter.

(57) Steps (1) through (56) have checked minor fault thresholds levels at : 1 dB and +3 dB and have checked major fault thresholds levels at 2 dB and 46 dB. Minor fault threshold levels are now set at 2 dB and major fault threshold levels are set at 44 dB. To verify that fault threshold levels are set properly, monitor GAIN BALANCE meter and vary attenuator 1 from 0 to 6 dB to +6 dB, and back to 0. DOWNLINK 1 MIN ALARM indicator is lighted at 2 +0.5 dB and DOWNLINK 1 MAJ ALARM indicator is lighted at +4 +0.5 dB.

(58) Steps (1) through (57) have checked and set downlink 1 threshold levels. To check and set downlink 2 threshold levels, repeat steps (6) through (57), except check for 8 ± 40.5 volts at test points TP1 and TP2 in detect and auto-switch module A2, use potentiometer on DOWNLINK 2 side of receiver gain monitor front panel and use attenuator 2 to vary levels.

SECTION X. MAINTENANCE OF 28 V DC POWER SUPPLY HTA-3A6PS1

3-66. General. This section provides instructions for replacing chassis mounted components in 28 V dc power supply PSI during direct support maintenance in accordance with allocation chart in TM 11589589812. This section also provides adjustment procedures for over-current control R17.

3-67. Power Supply HTA3A6PS1 Cover Removal and Replacement (fig. 3-2, sh 1 **and 2).** For access to the internal power supply parts, the power supply cover must be removed. To remove and replace power supply cover, proceed as follows:

a. On power supply, remove three phillips head screws on right side, two on left side and two on lower front.
b. For access to power supply components, tilt rear of power supply cover upward from chassis.
c. To secure power supply cover, lower cover over power supply chassis. Secure cover to supply with three phillips head screws on right side, two on left side and two on lower front of power supply.

3-68. Power Transformer T1 Removal and Replacement (fig. 3-2, sh 4). To remove and replace power transformer T1, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-67.)
b. Tag destination points of wires connected to power transformer T1 for identification.
c. Remove power transformer T1 cable tie-wraps.
d. Remove four corner screws that secure printed circuit (PC) board B. Fold PC board B over for access to transformer connections.
e. Unsolder and disconnect wires connected to power transformer T1.
f. Remove one screw from bottom of power supply and two screws from rear that secure power transformer T1.
g. Remove power transformer T1.
h. Install and secure replacement power transformer T1 in power supply chassis with one screw on bottom and two on rear of chassis.
i. Solder transformer wires to applicable tagged destination points.
j. Secure PC board B with four corner screws.
k. Secure power transformer T1 cable tie-wraps to power supply chassis.
l. Replace cover on power supply. (Refer to paragraph 3-67.)
m. Perform testing procedures described in section XI of this chapter.

3-69. Filter Capacitor C8 Removal and Replacement (fig. 3-2, sh 4). To remove and replace filter capacitor C8, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-67.)
b. Place power supply chassis top side up on bench.
c. Tag wires connected to filter capacitor C8 for identification. Remove two screws that secure wires to capacitor.
d. Loosen capacitor mounting clamp screw and remove capacitor C8 from mounting clamp.
e. Install replacement filter capacitor C8 in power supply capacitor mounting clamp.
f. Connect tagged wires to applicable terminals on filter capacitor C8 with screws removed in step C.
g. Install cover on power supply. (Refer to paragraph 367.)
h. Perform testing procedures described in section XI of this chapter.

3-70. Series Regulator Transistors 08 through Q13 Removal and Replacement (fig. 3-2, sh 5). To remove and replace series regulator transistors Q8 through Q13 proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-67.)
b. On front cover of power supply, remove 24 hex head bolts that secure transistors Q8 through Q 13 heat sink assemblies and two phillips head screws that secure component board D.
c. Remove cable tie-wrap screw.
d. Remove transistor Q8 through Q13 heat sink assemblies along with component board D.
e. Tag for identification and unsolder electrical wires on bottom side of defective series regulator transistor as applicable.
f. Remove hex nut from back of the two mounting screws that secure series regulator transistor to the heat sink assembly.

g. Remove series regulator transistor from mounting screws. Remove and inspect insulating wafer. Replace if cracked.
h. Coat both sides of insulating wafer with heat sink compound (Dow Corning No. 340 silicone grease or equivalent).
i. Install insulating wafer and replacement series regulator transistor on heat sink mounting screws.
j. Install hex nut on each mounting screw to sec series regulator transistor to heat sink assembly.
k. Solder tagged electrical wires to applicable pins on bottom side of series regulator transistor.
l. Install component board D and heat sink assemblies with series regulator transistors Q8 through Q 13 on interior side of front cover with 24 hex head bolts.
m. Secure cable tie-wrap screw to cover.
n. Install cover on power supply. (Refer to paragraph 3-67.)
o. Perform testing procedures described in section XI of this chapter.

3-71. Bridge Rectifiers CR8 through CR11 Removal and Replacement (fig. 3-2, sh 4). To remove and replace a bridge rectifier, proceed as follows:
a. Remove power supply cover (para 3-67***a***).
b. Place power supply top side up on bench.
c. Identify and unsolder wire connected to rectifier anode.
d. Identify wire connected to rectifier cathode.
e. Remove hex nut and wire from rectifier stud. Remove rectifier from power supply.
f. Remove and inspect mica insulating washer. Re place if cracked.
g. Place mica insulating washer over rectifier stud and insert rectifier stud through mounting hole on power supply chassis.
h. Install identified wire and hex nut on rectifier stud.
i. Solder identified wire to rectifier anode.
j. Replace power supply cover (para 3-67).
k. Perform testing procedure described in section XI of this chapter.

3-72. Printed Circuit Board Component Removal and Replacement. When a defective component on the printed circuit board is to be replaced, observe the following maintenance techniques.
a. When unsoldering component from the board, never pry or force loose the part; unsolder the component by using the wicking process described below:
(1) Select a 3/16 in. copper braid for use a wick; if braid is not available, select AWG No. 17 or No. 16 stranded wire with 1/2 in. insulation removed.
(2) Dip wick in liquid rosin flux.
(3) Place wick onto soldered connection and apply soldering iron onto wick.
(4) When sufficient amount of solder flows onto wick, freeing the component, simultaneously remove iron and wick.
b. When soldering semiconductor devices, hold the lead being soldered with a pair of pliers or place a commercial heat sink device between the component and the solder joint.
c. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink
d. If foil is intact, but not covered with solder, it is a good contact. Do not attempt to cover with solder.
e. Broken or damaged printed wiring is usually the result of an imperfection, strain, or careless soldering. To repair small breaks, tin a short piece of hookup wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuit.
f. Check and clean all replacement component leads prior to soldering, regardless of visual appearance.
g. Use smooth finished tools for bending leads; avoid use of sharp edged tools that may pinch or break the lead. Leave a distance of at least twice the diameter of the lead from the end seal of the component to the start of the bend. This rule also applies to all components with soldered leads, such as tantalum capacitors.
h. Position replacement component in the same place as the removed component. Do not mount replacement component on top of another component. Position replacement component so that any identification mark, such as the part number, symbol, value, etc., is readily visible.
i. Observe polarity of replacement diodes, transistors, and electrolytic and tantalum capacitors.
j. Perform testing procedures described in section XI of this chapter.

3-73. Fuse F1 Removal and Replacement (fig. 3-2, sh 3.) To remove and replace fuse F1 proceed as follows:
a. Remove power supply cover. (Refer to paragraph 3-67).
b. Remove fuse F1 from fuse holder.
c. Insert replacement fuse F1 in fuse holder.
d. Replace power supply cover. (Refer to paragraph 3-67).

3-74. Thermostat 81 Removal and Replacement (fig. 3-2, sh 1 and 5). To remove and replace thermostat S1, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-67).

b. On left side of power supply front cover, remove two phillips head screws which secure thermostat S1.

c. Slide thermostat SI outward from power supply cover for access to electrical wires.

d. Tag for identification and unsolder electrical wires connected to thermostat S1. Remove thermostat S1.

e. Solder tagged electrical wires to replacement thermostat S1.

f. Install thermostat S1 on interior side of front cover. Secure with two phillips head screws.

g. Install cover on power supply. (Refer to paragraph 3-67).

3-75. Overcurrent Control R17 Adjustment (fig. 32. sh 3). Adjustment of overcurrent control R17 on printed circuit board B is required when transistor Q3, resistor R25 or overcurrent potentiometer R17 is replaced, and voltage and current indications do not reflect maximum ratings.

a. ***Test Equipment and Materials.*** Table 3-11 lists the test equipment required for adjustment of overcurrent control R17.

Table 3-11. Test Equipment Required for Power Supply HTA-3A6PS1, 3A6PS2, 3A6PS3 Overcurrent Control R17 Adjustment

Common name	Part/model no.	Qty	Manufacturer
AC Line Cord	17449-S	1	Belden
Adapter, AC, 3-Wire to 2-Wire	785-019	1	Allied
Adapter, Banana Jack to Spade Lug	3744	7	Pomona
Adapter, Single Banana Plug to Binding Post	2894	2	Pomona
Ammeter	931-2901001	1	Weston Instruments
Meter, Multifunction	3450B OPT 001, 002	1	Hewlett-Packard
Milliammeter, Volt-Ohm-	2606	1	Simpson
Oscilloscope, Dual-Trace	475	1	Tektronix
Rheostat, Carbon Compression	82905	1	Central Scientific
Test Lead, Banana Plug to Alligator Clip	1166-36B	1	Pomona
Test Lead, Banana Plug to Banana Plug	B-48-B	3	Pomona
Test Lead, Banana Plug to Banana Plug	B-48-R	2	Pomona
Test Lead, BNC Plug to Double Banana (44 inches)	11001A	1	Hewlett-Packard
Test Lead, Spade Lug to Banana Plug	1370-24-B	1	Pomona
Test Lead, Spade Lug to Banana Plug	1370-24R	1	Pomona
Test Lead, Spade Lug to Spade Lug	1743-36-R	1	Pomona
Transformer. Variable	3PN2210	1	Staco

***b. Test Connections and** Conditions.* Adjustment of overcurrent control R17 is accomplished in a bench test setup. Prior to performing the adjustment, prepare the equipment as follows:

(1) Connect variable transformer to power source. Set power switch to on and observe that indicator lights.

(2) Set vom function switch to AC and range switch to 250 V. Connect vom to variable transformer output plug and adjust variable transformer for 1 15volt ac indication on vom. Set variable transformer power switch to off. Disconnect vom.

(3) Remove power supply cover. (Refer to paragraph 3-67.)

(4) Locate potentiometer R17 on printed circuit The adjustable (inner) section of R17 is solder-sealed to the outer casing. This seal prevents inadvertent movement of the wiper following factory adjustment. Unsolder seal and adjust R17 to full cw position.

(5) Connect equipment as shown in figure FO-13 (6) Adjust rheostat for maximum resistance (fully ccw).

c. Initial Control Settings. Initial test equipment settings for the adjustment procedure are as follows:

Control	**Position**
	Multifunction meter
LINE	On (up)
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
	Oscilloscope
POWER	On (pull)
VERT MODE	CH 1
CH 1 VOLTS/DIV	As required to observe signal
CH 1 ACGNDDC	AC
HORIZ DISPLAY	A
TRIG MODE	NORMAL
COUPLING	AC
SOURCE	NORM
TIME/DIV	As required to observe signal
A TRIGGER SLOPE and LEVEL	As required for stable display

Control	**Position**
	Variable transformer
POWER	On

d. *Adjustment Procedure.* Perform the adjustment as follows:

(1) Disconnect load from power supply by disconnecting test lead from positive terminal of dc ammeter.

(2) On front side of power supply (fig. 3-2, sh 1) adjust VDC control for 26.6 V dc indication on multifunction meter.

(3) Connect test lead to positive terminal of dc ammeter to power supply as shown in figure FO-13.

(4) Adjust rheostat for 6.6 A (110 pet of 40 deg C rating for unit) indication on dc ammeter.

(5) Observe oscilloscope and adjust R 17 (fig. 3-2, sh 3) on circuit card ccw until output ripple increases sharply and oscilloscope pattern changes.

(6) On variable transformer, set power switch to off.

(7) On power supply circuit card, solder seal the adjustable (inner) section of R 17 to the outer casing, to prevent further movement of the wiper, and increase resistance of rheostat (rotate ccw).

(**8)** After soldering, check setting of R 17 by placing variable transformer power switch to ON. Adjust rheostat to produce a load current of 6.6 A while observing the oscilloscope and current meter. When load current indication on current meter reaches 6.6 A, verify that output ripple increases sharply and oscilloscope pattern changes. If indications on oscilloscope are not as specified, place variable transformer power switch to OFF, unsolder solder seal of R 17, place variable transformer to ON and repeat steps (I) through (8).

(9) Adjust rheostat to reduce load current to 6 A.

(10) On front of power supply, adjust VDC control for 28 : 1.40 V dc indication on multifunction meter.

(11) On variable transformer, set power switch to off.

(12) Disconnect test equipment and replace cover on power supply.

(13) Perform direct support testing procedures described in section XI of this chapter.

3-76. Overvoltage Protector Z15 Adjustment. The following subparagraphs describe the test equipment, connections and conditions, initial control settings, and procedure for adjustment of 28 V dc power supply PS1 overvoltage protector Z15.

a. Test Equipment. The following test equipment is required for adjustment:

(1) Multifunction Meter, HP 3450B OPT 001, 002.

(2) Pomona test leads 116636B and 116636R (banana plug to alligator clip).

b. Connections and Conditions. Adjustment of overvoltage protector Z15 is accomplished with the 28 V dc power supply PS1 removed from receiver gain monitor HTA3A6 chassis. Prepare equipment for adjustment of overvoltage protector Z15 as follows:

(1) Refer to paragraph 3-47 for instructions for removing power supply PS1 enough to gain access to overvoltage protector Z15 and the terminal board of power supply PS1.

(2) Remove two screws and washers securing cover to terminal board of power supply PS1.

(3) Remove load from power supply by tagging and removing wires connected to terminal board terminals 3 and 4. Leave overvoltage protector Z15 connected at terminal board terminal 4.

c. Initial Control Settings. Set controls as follows:

Control	Position
Multifunction meter	
LINE	On (up)
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER INT	
Overvoltage protector Z15	
ADJUST	Full cw (approximately 20 turns).
Receiver gain monitor	
CB2 CIRCUIT BREAKER	ON

d. Adjustment Procedures. Perform overvoltage protector Z15 adjustment procedure as follows:

(1) Connect black test lead from black X terminal on multifunction meter to power supply terminal board terminal 6 and connect red test lead from red X terminal on multifunction meter to power supply terminal board terminal 4.

(2) Adjust 28 V dc power supply PSI for 33.2 V dc indication on multifunction meter.

(3) While observing multifunction meter, slowly turn overvoltage protector screwdriver ADJUST control counterclockwise until power supply output voltage drops. Overvoltage protection point is now set.

(4) Rotate power supply VDC screwdriver control counterclockwise five times.

(5) On receiver gain monitor front panel, set 28 VPS circuit breaker CB2 to OFF, then back to ON.

(6) Using power supply VDC screwdriver control, adjust power supply voltage to 28 40.28 V dc.

(7) On receiver gain monitor front panel, set 28 VPS circuit breaker to OFF. Identify by tag and reconnect wires to power supply terminal board pins 3 and 4.

(8) Place receiver gain monitor 28 VPS circuit breaker CB2 to ON and verify that power supply voltage still is 28 +0.28 V dc.

(9) Refer to paragraph 3-47 for instructions to restore receiver gain monitor to operational configuration.

SECTION XI. TESTING OF 28 V DC POWER SUPPLY HTA-3A6PS1

3-77. General. This section contains procedure for performance testing 28 V dc power supply PS1 after replacement of line replaceable units following the troubleshooting procedures. Each preliminary procedure and performance test must be performed in the given sequence. Preliminary procedures consist of obtaining listed test equipment, making prescribed test connections, and initially setting equipment controls to the specified settings. These settings, and all subsequent settings given in the performance test table, must be made carefully to ensure accurate test conditions. If the test procedures result in the 28 V dc power supply meeting all performance standards specified in the performance test, the equipment can be returned to service.

3-78. Test Equipment and Materials. Test equipment required for testing of the 28 V dc power supply is the same as that required for overcurrent control R17 adjustment and is listed in table 3-11.

3-79. Test Connections and Conditions. Performance testing of the power supply is accomplished in a bench test setup. Prior to performing the performance test, prepare equipment as follows:

a. Connect variable power transformer to power source. Set power switch to ON and observe that indicator lights.

b. Set volt-ohm-milliammeter (vom) function switch to AC and range switch to 250 V. Connect vom to output plug and adjust variable power transformer for 108 ±3.25 V dc indication on vom. Disconnect vom.

c. Adjust rheostat for maximum resistance (fully ccw).

d. Connect test equipment as shown in figure FO-13.

NOTE

Twist leads on multifunction meter, rheostat and ammeter that connect to power supply to cancel external noise signals.

3-80. Initial Control Settings. The initial test equipment settings for the performance test are the same as those specified in paragraph 3-74c.

3-81. Performance Test Procedures. Table 3-12 contains the performance test procedure for the 28 V dc power supply. Proceed sequentially through the table in accordance with numbered steps. Set test equipment controls and equipment under test controls exactly as directed in the table and perform the prescribed test procedure. If test result is within the specified performance standard limits, proceed to the next step in the table. If test result is not as specified, perform the troubleshooting procedure in section IV of this chapter. After fault correction, repeat the performance test.

Table 3-12. 28 V DC Power Supply HTA-3A6PS1 Performance Test Procedure

Step no.	Test equipment control settings	Test procedure	Performance standard
1	As specified in paragraph 3-74c.	Observe ammeter and adjust rheostat for value specified as performance standard	6 A
2		Disconnect test lead from positive post of ammeter.	
3		Adjust power supply VDC control to obtain specified output voltage indication on multifunction meter.	28 + 1.4 V dc
4		Record multifunction meter indication as V1.	
		Reconnect test lead to ammeter and record multifunction meter Indication as V2.	
		Load regulation is difference between V1 and V2. Calculate this difference.	Equal to or less than 11.4 mV dc
5		Set multifunction meter power switch off.	
		Observe oscilloscope display and measure ripple voltage and noise.	Equal to or less than 3 mV p-p
6		Set multifunction meter power switch on.	
7		Adjust variable transformer for a 132 V ac indication on vom.	
		Record multifunction meter Indication as V3.	

Table 3-12. 28 V DC Power Supply HTA-3A6PS1 Performance Test Procedure (Continued)

Step no.	Test equipment control settings	Test procedure	Performance standard
8		Repeat step 7 above for 105 V ac indication on vom and record multifunction meter readings as V4. Calculate line regulation as difference between V3 and V4.	 Equal to or less than 18 mV dc

SECTION XII. MAINTENANCE OF 15 V DC POWER SUPPLY HTA-3A6PS2

3-82. General. This section provides instructions for replacing chassis mounted components in 15 V dc power supply PS2 during direct support maintenance. This section also provides adjustment procedures for overcurrent control R1 7.

3-83. Power Supply PS2 Cover Removal and Replacement (fig. 3-3, sh 1). For access to the internal power supply parts, the power supply cover must be removed. To remove and replace power supply cover, proceed as follows:

a. On front of power supply, remove bottom three phillips head screws.

b. Place power supply bottom side up on bench. Remove six phillips head screws on bottom side and remove cover.

c. For access to power supply components, carefully slide power supply cover away from chassis until extended to length of cable.

d. Replace bottom cover on power supply and align with mounting holes on front and bottom of supply. Secure bottom cover to supply with six phillips head screws on bottom and three on lower front of power supply.

3-84. Power Transformer T1 Removal and Replacement (fig. 3-3, sh 3, 4, and 5). To remove and replace power transformer T1, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-83.) ***b.*** Tag wires connected to power transformer T1 for identification.

c. Remove power transformer T1 cable tie-wraps.

d. Remove four corner screws that secure pcb B. Fold pcb B over for access to transformer connections.

e. Unsolder and disconnect wires connected to power transformer T1.

f. Remove nut and lock washer from each of the four transformer T1 mounting bolts.

g. Remove power transformer T1.

h. Install replacement power transformer T1 in power supply chassis so that mounting bolts protrude through mounting holes on chassis.

i. Install lock washer and nut on each power transformer T1 mounting bolt to secure transformer to chassis.

j. Solder transformer wires to applicable tagged destination points.

k. Secure pcb B with four corner screws.

l. Replace cover on power supply. (Refer to paragraph 3-83.)

m. Perform testing procedures described in section XIII of this chapter.

3-85. Filter Capacitor C8 Removal and Replacement **(fig. 3-3, sh 4 and 5).** To remove and replace filter capacitor C8, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-83.)

b. Place power supply chassis top side up on bench.

c. Noting polarity, tag wires connected to filter capacitor C8 for identification. Remove two screws that secure wires to capacitor.

d. Remove capacitor C8 from mounting clamp.

e. Install replacement filter capacitor C8 in power supply capacitor mounting clamp.

f. Noting polarity, connect tagged wires to applicable terminals on filter capacitor C8 with screws removed in step 4.

g. Install cover on power supply. (Refer to paragraph 3-83.)

h. Perform testing procedures described in section XIII of this chapter.

3-86. Series Regulator Transistors Q8 and Q9 Removal and Replacement (fig. 3-3, sh 1 and 6). To remove and replace series regulator transistor Q8 or proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-83.)

b. Place power supply bottom side up on bench.

c. On front cover of power supply, remove eight hex head bolts that secure transistors Q8 and Q9 heat sink assemblies and two phillips head screws that secure component board C.

d. Remove cable tie-wrap screw.

e. Remove transistor Q8 and Q9 heat sink assemblies along with component board C.

f. Tag for identification and unsolder two wires on bottom side of transistor Q8 or Q9, as applicable.

g. Remove hex nut from back of the two mounting screws that secure transistor Q8 or Q9 to the heat sink assembly.

h. Remove transistor Q8 or Q9 from mounting screws. Remove and inspect insulating wafer. Replace if cracked.

i. Coat both sides of insulating wafer with heat sink compound (Dow Corning No. 340 silicone grease, or equivalent).

j. Install insulating wafer and replacement transistor QS or Q9 on heat sink mounting screws.

k. Install hex nut on each mounting screw to secure transistor Q8 or Q9 to heat sink assembly.

l. Solder tagged electrical wires to applicable pins on bottom side of transistor Q8 or Q9.

m. Install component board C and heat sink assemblies with transistors Q8 and Q9 on interior side of front cover so that heat sink mounting holes are aligned with mounting holes on front cover. Replace retaining screws to secure component board C.

n. Secure heat sink assemblies to front cover with eight hex head mounting bolts.

o. Secure cable tie-wrap screw to cover.

p. Install cover on power supply. (Refer to paragraph 3-83.)

q. Perform direct support testing procedures described in section XII of this chapter.

3-87. Bridge Rectifiers CR8 through CF through CR11 Removal and Replacement (fig. 3-3, sh 4). To remove and replace a bridge rectifier proceed as follows:

a. Remove power supply cover (para 3-83).

b. Place power supply top side up on bench.

c. Identify and unsolder wire connected to rectifier anode.

d. Identify wire connected to rectifier cathode.

e. Remove hex nut and wire from rectifier stud. Remove rectifier from power supply.

f. Remove and inspect mica insulating washer. Replace if cracked.

g. Place mica insulating washer over rectifier stud and insert rectifier stud through mounting hole on power supply chassis.

h. Install identified wire and hex nut on rectifier stud.

i. Solder identified wire to rectifier anodes.

j. Replace power supply cover (para 3-83d).

k. Perform testing procedures described in section XIII of this chapter.

3-88. Printed Circuit Board Component Removal and Replacement. When a defective component on the printed circuit board is to be replaced, observe the following maintenance techniques.

a. When unsoldering a component from the board, never pry or force it loose; unsolder the component by using the wicking process described below:

(1) Select a 3/16 in. tinned copper braid for use as a wick; if braid is not available, select AWG No. 17 or No. 16 stranded wire with 1/2 in. insulation removed.

(2) Dip wick in liquid rosin flux.

(3) Place wick onto soldered connection and apply soldering iron onto wick.

(4) When sufficient amount of solder flows onto wick, freeing the component, simultaneously remove iron and wick.

b. When soldering semiconductor devices, hold the lead being soldered with a pair of pliers or place a commercial heat sink device between the component and the solder joint.

c. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.

d. If foil is intact, but not covered with solder, it is a good contact. Do not attempt to cover with solder.

e. Broken or damaged printed wiring is usually the result of an imperfection, strain, or careless soldering. To repair small breaks, tin a short piece of hookup wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuit.

f. Check and clean all replacement component leads prior to soldering, regardless of visual appearance.

g. Use smooth finished tools for bending leads; avoid use of sharp edged tool that may pinch or break the lead. Leave a distance of at least twice the diameter of the lead from the end seal of the component to the start of the bend. This rule also applies to all components with soldered leads, such as tantalum capacitors.

h. Position replacement component in the same place as the removed component. Do not mount component on top of another component. Position replacement component so that any identification mark, such as the part number, symbol, value, etc., is readily visible.

i. Observe polarity of replacement diodes, transistors, and electrolytic and tantalum capacitors.

j. Perform direct support testing described in section XIII of this chapter.

3-89. Overcurrent Control R17 Adjustment (fig. 3-3, sh 5). Adjustment of overcurrent control R17 on printed circuit board B is required when transistor Q3, resistor R28 or overcurrent potentiometer R17 is replaced, and voltage and current indications do not reflect maximum ratings.

a. Test Equipment and Materials. Table 311 lists the test equipment required for adjustment of overcurrent control R17.

b. Test Connection and Conditions. Adjustment of the overcurrent control is accomplished in a bench test setup. Prior to performing adjustment, prepare equipment as follows:

(1) Connect variable transformer to power source. Set power switch to on and observe that indicator lights.

(2) Set volt-ohm-milliammeter (vom) function switch to AC and range switch to 250 V. Connect vom to variable transformer outpt plug and adjust variable transformer for 115 V ac indication on vom. Set variable transformer power switch to off. Disconnect vom.

(3) Remove power supply cover. (Refer paragraph 3-83.)

(4) Locate potentiometer R17 on printed Circuit. The adjustable (inner) section of R17 is solder-sealed to the outer casing. This seal prevents inadvertent movement of the wiper following factory adjustment. Unsolder the seal and adjust R17 to the full cw position

(5) Connect equipment as shown in figure FO-13

(6) Adjust rheostat for maximum resistance (fully ccw).

c. Initial Control Settings. Initial test equipment settings for the adjustment procedure are as follows

Control	Position
Multifunction meter	
LINE	On (up)
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Oscilloscope	
POWER	On (pull)
VERT MODE	CH 1
CH 1 VOLTS/DIV	As required to observe signal
CH 1 ACGNDDC	AC
HORIZ DISPLAY	A
TRIG MOD	NORMAL
COUPLING	AC
SOURCE	NORM
TIME/DIV	As required to observe signal
A TRIGGER SLOPE and LEVEL	As required for stable display
Variable transformer	
POWER	On

d. Adjustment Procedure (fig. 3-3, sh 1). Perform adjustment as follows:

(1) Disconnect load from power supply by disconnecting test lead from negative terminal of dc ammeter.

(2) On front side of power supply adjust VDC control for 14.25 V dc indication on the multifunction meter.

(3) Reconnect test lead from negative terminal of dc ammeter to power supply as shown in figure FO13.

(4) Adjust rheostat for 3.85 A (110 percent of 40 deg C rating for unit) indication on dc ammeter.

(5) Observe oscilloscope and adjust R17 (fig. 3-3, sh 5) on circuit card in a ccw direction until output ripple increases sharply and oscilloscope pattern changes.

(6) On variable transformer, place power switch to the off position.

(7) On power supply circuit card, solder seal the adjustable (inner) section of R 17 to the outer casing, to prevent further movement of the wiper, and increase resistance of rheostat (rotate ccw).

(8) After soldering, check setting of R17 by placing variable transformer power switch to ON. Adjust rheostat to produce a load current of 3.85 A while observing the oscilloscope and current meter. When load current indication on current meter reaches 3.85 A, verify that output ripple increases sharply and oscilloscope pattern changes. If indications on oscilloscope are not as specified, place variable transformer power switch to OFF, unsolder solder seal of R17, place variable transformer to ON and repeat steps (l) through (8)

(9) Adjust rheostat to reduce load current to 3.5 A.

(10) On front of power supply, adjust VDC control for indication of 15 ± 0.1 5 V dc on multifunction meter.

(11) On variable transformer, set power switch to off.

(12) Disconnect test equipment and replace cover on power supply.

(13) Perform direct support testing procedures described in section XIII of this chapter

3-90. Overvoltage Protector Z16 Adjustment. The following subparagraphs describe the test equipment, connections and conditions, initial control settings, and procedures for adjustment of 15 V dc power supply PS2 overvoltage protector Z16.

a. Test Equipment. Test equipment required for the adjustment is as follows:

(1) Multifunction Meter, HP 3450B OPT 001, 002.

(2) Pomona test leads 116636B and 116636R (banana plug to alligator clip).

b. Connections and Conditions. Overvoltage protector Z16 is adjusted with the 15 V dc power supply PS2 removed from the receiver gain monitor HTA3A6 chassis. Prepare equipment for the adjustment as follows:

(1) Refer to paragraph 3-47 for instructions for removing power supply PS2 to gain access to overvoltage protector Z16 and the terminal board of power supply PS2.

(2) Remove two screws and washers securing cover to terminal board of power supply PS2.

(3) Remove load from power supply by tagging and removing wires connected to terminal board pins 6 and 7. Leave overvoltage protector Z16 connected at terminal board pin 6.

c. Initial Control Settings. Set controls as follows:

Control	Position
Multifunction meter	
LINE	On (up)
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Overvoltage protector Z16	
ADJUST	Full cw (approximately 20 turns).
Receiver gain monitor	
5/15 VPS (CB3)	ON

d. Adjustment Procedures. To adjust overvoltage protector Z16, proceed as follows:

(1) Connect black test lead from black X terminal on multifunction meter to power supply terminal board pin 4 and connect red test lead from red X terminal on multifunction meter to power supply terminal board pin 6.

(2) On front of power supply, adjust VDC control for +18.25 V dc indication on multifunction meter.

(3) While observing multifunction meter, slowly turn overvoltage protector screwdriver ADJUST control counterclockwise until power supply output voltage drops. Overvoltage protection point is now set.

(4) Rotate power supply VDC screwdriver control counterclockwise five times.

(5) On receiver gain monitor front panel, set 5/15 VPS circuit breaker CB3 to OFF, then back to ON.

(6) Using power supply VDC screwdriver control, adjust power supply voltage for +15 ± 0.75 V dc indication.

(7) On receiver gain monitor front panel, set 5/15 VPS circuit breaker to OFF. Identify by tag and reconnect wires to power supply terminal board pins 6 and 7.

(8) Set receiver gain monitor 5/15 VPS circuit breaker CB3 to ON, and verify that power supply voltage still is +15 ± 0.75 V de.

(9) Refer to paragraph 3-47 for instructions to restore receiver gain monitor to operational configuration.

SECTION XIII. TESTING OF15 V DC POWER SUPPLY HTA-3A6PS2

3-91. General. This section contains the procedures necessary for performance testing 15 V dc power supply PS2 after replacement of line replaceable units following the troubleshooting procedures. Each preliminary procedure and performance test must be performed in the given sequence. Preliminary procedures consist of obtaining the listed test equipment, making the prescribed test connections, and initially setting the equipment controls to the specified settings. These settings, and all subsequent settings given in the performance test table, must be made carefully to ensure accurate test conditions. If the test procedures result in the 15 V dc power supply meeting all performance standards specified in the performance test the equipment can be returned to service.

3-92. Test Equipment and Materials. Test equipment required for direct support testing of the 15 V dc power supply is the same as that required for overcurrent control R17 adjustment, as listed in table 3-11.

3-93. Test Connections and Conditions.
Performance testing of the power supply is accomplished in a bench test setup. Prior to performing the performance test, prepare the equipment as follows:

a. Connect variable power transformer to power source. Set power switch to ON and observe that indicator lights.

b. Set volt-ohm-milliammeter (vom) function switch to AC and range switch to 250 V. Connect vom to output plug and adjust variable power transformer for 1 15 V ac indication on vom. Disconnect vom.

c. Adjust rheostat for maximum resistance (fully ccw).

d. Connect test equipment as shown in figure FO- 13.

NOTE

Twist test leads on multifunction meter, rheostat and ammeter that connect to power supply to cancel external noise signals.

3-94. Initial Control Settings. The initial test equipment settings for the performance test are the same as those specified in paragraph 3-87c.

3-95. Performance Test Procedure. Table 3-13 contains the performance test procedure for the 15 V dc power supply. Proceed sequentially through the table in accordance with numbered steps. Set test equipment controls and equipment under test controls exactly as directed in the table and perform prescribed test procedure. If result is within the specified performance standard limits, proceed to next step in the table. If result is not as specified, perform troubleshooting procedure described in section V of this chapter. After fault correction, repeat the performance test.

Table 3-13. 15 V DC Power Supply HTA-3A6PS2 Performance Test Procedure

Step no.	Test equipment control settings	Test procedure	Performance standard
1	As specified in paragraph 3-87c.	Observe ammeter and adjust rheostat for value specified as performance standard.	3.5 A
2		Disconnect test lead from positive post of ammeter.	
3		Adjust power supply VDC control to obtain specified output voltage indication on multifunction meter.	15 V dc +0.75 V
4		Record multifunction meter indication as V1.	
		Reconnect test lead to ammeter and record multifunction meter indication as V2.	
		Load regulation Is difference between V1 and V2. Calculate this difference.	Equal to or less than 7.5 mV dc

Table 3-13. *15 V DC Power Supply HTA-3A 6PS2 Performance Test Procedure (Continued)*

Step no.	Test equipment control settings	Test procedure	Performance standard
5		Set multifunction meter power switch off.	
		Observe oscilloscope display and measure ripple voltage and noise.	Equal to or less than 3 mV p-p
6		Set multifunction meter power switch on.	
7		Adjust variable transformer for a 132 V ac indication on vom.	
		Record multifunction meter indication as V3.	
8		Repeat step 7 above for 105 V ac indication on vom and record multifunction meter reading as V4.	
		Calculate line regulation as difference between V3 and V4.	Equal to or less than 11.5 mV dc

SECTION XIV. MAINTENANCE OF 5 V DC POWER SUPPLY HTA-3A6PS3

3-96. General. This section provides instructions for replacing chassis mounted components in 5 V dc power supply PS3 during maintenance. This section also provides adjustment procedures for overcurrent control R1.

3-97. Power Supply HTA3A6PS3 Cover Removal and Replacement (fig. 3-4, sh 1). For access to the internal power supply parts, the power supply cover must be removed. To remove and replace power supply cove proceed as follows:

a. On front of power supply, remove bottom three phillips head screws.

b. Place power supply bottom side up on bench. Remove six phillips head screws on bottom side and remove cover.

c. For access to power supply components, carefully slide power supply cover away from chassis until extended to length of cable.

d. Replace bottom cover on power supply and align with mounting holes on front and bottom of supply. Secure bottom cover to supply with six phillips head screws on bottom and three on lower front of power supply.

3-98. Power Transformer T1 Removal and Replacement (fig. 3-4, sh 3 and 4). To remove and replace power transformer T1, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-97.)

b. Tag destination points of wires connected to power transformer T1 for identification.

c. Remove power transformer T1 cable tie-wraps.

d. Remove four corner screws that secure printed circuit (PC) board B. Fold PC board B over for access to transformer connections.

e. Unsolder and disconnect wires connected to power transformer T1.

f. Remove nut and lock washer from each of the four transformer T1 mounting bolts.

g. Remove power transformer T1.

h. Install replacement power transformer T1 in power supply chassis so that mounting holes are aligned with mounting holes on chassis.

i. Install lock washer and nut on each power transformer T1 mounting bolt and secure to chassis.

j. Solder transformer wires to applicable tagged destination points.

k. Secure PC board B with four corner screws.

l. Replace cover on power supply. (Refer to paragraph 3-97.) ***m.*** Perform direct support testing procedures described in section XV of this chapter.

3-99. Filter Capacitor C8 Removal and Replacement (fig. 3-4, sh 4). To remove and replace filter capacitor C8, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-97.) ***b.*** Place power supply chassis top side up on bench.

c. Noting polarity, tag destination points of 'wires connected to filter capacitor C8 for identification.

Remove two screws that secure wires to capacitor.

d. Remove capacitor C8 from mounting clamp ***e.*** Install replacement filter capacitor C8 in power supply capacitor mounting clamp.

f. Noting polarity, connect tagged wires to applicable terminals on filter capacitor C8 with screws removed in step ***d.***

g. Install cover on power supply. (Refer to paragraph 3-97.) ***h.*** Perform direct support testing procedures scribed in section XV of this chapter.

3-100. Series Regulator Transistors Q8 and Q9 Removal and Replacement (fig. 3-4, sh 1 and 5).
To remove and replace series regulator transistor Q8 or Q9, proceed as follows:

a. Remove power supply cover. (Refer to paragraph 3-97.) ***b.*** Place power supply bottom side up on bench.

c. On front cover of power supply, remove eight hex head bolts that secure transistors Q8 and Q9 heat sink assemblies and two phillips head screws that secure component board C.

d. Remove cable tie-wrap screw.

e. Remove transistor Q8 and Q9 heat sink assemblies along with component board C.

f. Tag for identification and unsolder two wires on bottom side of transistor Q8 or Q9, as applicable.

g. Remove hex nut from back of the two mounting screws that secure transistor Q8 or Q9 to the heat sink assembly.

h. Remove transistor Q8 or Q9 from mounting screws. Remove and inspect insulating wafer. Replace if cracked.

i. Coat both sides of insulating wafer with heat sink compound (Dow Corning No. 340 silicone grease, or equivalent).

j. Install insulating wafer and replacement transistor Q8 or Q9 on heat sink mounting screws.

k. Install hex nut on each mounting screw to secure transistor Q8 or Q9 to heat sink assembly.

l. Solder tagged wires to applicable pins on bottom side of transistor Q8 or Q9.

m. Install component board C and heat sink assemblies with transistors Q8 and Q9 on interior side of front cover so that heat sink mounting holes are aligned with mounting holes on front cover. Replace retaining screws on component board C.

n. Secure heat sink assemblies to front cover with eight hex head mounting bolts.

o. Secure cable tie-wrap screw to cover.

p. Install cover on power supply. (Refer to paragraph 3-97.) ***q.*** Perform direct support testing procedures described in section XV of this chapter.

3-101. Bridge Rectifiers CR8 through CR11 Removal and Replacement (fig. 3-4, sh 4). To remove and replace a bridge rectifier, proceed as follows:

a. Remove power supply cover (para 3-97).

b. Place power supply top side up on bench.

c. Identify and unsolder wire connected to rectifier anode.

d. Identify wire connected to rectifier cathode.

e. Remove hex nut and wire from rectifier stud. Remove rectifier from power supply.

f. Remove and inspect mica insulating washer. Replace if cracked.

g. Place mica insulating washer over rectifier stud and insert rectifier stud through mounting hole on power supply chassis.

h. Install identified wire and hex nut on rectifier stud.

i. Solder identified wire to rectifier anode.

j. Replace power supply cover (para 3-97).

k. Perform direct support testing procedures described in section XV of this chapter.

3-102. Printed Circuit Board Component Removal and Replacement. When a defective component on the printed circuit board is to be replaced, observe the following maintenance techniques.

a. When unsoldering a component from the board, never pry or force it loose; unsolder the component by using the wicking process described below:

(1) Select a 3/16 in. tinned copper braid for use as a wick; if braid is not available, select AWG No. 17 or No. 16 stranded wire with 1/2 in. insulation removed.

(2) Dip wick in liquid rosin flux.

(3) Place wick onto soldered connection and apply soldering iron onto wick.

(4) When sufficient amount of solder flows onto wick, freeing the component, simultaneously remove iron and wick.

b. When soldering semiconductor devices, hold the lead being soldered with a pair of pliers or place a commercial heat sink device between the component and the solder joint.

c. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.

d. If foil is intact, but not covered with solder, it is a good contact. Do not attempt to cover with solder.

e. Broken or damaged printed wiring is usually the result of an imperfection, strain, or careless soldering. To repair small breaks, tin a short piece of hookup wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

f. Check and clean all replacement component leads prior to soldering, regardless of visual appearance.

g. Use smooth finished tools for bending leads; avoid use of any sharp-edged tool that may pinch or break the lead. Leave a distance of at least twice the diameter of the lead from the end seal of the component to the start of the bend. This rule also applies to all components with soldered leads, such as tantalum capacitors.

h. Position replacement component in the same place as the removed component. Do not mount component on top of another component. Position replacement component so that any identification mark, such as the part number, symbol, value, etc., is readily visible.

i. Observe polarity of replacement diodes, transistors, and electrolytic and tantalum capacitors.

j. Perform direct support testing procedures described in section XV of this chapter.

3-103. Overcurrent Control R17 Adjustment (fig. 3-4, sh 3). Adjustment of overcurrent control R17 on printed circuit board B is required when transistor Q3, resistor R28 or overcurrent potentiometer R17 is replaced, and voltage and current indications do not reflect maximum ratings.

a. Test Equipment and Materials. Table 3-11 lists the **test** equipment required for adjustment of overcurrent control R17.

b. Test Connections and Conditions. Adjustment of the overcurrent control is accomplished in a bench test setup. Prior to performing the adjustment, prepare the equipment as follows:

(1) Connect variable transformer to power source. Set power switch to on and observe that indicator lights.

(2) Set volt-ohm-milliammeter (vom) function switch to AC and range switch to 250 V. Connect vom to variable transformer output plug and adjust variable transformer for 115 V ac indication on vom. Set variable transformer power switch to off. Disconnect vom.

(3) Remove power supply cover. (Refer to paragraph 3-97.)

(4) Locate potentiometer R17 on printed circuit. The adjustable (inner) section of R17 is solder-sealed to the outer casing. This seal prevents inadvertent movement of the wiper following factory adjustment. Unsolder the seal and adjust R17 to the full CW position.

(5) Connect equipment as shown in figure FO-13.

(6) Adjust rheostat for maximum resistance (fully ccw).

c. **Initial *Test Equipment Settings.*** Initial test equipment settings for the adjustment procedure are as follows:

Control	Position
Multifunction meter	
LINE	On (up)
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Oscilloscope	
POWER	On (pull)
VERT MODE	CH 1
CH 1 VOLTS/DIV	As required to observe signal
CH 1 AC-GND-DC	AC
HORIZ DISPLAY	A
TRIG MODE	NORMAL
COUPLING	AC
SOURCE	NORM
TIME/DIV	As required to observe signal
A TRIGGER - SLOPE and LEVEL	As required for stable display
Variable transformer	
POWER	On

d. Adjustment Procedure (fig. 3-4, sh 1). **Perform the adjustment as follows:**

(1) Disconnect load from power supply by disconnecting test lead from negative terminal of dc ammeter.

(2) On front side of panel supply (fig. 3-4, sh1 adjust VDC control for an indication of 4.75 V dc on the multifunction meter.

(3) Reconnect test lead to negative terminal of dc ammeter as shown in figure FO-13.

(4) Adjust rheostat for 5.6 A (110 percent of 40 deg C rating for unit) indication on dc ammeter.

(5) Observe oscilloscope and adjust RI 7 (fig. 3-4, sh 3) on circuit card in a ccw direction until output ripple increases sharply and oscilloscope pattern changes.

(6) On variable transformer, place power switch to the off position.

(7) On power supply circuit card, solder sea; the adjustable (inner) section of R17 to the outer casing, to prevent further movement of the wiper, and increase resistance of rheostat (rotate ccw).

(8) After soldering, check setting of R1 7 by placing variable transformer power switch to ON. Adjust rheostat to produce a load current of 5.6 A while observing the oscilloscope and current meter. When load current indication on current meter reaches 5.6 A, verify that output ripple increases sharply and oscilloscope pattern changes. If indications on oscilloscope are not as specified, place variable transformer power switch to OFF, unsolder solder seal of R17, place variable transformer to ON and repeat steps (1) through (8).

(9) Adjust rheostat to reduce load current to 5.1 A.

(10) On front of power supply, adjust VDC control for indication of 5 +0.05 V dc on multifunction meter.

(11) On variable transformer, place power switch to the off position.

(12) Disconnect test equipment and replace cover on power supply.

(13) Perform direct support testing procedures described in section XV of this chapter.

3-104. Overvoltage Protector Z17 Adjustment.

The following subparagraphs describe the test equipment, connections and conditions, initial control settings, and procedure for adjustment of 5 V dc power supply PS3 overvoltage protector Z 17.

a. Test Equipment. **The following test equipment is required for adjustment:**

(1) Multifunction meter, HP 3450B OPT 001, 002.

(2) Pomona test leads 1166-36-B and 1166-36-R (banana plug to alligator clip).

b. Connections and Conditions. **Adjustment of overvoltage protector Z17 is accomplished with the 5 V power supply PS3 removed from the receiver gain monitor HTA-3A6 chassis. Prepare equipment for adjustment of overvoltage protector ZI17 as follows:**

(1) Refer to paragraph 3-47 for instructions for removing power supply PS3 far enough to gain access to overvoltage protector Z 17 and the terminal board of power supply PS3.

(2) Remove two screws and washers securing cover to terminal board of power supply PS3.

(3) Remove load from power supply by tagging and removing wires connected to terminal board terminals 6 and 7. Leave overvoltage protector Z17 connected at terminal board terminal 6.

c. *Initial control settings*. **Set controls as follows:**

Control	Position
Multifunction meter	
LINE	On (up)
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Overvoltage protector Z17	
ADJUST	Full cw (approximately 20 turns).
Receiver gain monitor	
5/15 VPS(CB3)	ON

d. **Adjustment Procedures. Perform overvoltage protector Z17 adjustment procedure as follows:**

(1) Connect black test lead from black X terminal on multifunction meter to power supply terminal board terminal 4 and connect red test lead from red X terminal on multifunction meter to power supply terminal board terminal 6.

(2) On front of power supply, adjust VDC control for an indication of +6.75 V dc on multifunction meter.

(3) While observing multifunction meter, slowly turn overvoltage protector screwdriver ADJUST control counterclockwise until power supply output voltage drops. Overvoltage protection point is now set.

(4) Rotate VDC control counterclockwise five times.

(5) On receiver gain-monitor front panel, set 5/15 VPS circuit breaker CB3 to OFF, and then to ON.

(6) Using power supply VDC control, adjust power supply voltage to +5 ±0.5 V dc.

(7) On receiver gain monitor front panel, set 5/15 VPS circuit breaker to OFF. Identify by tag and reconnect wires to power supply terminal board pins 6 and 7.

(8) Set receiver gain monitor 5/15 VPS circuit breaker CB3 to ON and verify that power supply voltage still is +5 ±0.05 V dc.

(9) Refer to paragraph 3-47 for instructions to restore receiver gain monitor to operational configuration.

SECTION XV. TESTING C DC POWER SUPPLY HTA-3A6PS3

3-105. General. This section contains the procedures necessary for performance testing 5 V dc power PS3 after replacement of line replaceable units fol the troubleshooting procedures. Each preliminary dure and performance test must be performed in the sequence. The preliminary procedure consists of obtaining the listed test equipment, making the prescribed test connections, and initially setting the equipment cc to the specified settings. These settings, and all frequent settings given in the performance test table be made carefully to ensure accurate test conditions the test procedures result in the 5 V dc power meeting all performance standards specified in the performance test, the equipment can be returned to service.

3-106. Test Equipment and Materials. Test equipment required for direct support testing of the 5 V dc power supply is the same as that required for overcurrent control R17 adjustment, as listed in table 3-11.

3-107. Test Connections and Conditions. Performance testing of the power supply is accomplished in a bench test setup. Prior to performing the performance test, prepare equipment as follows:

a. **Connect variable power transformer to source. Set power switch to ON and observe indicator lights.**

b. **Set volt-ohm-milliammeter (vom) function to AC and range switch to 250 V. Connect to output plug and adjust variable power transformer for 115 V ac indication on vom. Disconnect vom.**

c. **Adjust rheostat for maximum resistance (fully ccw).**

d. **Connect test equipment as shown in figure FO-13.**

NOTE

Twist test leads on multifunction meter, rheostat and ammeter that connect to power supply to cancel external noise signals.

3-108. Initial Control Settings. The initial test equipment settings for the performance test are the same as those specified in paragraph 3-103c.

3-109. Performance Test Procedure. Table 3-14 contains the test procedure for the 5 V dc power supply. Proceed sequentially through the table in accordance with numbered steps. Set test equipment controls and equipment under test controls as directed in the table and perform the prescribed test procedure. If result is within the specified performance standard limits, proceed to the next step in the table. If result is not as specified, perform troubleshooting procedure in section VI of this chapter. After fault correction, repeat the performance test.

Table 3-14. 5 V DC Power Supply HTA-3A6PS3 Performance Test Procedure

Step no.	Test equipment control settings	Test procedure	Performance standard
1	As specified in paragraph 3-100c.	Observe ammeter and adjust rheostat for value specified as performance standard.	5.1 A
2		Disconnect test lead from positive post of ammeter.	
3		Adjust power supply VDC control to obtain specified output voltage indication on multifunction meter.	5 +0.25 V dc
4		Record multifunction meter indication as V1.	
		Reconnect test lead to ammeter and record multifunction meter indication as VL2	
		Load regulation is difference between V1 and V2. Calculate this difference.	Equal to or less than 4.5 mV dc
5		Set multifunction meter power switch off.	
		Observe oscilloscope display and measure ripple voltage and noise.	Equal to or less than 3 mV p-p
6		Set multifunction meter power switch on.	
7		Adjust variable transformer for a 132 V ac indication on vom.	
		Record multifunction meter indication as V3.	
8		Repeat step 7 above for 105 V ac indication on vom and record multifunction meter reading as V4.	
		Calculate line regulation as difference between V3 and V4.	Equal to or less than 6.5 mV dc

SECTION XVI. TESTING OF PILOT CARRIER MONITOR PANEL 14A26

3-110. General. This section contains the procedure necessary for performance testing pilot carrier monitor panel 14A26 after replacement of meter, connector, or wiring, following the troubleshooting procedures of section II. Each preliminary procedure and performance test must be performed in the given sequence. The preliminary procedure consists of obtaining the listed test equip ment, making the prescribed test connections, and initially setting the equipment controls to the specified settings. These settings, and all subsequent settings given in the performance test, must be made carefully to ensure accurate test conditions. If the test procedure results in pilot carrier monitor panel 14A26 meeting all performance standards specified in the performance test, the equipment can be certified for return to service

3-111. Test Equipment. The test equipment required for performance testing pilot carrier monitor 14A26 is the same as is required in troubleshooting, as listed in table 3-2.

3-112. Test Connections and Conditions. The test procedure is to be performed with the pilot carrier monitor panel 14A26 on a work bench. Unscrew four captive screws, carefully pull pilot carrier monitor panel 14A26 from the console far enough to reach in and disconnect connector from J1 and ground wire from GND terminal, and place unit on work bench. Use figure 3-1 as a guide in connecting pilot carrier monitor panel 14A26 to test equipment.

3-113. Initial Control Settings. VOLTAGE control on power supply fully counterclockwise. Set volt-ohm-milliammeter (vom) range switch to 1MA position. Set potentiometer for 10 kilohm resistance. Connect test equipment to the power source and apply power.

3-114. Performance Test Procedure. Table 3-15 contains the test procedure for the pilot carrier monitor panel and is supported by figure 3-1. In the following procedure, the control settings and connections are the same from one step to another unless otherwise indicated. Disconnect all test equipment return pilot carrier monitor panel 14A26 to operational configuration upon successful completion of test.

Tale 3-15. Pilot Carrier Monitor Panel 14A26 Performance Test

Step no.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Vom Function: +DC Range: 1 mA		Adjust OUTPUT VOLTAGE control on dual-output power supply until DOWNLINK 1 LOW PILOT meter on pilot carrier monitor panel 14A26 indicates +6 dB. Observe indication on vom.	The vom should indicate 0.97±0.07 mA. Indicated power supply voltage should be approximately 10 V dc.
2			Connect ground terminal of dual-output power supply and COMMON terminal of vom to jacks J1-F and J1-E, respectively.	None
3			Adjust OUTPUT VOLTAGE control on dual-output power supply until DOWNLINK I HIGH PILOT meter indicates +6 dB. Observe indication on vom.	The vom should indicate 0.97 40.07 mA. Indicated power supply voltage should be approximately 10 V dc.
4			Connect ground terminal on dual-output power supply and COMMON terminal of vom to jacks J1-K and J1-J, respectively.	None
5			Adjust OUTPUT VOLTAGE control on dual-output power supply until DOWNLINK 2 LOW PILOT meter indicates +6 dB. Observe indication on vom.	The vom should indicate 0.97 0.07 mA. Indicated power supply voltage should be approximately 10 V dc.
6			Connect ground terminal of dual-output power supply and COMMON terminal of vom to jacks J1-P and J1-N, respectively.	None
7			Adjust OUTPUT VOLTAGE control on dual-output power supply until DOWNLINK 2 HIGH PILOT meter indicates +6 dB. Observe indication on vom.	The vom should indicate 0.97 40.07 mA. Indicated power supply voltage should be approximately 10 V de.
8			Connect ground terminal of dual-output power supply and COMMON terminal of vom to jacks J1-A and J1-B, respectively.	None
9			Repeat step 1, except obtain a -6	The vom should indicate 0.96 ±0.07

Table 3-15. Pilot Carrier Monitor Panel 14A26 Performance Test -Continued

Step no.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
		dB indication on DOWNLINK 1 LOW PILOT meter.	mA. Indicated power supply voltage should be approximately 10 V	dc.
10			Connect ground terminal of dual-output power supply and COMMON terminal of vom to jacks J1-E and J1-F, respectively.	None
11		dB indication on DOWNLINK 1 HIGH PILOT meter.	Repeat step 3, except obtain a -6 mA. Indicated power supply voltage should be approximately 10 V dc.	The vom should indicate 0.96 -±0.07
12		output power supply and COMMON terminal of vom to jacks J1-J and J1-K, respectively.	Connect ground terminal of dual-	None
13		indication on DOWNLINK 2 LOW PILOT meter.	Repeat step 5, except obtain -6 dB mA. Indicated power supply voltage should be approximately 10 V dc.	The vom should indicate 0.96 ±0.07
14		output power supply and COMMON terminal of vom to jacks J1-N and J1-P, respectively.	Connect ground terminal of dual-	None
15		indication on DOWNLINK 2 HIGH PILOT meter.	Repeat step 7, except obtain -6 dB mA. Indicated power supply voltage should be approximately 10 V dc.	The vom should indicate 0.96 ±0.07

SECTION XVII. TESTING 0F RECEIVER GAIN MONITOR HTA-3A6

3-115. General. This section contains procedures for performance testing receiver gain monitor HTA-3A6 after replacement of integral assemblies, subassemblies, or modules following troubleshooting procedures of section III. Each preliminary procedure and performance test must be performed in the given sequence. The preliminary procedure consists of obtaining listed test equipment making prescribed test connections, and initially setting equipment controls to specified settings. These settings, and all subsequent settings given in the performance test table, must be made carefully to ensure accurate test conditions. Figure FO-11 supports receiver gain monitor HTA-3A6 performance test. If the test procedure results in receiver gain monitor HTA-3A6 meeting all performance standards specified, the receiver gain monitor can be certified for return to service.

3-116. Test Equipment. Test equipment required for receiver gain monitor performance test is listed in table 3-16

Table 3-16. Test Equipment Required for Receiver Gain Monitor HTA-3A6 Performance Test

Common name	Part/model no.	Qty	Manufacturer
Adapter, Banana Jack to Size 20 Female Connector	3560	10	Pomona
Adapter, Banana Jack to Size 20 Male Connector	3561	10	Pomona
Adapter, N Jack to N Jack	679-1	1	Bendix
Analyzer, Spectrum, 1F Unit	8552B	1	Hewlett-Packard
Analyzer, Spectrum, Mainframe	141T	1	Hewlett-Packard
Analyzer, Spectrum, RF Unit	8555A	1	Hewlett-Packard
Attenuator, Variable (O to 60 dB)	H101	2	PDR Electronics
Attenuator, 20 dB	8491A	1	Hewlett-Packard
Converter, Frequency	5255A	1	Hewlett-Packard
Counter, Digital, Electronic (CP-772/U)	5245L	1	Hewlett-Packard
Generator, Signal, SHF	620B	1	Hewlett-Packard
Meter, Multifunction	3450B OPT 001.002		Hewlett-Packard
Meter, Power. Microwave	460B	1	General Microwave
Milllammeter, Volt-Ohm-	260-6	1	Simpson
Mount, Thermoelectric	N422C	1	General Microwave
Oscilloscope, Dual-Trace	475	1	Tektronix
Probe, Oscilloscope, X, X10	010-6063	1	Tektronix
Test Lead. Banana Plug to Banana Plug	B-48(B)	2	Pomona
Test Lead, Banana Plug to Banana Plug	B-48(R)	2	Pomona
Test Lead, N Plug to N Plug (72 Inches)	11500A	1	Hewlett-Packard
Test Lead, N Plug to N Plug	165S-T-36	7	Pomona

3-117. Test Connections and Conditions. The performance test is performed offline. Refer to paragraph 3-39 for instructions for removing receiver gain monitor from rf plate.

3-118. Initial Control Settings. Prior to performance testing, set controls as follows:

Control	Position
Multifunction meter	
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT
Oscilloscope	
POWER	Pull ON (out)
VERT MODE	CH2
VOLTS/DIV	2
AC-GND-	DC
POSITION	As required
TRIG MODE	AUTO
COUPLING	DC

Control	Position
Oscilloscope	
SOURCE CH 2	
HORIZ DISPLAY	A LOCK KNOBS
A AND B TIME/ DIV and DELAY TIME	50 us
Spectrum analyzer	
LINE	ON (up)
BANDWIDTH	300 kHz
SCAN WIDTH	10 MHz
TUNING STABILIZER	OFF
SIGNAL IDENTIFIER	OFF
INPUT ATTENUATION	10dB
MANUAL SCAN	Fully ccw
BASE LINE CLIPPER	Fully ccw
LOG REF LEVEL	-20 dBm
2 dB LOG/10 dB LOG/LINEAR	2 dB LOG
LINEAR SENSITIVITY	0
VIDEO FILTER	OFF
SCAN MODE	INT
SCAN TRIGGER	AUTO
INTENSITY As required	
FREQUENCY	Tone to 7.61 GHz on dial
Power meter	
EFF	Set to value as determined from graph on mount N422
115-230VLINE switch (rear)	115 V
RESPONSE switch (rear)	NORM
RANGE	3 W/+35 dBm (press)

Control	Position
Power meter	
POWER	LINE ON (PRESS); allow 15 min warmup period
RANGE	3 m^{W}/+5 dBm (press)
ZERO METER control	Adjust to indicate 0 dB on meter
Vom	
FUNCTION	+D.C.
RANGE	RX10,000
Electronic counter	
FUNCTION	FREQUENCY
TIMEBASE	1 s
SENSITIVITY (VOLTS rms)	PLUG-IN
PRESET	Fully ccw
LINE	ON
MOD SELECTOR	CW
POWER SET Switch	Zero POWER SET meter
FREQUENCY	7.61 GHz
OUTPUT ATTEN	fully CW
SYNC SELECTOR	EXT. +
Attenuators 1 and 2	
Attenuation	6 dB
Receiver gain monitor	
FAN	ON
28VPS	ON
5/15VPS	ON
BYPASS	If lit, press to extinguish
NORMAL	Press to light

3-119. Performance Test Procedure. Table 3-17 and table 3-18 contain the test procedure and autoswitch configuration data for receiver gain monitor HTA-3A6. Upon successful completion of the test procedure, receiver gain monitor HTQ-3A6 can be returned to service

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1		POWER SUPPLY MONITOR selector S5 -28 V	Observe indication on POWER SUPPLY MONITOR meter M2.	Meter should indicate in green portion of scale.
2		POWER SUPPLY MONITOR selector S5: +5 V M2.	Observe indication on POWER SUPPLY MONITOR meter	Meter should indicate in green portion of scale.
3		POWER SUPPLY MONITOR selector S5:+15 V M2.	Observe indication on POWER SUPPLY MONITOR meter	Meter should indicate in green portion of scale.
4		HIGH PILOT FREQUENCY HIGH PILOT connector on RGMU. Observe indication on electronic counter as HIGH PILOT FREQUENCY control is rotated from full cw to full ccw positions.	Connect electronic counter to 7.75 GHz minimum.	Electronic counter indicates 7.25 to
5		HIGH PILOT FREQUENCY tronic counter, adjust HIGH PILOT FREQUENCY control for counter indication of 7 710 GHz.	While observing indication on elec- GHz t0±0.5 MHz.	Electronic counter indicates 7.710
6		LOW PILOT FREQUENCY LOW PILOT FREQUENCY control is rotated from full cw to full ccw positions.	Connect electronic counter to 7.75 GHz minimum.	Electronic counter indicates 7.25 to
7		LOW PILOT FREQUENCY tronic counter, adjust FREQUENCY control for counter indication of 7.290 GHz.	While observing indication on dec- ±0.5 MHz.	Electronic counter indicates 7.290
8		HIGH PILOT OUTPUT tric mount through 20 dB attenuator (8491A) to HIGH PILOT connector. Observe indication on power meter.	Connect power meter thermoelec- dB).	Power meter indicates -23 dBm (±5
9		LOW PILOT OUTPUT connect power meter to LOW PILOT connector. Observe indication on meter. At completion	Disconnect electronic counter and dB). of step, disconnect power meter.	Power meter indicates -23 dBm (±5
10	a. Set attenuators 1 and 2 to 6 dB.		a. Connect oscilloscope to TP1 of detect and qualification module A1.	
		b. Adjust LOW PILOT FREQUENCY control for V ac.	b. 8 ±0.5 V ac	b. 8 ±0.5 V ac
			c. Connect oscilloscope to TP2 of detect and qualification module A2.	
		d. Adjust HIGH PILOT		d. 8 ±0.5 V a

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
		FREQUENCY control for 8 ±0.5 V ac.		
11		a. Set DOWNLINK 1 GAIN BALANCE switch to PILOT 1.	a. Adjust DOWNLINK 1 PILOT 1 potentiometer for 0 dB indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates 0 dB.
		b. Set DOWNLINK 1 GAIN BALANCE switch to PILOT 2.	b. Adjust DOWNLINK 1 PILOT 2 potentiometer for 0 dB indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dB.
12	a. Set attenuator 1 for -6 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates -6 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2.	c. Adjust DOWNLINK 1 FAULT THRESHOLDS LOW MAJOR potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 1 FAULT THRESHOLDS MAJ ALARM indicator goes out.
13	a. Set attenuator 1 for -2 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indi-
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2.	c. Set DOWNLINK 1 FAULT THRESHOLDS LOW MAJOR potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 1 FAULT THRESHOLDS MAJ ALARM indicator goes out.
14	a. Set attenuator 1 for -4 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates -4 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2.	c. Adjust DOWNLINK I FAULT THRESHOLDS LOW MAJOR potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK I FAULT THRESHOLDS MAJ ALARM indicator goes out.
15	a. Set attenuator 1 for -3 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates -3 dBm.

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
		b. Set GAIN BALANCE switch to DOWNLINK	b. Adjust DOWNLINK 1 PILOT 1 PILOT for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2.	c. Adjust DOWNLINK 1 FAULT THRESHOLDS LOW MINOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 1 FAULT THRESHOLDS MIN ALARM indicator goes out.
16	a. Set attenuator 1 for -1 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates -I dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK I PILOT 2	c. . Adjust DOWNLINK 1 FAULT THRESHOLDS LOW MINOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 1 FAULT THRESHOLDS MIN ALARM indicator goes out.
17	a. Set attenuator 1 for -2 dBm indication on GAIN BALANCE meter	a. GAIN BALANCE meter indicates 0 dBm		
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2.	c. Adjust DOWNLINK 1 FAULT THRESHOLDS LOW MINOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 1 FAULT THRESHOLDS MIN ALARM indicator goes out.
18	a. Set attenuator I for +6 dBm indication on GAIN BALANCE meter	a. GAIN BALANCE meter indicates +6 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1 BALANCE meter.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2.	c. Adjust DOWNLINK 1 FAULT THRESHOLDS HIGH MAJOR potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 1 FAULT THRESHOLDS MAJ indicator goes out.
19	a. Set attenuator 1 for +2 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates +2 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1 BALANCE meter.	b. Adjust DOWNLINK I PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2 JOR potentiometer counterclock-	c. Adjust DOWNLINK I FAULT THRESHOLDS HIGH MA- indicator goes out	c. DOWNLINK I FAULT THRESHOLDS MAJ ALARM

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
			wise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	
20	a. Set attenuator I for +4 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates +4 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1. BALANCE meter.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK I PILOT 2.	c. Adjust DOWNLINK I FAULT THRESHOLDS HIGH MAJOR potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 1 FAULT THRESHOLDS MAJ ALARM indicator goes out.
21	a. Set attenuator 1 for +3 dBm indication on GAIN BALANCE meter			a. GAIN BALANCE meter indicates +3 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1. BALANCE meter.	b. Adjust DOWNLINK I PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK I PILOT 2.	c. Adjust DOWNLINK I FAULT THRESHOLDS HIGH MINOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK I FAULT THRESHOLDS MIN ALARM indicator goes out.
22	a. Set attenuator 1 for +1 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates +1 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2.	c. Adjust DOWNLINK 1 FAULT THRESHOLDS HIGH MINOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK FAULT THRESHOLDS MIN ALARM indicator goes out.
23	a. Set attenuator 1 for +2 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates +2 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK I PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 2. NOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. Adjust DOWNLINK I FAULT THRESHOLDS HIGH MI indicator goes out.	c. DOWNLINK I FAULT - THRESHOLDS MIN ALARM

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
24	a. Set attenuator 1 for 0 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates 0 dBm
		b. Set GAIN BALANCE switch to DOWNLINK 1 PILOT 1.	b. Adjust DOWNLINK 1 PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
25	a. Set attenuators 1 and 2 to 6 dBm.		a. Connect oscilloscope to TP1 of detect and auto-switch module A2.	
		b. Adjust LOW PILOT FREQUENCY control for 8 ±0.5 V ac.		b. 8 ±0.5 V ac
			c. Connect oscilloscope to TP2 of detect and auto-switch module A2.	
		d. Adjust HIGH PILOT FREQUENCY control for 8 ±0.5 V ac.		d. 8 ±0.5 V ac
26		a. Set DOWNLINK 2 GAIN BALANCE switch to PILOT 1.	a. Adjust DOWNLINK 2 PILOT 1 potentiometer for O dB indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates 0 dB.
		b. Set DOWNLINK 2 GAIN BALANCE switch to PILOT 2.	b. Adjust DOWNLINK 2 PILOT 2 potcntiomnter for 0 dB indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dB.
27	a. Set attenuator 2 for 6 dBm indication on GAIN BALANCE meter.			a. GAIN BALANCE meter indicates -6 dBm.
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1. BALANCE meer.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2.	c. Adjust DOWNLINK 2 FAULT THRESHOLDS LOW MAJOR potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 2 FAULT THRESHOLDS MAJ ALARM indicator goes out.
28	a. Set attenuator 2 for -2 dBm indication on GAIN BALANCE meter			a. GAIN BALANCE meter indicater -2 dBm.
		b. Switch to DOWNLINK 2 PILOT 1.	b. Adjust DOWNLINK 2 PILOT 1 for O dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2.	c. Adjust DOWNLINK 2 FAULT THRESHOLDS LOW MAJOR potentiometer counterclockwise until MAJ ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 2 FAULT THRESHOLDS MAJ ALARM indicator goes out.
29	a. Set attenuator 2 for			a. GAIN BALANCE meter indicates -4 dBm.

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
	- 4 dBm indication on GAIN BALANCE meter.			
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dB indication on GAIN BALANCE meter.	b GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2.	c. Adjust DOWNLINK 2 FAULT THRESHOLDS LOW MAJOR potentiometer counterclockwise until MAJ ALARM indication flickers, then clock wise until indicator goes out.	c. DOWNLINK 2 FAULT THRESHOLDS MAJ ALARM indicator goes out.
30	a. Set attenuator 2 for -3 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates -3 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2.	c. Adjust DOWNLINK 2 FAULT THRESHOLDS LOW MINOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 2 FAULT THRESHOLDS MIN ALARM indicator goes out.
31	a. Set attenuator 2 for -1 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates -1 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1. BALANCE meter.	b. Adjust DOWNLINK 2 PILOT I for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2	c. Adjust DOWNLINK 2 FAULT THRESHOLDS LOW MINOR potentiometer counterclockwise until MIN ALARM indicator flickers, then clock wise until indicator goes out.	c. DOWNLINK 2 FAULT THRESHOLDS MIN ALARM indicator goes out.
32	a. Set attenuator 2 for -2 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates -2 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1. BALANCE meter.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2. potentiometer counterclockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out	c. Adjust DOWNLINK 2 FAULT THRESHOLDS LOW MINOR indicator goes out.	c. DOWNLINK 2 FAULT THRESHOLDS MIN ALARM
33	a. Set attenuator 2 for +6 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates +6 dBm.		
		b. Set GAIN BALANCE switch	b. Adjust DOWNLINK 2 PILOT	b. GAIN BALANCE meter indi-

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
		to DOWNLINK 2 PILOT 1. c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2. JOR potentiometer counterclock-wise until MAJ ALARM indica-tor flickers, then clock wise until indicator goes out.	1 for 0 dBm indication on GAIN BALANCE meter. c. Adjust DOWNLINK 2 FAULT THRESHOLDS HIGH MA-indicator goes out.	cates 0 dbm. c. DOWNLINK 2 FAULT THRESHOLDS MAJ ALARM
34	a. Set attenuator 2 for +2 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indi-cates +2 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1. BALANCE meter. c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2. JOR potentiometer counterclock wise until MAJ ALARM indica-tor flickers, then clockwise until indicator goes out.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN c. Adjust DOWNLINK 2 FAULT THRESHOLDS HIGH MA- - indicator goes out.	b. GAIN BALANCE meter indi-cates 0 dBm. c. DOWNLINK 2 FAULT THRESHOLDS MAJ ALARM
35	a. Set attenuator 2 for +4 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indi-cates +4 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1. BALANCE meter. c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN c. Adjust DOWNLINK 2 FAULT THRESHOLDS HIGH MA-JOR potentiometer counterclock-wise until MAJ ALARM indica-tor flickers, then clock wise until indicator goes out.	b. GAIN BALANCE meter indi-cates 0 dBm. c. DOWNLINK 2 FAULT THRESHOLDS MAJ ALARM indicator goes out.
36	a. Set attenuator 2 for +3 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indi-cates +3 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1. BALANCE meter. c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN c. Adjust DOWNLINK 2 FAULT THRESHOLDS HIGH MI-NOR potentiometer counter-clockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	b. GAIN BALANCE meter indi-cates 0 dBm. c. DOWNLINK 2 FAULT THRESHOLDS MIN ALARM indicator goes out.
37	a. Set attenuator 2 for +1 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indi-cates +1 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 1. BALANCE meter. c. Set GAIN BALANCE switch	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN c. Adjust DOWNLINK 2 FAULT	b. GAIN BALANCE meter indi-cates 0 dBm. c. DOWNLINK 2 FAULT

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
		to DOWNLINK 2 PILOT 2.	THRESHOLDS HIGH MI- NOR potentiometer counter-clockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	THRESHOLDS MIN ALARM indicator goes out.
38	a. Set attenuator 2 for +2 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates +2 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT I. BALANCE meter.	b. Adjust DOWNLINK 2 PILOT 1 for 0 dBm indication on GAIN	b. GAIN BALANCE meter indicates 0 dBm.
		c. Set GAIN BALANCE switch to DOWNLINK 2 PILOT 2.	c. Adjust DOWNLINK 2 FAULT THRESHOLDS HIGH MI- NOR potentiometer counter-clockwise until MIN ALARM indicator flickers, then clockwise until indicator goes out.	c. DOWNLINK 2 FAULT THRESHOLDS MIN ALARM indicator goes out.
39	a. Set attenuator 2 for 0 dBm indication on GAIN BALANCE meter.	a. GAIN BALANCE meter indicates 0 dBm.		
		b. Set GAIN BALANCE switch to DOWNLINK 2 PILOT I.	b. Adjust DOWNLINK 2 PILOT 1 potentiometer for 0 dBm indication on GAIN BALANCE meter.	b. GAIN BALANCE meter indicates 0 dBm.
40			a. Vary attenuator I from 0 dBm indication on GAIN BALANCE meter to -6 dBm and back to 0 dBm.	a. DOWNLINK I FAULT THRESHOLDS MIN ALARM indicator lights when GAIN BALANCE meter exceeds -2 dBm. MAJ ALARM indicator lights when meter exceeds -4 dBm. MAJ ALARM indicator goes out when meter indicates less than -4 dBm, and MIN ALARM indicator goes out when meter indicates less than -2 dBm.
			b. Vary attenuator from 0 dBm indication on GAIN BALANCE meter to +6 dBm and back to 0 dBm.	b. DOWNLINK I FAULT THRESHOLDS MIN ALARM indicator lights when GAIN BALANCE meter exceeds +2 dBm. MAJ ALARM indicator lights when meter exceeds +4 dBm. MAJ ALARM indicator goes out when meter indicates less than +4 dBm, and MIN ALARM indicator goes out when meter indicates less than +2 dBm.
			c. Vary attenuator 2 from 0 dBm indication on GAIN BALANCE meter to -6 dBm and back to 0 dBm.	c. DOWNLINK 2 FAULT THRESHOLDS MIN ALARM indicator lights when GAIN BALANCE meter exceeds -2 dBm. MAJ ALARM indicator

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
				lights when meter exceeds-4 dBm. MAJ ALARM indicator goes out when meter indicates less than -4 dBm, and MIN ALARM indicator goes out when miter indicates less than -2 dbm.
			d. Vary attenuator 2 from 0 dBm indication on GAIN BALANCE meter to +6 dBm and back to 0 dBm.	d. DOWNLINK 2 FAULT THRESHOLDS MIN ALARM indicator lights when GAIN BALANCE meter exceeds +2 dBm. MAJ ALARM indicator lights when meter exceeds +4 dBm. MAJ ALARM indicator goes out when meter indicates less than +4 dBm, and MIN ALARM indicator goes out when meter indicates less than +2 dB.
41	Multifunction meter FUNCTION: OHMS		Connect multifunction meter between J2-E and J2-G. Observe indication on meter.	Open circuit (OL indicator lights).
42	Connect B- 12 jumpers across x-y posts (remove after resistance measurements completed).		Connect meter between J2-J and J2-L. Observe indication on meter.	Open circuit (OL indicator lights).
43			Connect meter between J2-N and J2-R. Observe indication on meter. At completion of step, disconnect meter.	Open circuit (OL indicator lights).
44	Attenuator Increase setting until MIN and MAJ ALARM portions of DOWNLINK 1 FAULT THRESHOLDS split-lgend indicator lights.			None
45	Multifunction meter FUNCTION: OHMS	RF MONITOR STATUS: NORMAL	Connect meter between J2-E and J2G. Observe indication on meter.	Meter indicates less than 1 ohm.
46			Connect meter between J2-N and J2-R. Observe indication on meter.	Meter indicates less than 1 ohm.
47	Oscilloscopic TIME/ DIV: 0.5 VOLTS/ DIV: 10		Perform step 1 of automatic switching test (table 3-18) as folows:	
			a. Ensure that jumper wires are connected between: J2-k and J2-m J2-q and J2-r J2-u and J2-v J2-y and J2-z	a. None

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
			J3-Y and J3-Z J3-c and J3-d J3-B and J3-C J3-F and J3-G Tag jumpers for easy recognition. Connect 3561 adapters to J3-K, J3-L, J3-P, J3-R, J3-U, and J3-V. Tag the adapters for future use as test points.	
			b. Connect probe of oscilloscope to J3-K. Ground oscilloscope of J3-L.	b. None
			c. While observing indication on oscilloscope; periodically cause a major gain fault to occur in downlink 1 by varying attenuator 1.	c. A -28 V dc, 500 ms nominal) pulse is displayed on oscilloscope each time a major gain fault occurs.
			d. Connect probe of oscilloscope to J3-P. Ground oscilloscope at J3-R.	d. None
			e. While observing indication on oscilloscope, periodically cause a major gain fault to occur in downlink I by varying attenuator 1.	e. 0 V is displayed on the oscilloscope each time a major gin fault occurs.
			f. Connect probe of oscilloscope to J3-U. Ground oscilloscope at J3-V.	f. None
			g. While observing indication on oscilloscope, periodically cause a major gain fault to occur in downlink I by varying attenuator 1.	g. A -28 V, 500 ms (nominal) pulse is displayed on oscilloscope each time a major gain fault occurs.
48			Using corresponding data from table 3-18, perform steps 2 through 16 of automatic switching test in an identical manner as described in step 47 above.	Refer to applicable step of table 3-18.
49	Attenuator 2 Increase setting until MAJ ALARM portion of DOWNLINK 2 FAULT THRESHOLDS split-legend indicator DS8 lights.			

NOTE

A major gain fault is now constantly present in downlink 2.

Step no.	Test equipment	Equipment under test	Test procedure	Performance standard
50			Using corresponding data from table 3-18, perform steps 17 through 32 of automatic switching test in an identical manner	Refer to applicable step of table 3-18.

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
			as described in step 47 above. Disconnect oscilloscope at completion of step 32 of automatic switching test. Verify jumper configuration listed in step 47a. above.	
51			Connect jumper wire between J3-f and J3-h, and observe MANUAL CONTROL AT CONSOLE indicator DS4.	MANUAL CONTROL AT CONSOLE indicator DS4 lights.
52			a. Remove jumper wire at J3-Y and observe PARAMP MAINT/FAULT portion of DOWNLINK I MODE split-legend indicator DS2. At completion of step, reconnect jumper wire.	a. PARAMP MAINT/FAULT indicator DS2 of DOWNLINK lights.
			b. Repeat substep a., but remove jumper wire at J2-k Reconnect jumper wire at completion of step.	b. PARAMP MAINT/FAULT indicator DS2 of DOWNLINK 1 lights.
53			a. Remove jumper wire at J3-c and observe PARAMP MAINT/FAULT portion of DOWNLINK 2 MODE split-legend indicator DS6. At completion of step, reconnect jumper wire.	a. PARAMP MAINT/FAULT indicator DS6 of DOWNLINK lights.
			b. Repeat substep a. but remove jumper wire at J2-q. Reconnect jumper wire at completion of step.	b. PARAMP MAINT/FAULT indicator D6 of DOWNLINK 2 lights.
54			a. Remove jumper wire at J3-B and observe IFL MAINT/FAULT portion of DOWNLINK I MODE split-legend indicator DS3. At completion of step, reconnect jumper wire.	a. IFL MAINT/FAULT indicator DS3 of DOWNLINK I lights.
			b. Repeat substep a., but remove jumper wire at J2-u. Reconnect jumper wire at completion of step.	b. IFL MAINT/FAULT indicator DS3 of DOWNLINK
55			a. Remove jumper wire at J3-F and observe IFL MAINT/FAULT portion of DOWNLINK 2 MODE split-legend indicator DS7. At completion of step, reconnect jumper wire.	a. IFL MAINT/FAULT indicator DS7 of DOWNLINK 2 lights.
			b. Repeat substep a., but remove jumper wire at J2-y. Reconnect jumper wire at completion of step.	b. IFL MAINT/FAULT indicator DS7 of DOWNLINK 2 lights.
56	Attenuator 1 Set to 5 dB Power Meter		Disconnect cable between receiver gain monitor connector J4 and attenuator 1. Connect test cable	None

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
	1 RANGE: -5 dBm METER ZERO: Zero the meter. CALIBRATION FACTOR: Set to value indicated on associated power head for frequency of 7.25 to 7.75 GHz.		11500A between signal generator and attenuator 1. Disconnect cable at receiver gain monitor connector J6 and connect cable to power meter (A, fig. FO- 11, sh 2). Adjust OUTPUT ATTEN control on signal generator until power meter indicates -15 dBm.	
57	Attenuator 1 Attenuation: 22 dB (-32 dBm)		Disconnect power meter and connect spectrum analyzer to output of attenuator I (B, fig. FO-11, sh 2). Using a grease pencil, mark power level of the generator signal displayed on the spectrum analyzer. This mark represents -32 dBm power level.	None
58		28 VPS: OFF ATTENUATION: 0 dB	Disconnect lead from attenuator 1 output and connect spectrum analyzer to RGMU connector J4 (C, fig. FO-11, sh 2). Tune HIGH PILOT as required to center signal on display. Observe power level of HIGH PILOT signal displayed on the spectrum analyzer. Record actual power level. Check power level for HIGH PILOT from 7.25 to 7.75 GHz. (Use spectrum analyzer for rough frequency check.)	Power level of displayed signal should be -32 *5 dBm.
59	Spectrum Analyzer Vert Display: LINEAR SENSITIVITY: Set to -30 dBm	ATTENUATION: 0dB		None
60		ATTENUATION: 19dB	Increase spectrum analyzer if in (LOG REF LEVEL and LINEAR SENSITIVITY) until signal level is returned to -30 dBm line.	Difference between if pin of step 59 (reference) and tep 60 should be 19 *I dB.
61	Attenuator 1 Set to 5 dB Spectrum Analyzer FREQUENCY: Tune for 7.39 GHz on dial Power Meter RANGE: -5 dBm METER ZERO:		Connect attenuator 1 input to signal generator and attenuator I output to power meter (A, fig. FO-11, sh 2). Adjust OUTPUT ATTEN control on signal generator until power meter indicates -15 dBm.	None

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
	Zero the meter. CALIBRATION FACTOR Set to indicated on associated power head for frequency of 7.25 to 7.75 GHz.			
62	Signal Generator FREQUENCY: 7.39 GHz Attenuator 1 Attenuation: 22 dB (-32 dBm)		Disconnect power meter and connect spectrum analyzer.	None
			Disconnect power meter and connect spectrum analyzer to output of waveguide variable attenuator (B. fig. FO-11, sh 2). Using a grease pencil, mark power level of the generator signal displayed on the spectrum analyzer. This mark represents -32 dBm power level.	None
63		28 VPS: OFF ATTENUATION: 0 dB	Disconnect lead from attenuator output and connect spectrum analyzer to RGMU connector J4 (C, fig. FO-11, sh 2). Tune LOW PILOT as required to center signal on display. Observe power level of LOW PILOT signal displayed on the spectrum analyzer. Record actual power level. Check power level for LOW PILOT from 7.25 to 7.75 GHz. (Use spectrum analyzer for rough frequency check.)	Power level of displayed signal should be -32 5 dBm.
64	Spectrum Analyzer Vert Display: LINEAR SENSITIVITY: Set to -30 dBL	ATTENUATION: 0 dB		None
65		ATTENUATION: 19 dB	Increase spectrum analyzer if pin (LOG REF LEVEL and LINEAR SENSITIVITY) until signal level is returned to -30 dBm line.	Difference between if gain of tp 64 (reference) and step 65 should be 19 *1 dB.
66			Using power levels recorded in step 58 (HIGH PILOT) and step 63 (LOW PILOT) calculate and record average pilot power level for 0 dB setting of ATTENUATION control as average of high low pilot signals.	None

Table 3-17. Receiver Gain Monitor HTA-3A6 Performance Test -Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard

NOTE

The individual pilot power levels should be within 1.5 dB of the average power level.

Step no.	Test equipment	Equipment under test	Test procedure	Performance standard
67			Using power levels recorded in step 60 HIGH PILOT) and step 65 (LOW PILOT) calculate and record average pilot power level for 19 dB setting of ATTENUATION control as average of high and low pilot signals.	

NOTE

The individual pilot power levels should be within 1.5 dB of the average power level.

Step no.	Test equipment	Equipment under test	Test procedure	Performance standard
68			Using average power levels recorded in steps 66 and 67 calculate difference between average power level for 0 dB setting of control.	The difference should be 19 *I dB.
69		a. Place 5/15 VPS circuit breaker to CFF position. b. Place 5/15 VPS circuit breaker to ON position.	a. Verify that SUMMARY FAULT indicator is lit. b. Verify that SUMMARY FAULT indicator goes out.	a. SUMMARY FAULT indicator is lighted. b. SUMMARY FAULT indicator is not lighted.
70		a. Disconnect If cable at input connection to receiver gain monitor at jacks J6 and J7. b. Press BYPASS switch.	a. Gain balance meter indicates 6 dBm. b. Use ATTENUATION control to set GAIN BALANCE meter to 0 dBm, with selector switch in DOWNLINK 1 PILOT 2, DOWNLINK 1 PILOT 1, DOWNLINK 2 PILOT 2, and DOWNLINK 2 PILOT 1.	 b. GAIN BALANCE meter indicates 0 dBm.

Table 3-18. Receiver Gain Monitor HTA-3A6 Automatic Switching Test

Major Fault			*Connector pins				**Correct results		
Test step	Link 1	Link 2	J2-k and J2-m	J2-q and J2-r	J2-u and J2-v	J2-y and J2-z	J3-K and J3L	J3-P and J3R	J3-U and J-V
1	Yes	No	0	0	0	0	1	0	1
2	Yes	No	0	0	0	1	1	1	0
3	Yes	No	1	0	0	1	1	1	0
4	Yes	No	1	0	0	0	1	0	1
5	Yes	No	1	0	1	0	1	0	1
6	Yes	No	0	0	1	0	1	0	1
7	Yes	No	0	1	1	0	0	1	1
8	Yes	No	0	1	0	0	0	1	1
9	Yes	No	0	1	0	1	0	0	0
10	Yes	No	1	1	0	1	0	0	0
11	Yes	No	1	1	0	0	0	0	0
12	Yes	No	1	1	1	0	0	0	0
13	Yes	No	1	1	1	1	0	0	0
14	Yes	No	1	0	1	1	0	0	0
15	Yes	No	0	0	1	1	0	0	0
16	Yes	No	0	1	1	1	0	0	0
17	Yes	Yes	0	1	1	0	0	1	1
18	Yes	Yes	0	0	1	0	0	1	1
19	Yes	Yes	0	0	0	1	1	1	0
20	Yes	Yes	1	0	0	1	1	1	0
21	Yes	Yes	1	0	0	0	1	1	0
22	Yes	Yes	0	1	0	0	0	1	1
23	Yes	Yes	0	1	0	1	0	0	0
24	Yes	Yes	0	1	1	1	0	0	0
25	Yes	Yes	1	1	1	1	0	0	0
26	Yes	Yes	1	1	0	1	0	0	0
27	Yes	Yes	1	1	0	0	0	0	0
28	Yes	Yes	1	1	1	0	0	0	0
29	Yes	Yes	1	0	1	0	0	0	0
30	Yes	Yes	1	0	1	1	0	0	0
31	Yes	Yes	0	0	1	1	0	0	0
32	Yes	Yes	0	0	0	0	0	0	0

* Logic 1 is an open circuit between corresponding pins (jumper disconnected).
Logic 0 is a short circuit between corresponding pins (jumper disconnected).

** Logic 1 Is a -28 V, 500 1 ms (nominal) pulse measured across the pins listed.
Logic 0 is 0 V measured across the pins listed.

CHAPTER 4
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

SECTION I. GENERAL

4-1. Voltage and Resistance Measurements. The voltage and resistance measurements required to perform general support maintenance on the linear detect and threshold circuit card assembly are given in table 4-1. Each point of test can be located by referring to the parts location diagram, figure 4-1. A Hewlett-Packard multifunction meter 3450B should be used for making all measurements. All semiconductor resistance measurements are forward resistance readings unless specifically indicated otherwise. Specific instructions or precautions contained in the conditions column must be strictly observed when making measurements.

Table 4-1. Detector and Threshold Circuit Card Assembly HTA-3A6AIAI,A2AI Voltage and Resistance

Measurements

Point of test	Voltage (V dc) (Note 1)	Resistance (ohms) (Note 21
U1, U2		
Pin 1	-12.3 V	100.0 K
Pin 2	+4.6 mV	92.9 k
Pin 3	+4.5 mV	0.08ohm
Pin 5	-13A V	50.0 k
Pin 6	+4mV	1.8 k
Pin 7	15.0 V	0.6k
U3, U4		
Pin 1	-12.5V	101.9 k
Pin2	+5. MV	132.5 k
Pin 3	+4.3 mV	0.06 ohm
Pin 4	.14.0V	50.0 k
Pin 6	+7.3 mV	92.5 k
Pin 7	+15.12 V	0.6 k
U5, U6, U7,. U8		
Pin 2	+1.7 mV	105.9 k
Pin 3	+2 mV	109.9 k
Pin 4	-2.0 mV	50.0 k
Pin 6	+1.7 mV	106.1 k

Table 4-1. Linear Detector and Threshold Circuit Card Assembly HTA-3A6AIAI,A2AI Voltage and Resistance

Measurements -Continued

Point of test	Voltage (V dc) (Note 1)	Resistance (ohms) (Note 2)
Pin 7	+15.0 V	0.6k
Pin 1	-12.6 V	99.7 k
U9, U10		
Pin 2	+6.6 mV	93.6 k
Pin 3	+5.3 mV	0.06 ohm
Pin 4	-14.1 V	49.4 k
Pin 6	-25.8 mV	85.5 k
Pin 7	+15.0 V	0.6 k
U11, UI2, U17, U18		
Pin 1	+5.1 mV	0.06 ohm
Pin 3	-3.1 V	54.2 k
Pin 4	-64.9 mV	101.6 k
Pin 5	-5.4 V	103.6 k
Pin 6	-3.1 V	54.3 k
Pin 7	-71.2 mV	106.6 k
Pin 9	+3.5 V	50.3 k
Pin 10	+12.1 V	0.59 k
U13, U14		
Pin 1	-12.1 V	67.4 k
Pin 2	++0.8 V	504.0 k
Pin 3	N/A	640.1 k
Pin 4	-14.2 V	49.2 k
Pin 6	-12.0 V	60.3 k
Pin 7	+15.0 V	0.59 k
Pin 8	-13.5 V	62.5 k
U15, U16		
Pin 1	+15.0 V	0.6 k
Pin 2	+15.0V	0.6k
Pin 4	-3.2 V	53.9 k

Table 4-1. Linear Detector and Threshold Circuit Card Assembly HTA-3A6A1A1,A2A1 Voltage and Resistance

Measurements -Continued

Point of test	Voltage (V dc) (Note 1)	Resistance (ohms) (Note 2)
Pin 6	-12.8 V	50.4 lt
Pin 7	-14.2 V	50.2 k
Pin 8	-3.2 V	62.2 k

Note 1: Voltage measurements are made with plug P1(fig. 4-1) connected, and voltage applied. Voltage measurements are reference to ground.

Note 2: Resistance measurements are made with all plugs disconnected and no voltage applied. Resistance measurements are referenced to ground.

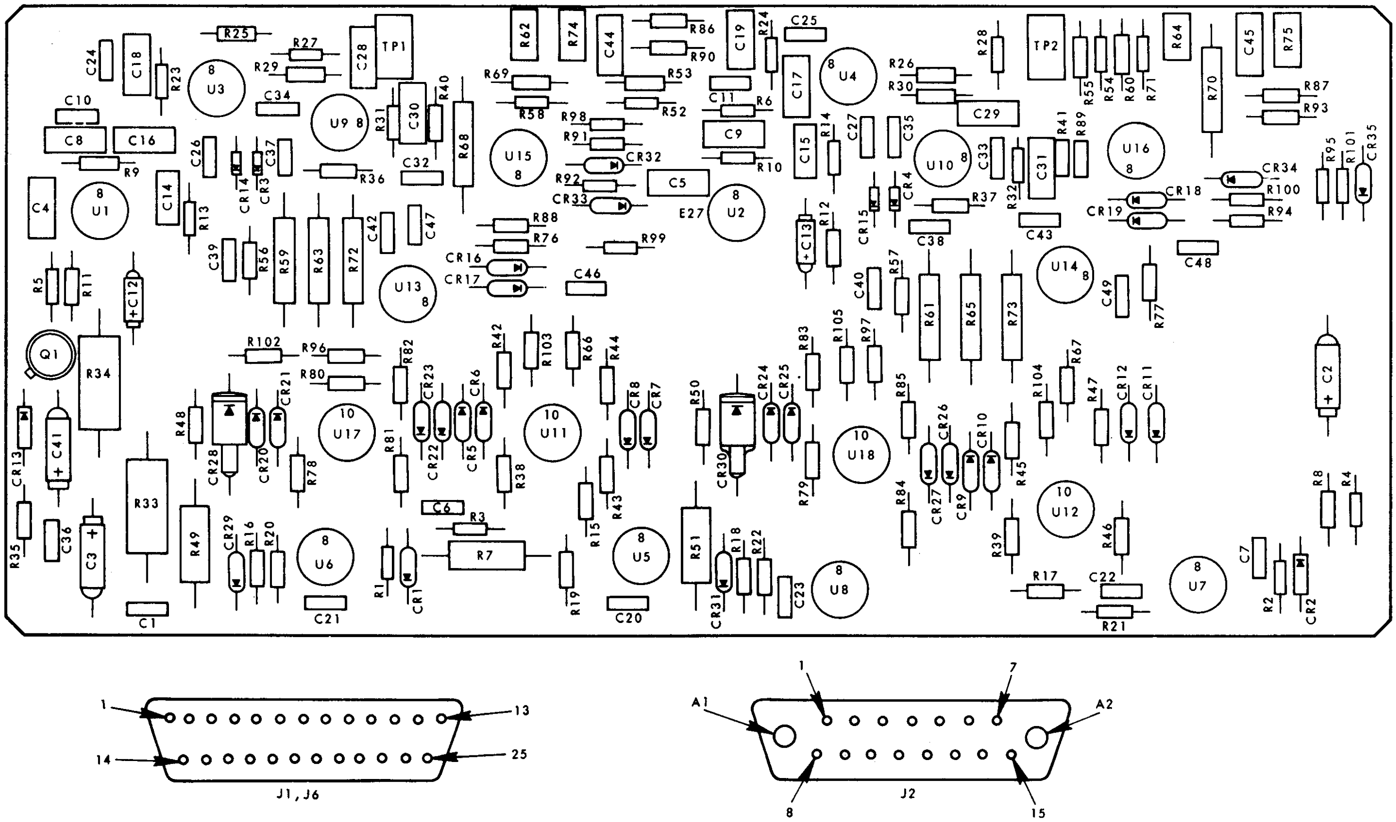
2. Tools and Equipment. Tools and equipment rquired for maintenance are found in the Repair Parts and Special Tools List (RPSTL), TM 11-5895-909-34P. Additional tools and test equipment required for maintenance are listed in table 4-2.

Table 4-2. Tool Test and Support Equipment Required for Maintenance

Common name	Official nomenclature	Part/model no.	Qty.	Manufacturer
Adapter, Banana Jack to Size 20 Female Connector		3560	27	Pomona
Meter, Multifunction		3450B OPT 001, 002	1	Hewlett-Packard
Milliammeter, Volt-Ohm-		260-6	2	Simpson
Oscillator, Test		651B	1	Hewlett-Packard
Oscilloscope, Dual-Trace		475	1	Tektronix
Potentiometer, 0 to 500 ohms		Jan200P501UA	2	Allen Bradley
Potentiometer, 0 to 1 kilohm		JAN200PP102UA	4	Allen Bradley
Power supply, 0-80/0-40 V		LPD-422A-FM	1	Lambda
Test Lead, Banana Plug to Banana Plug		B-12	3	Pomona
Test Lead, Banana Plug to Banana Plug		B-48-(B)	5	Pomona

Table 42. Tools, Test and Support Equipment Required for Maintenance -Continued

Common name	Official nomenclature	Part/model no.	Qty	Manufacturer
Test Lead, Banana Plug to Banana Plug		B-48-(R)	4	Pomona
Test Lead, Banana Plug to Mini Test Clip		3782-36-B	18	Pomona
Test Lead, BNC Male to Single Banana Plug		2241-C-36	1	Pomona
Test Lead, BNC Plug to Stackup Pin Tips		2882-C-36	1	Pomona



EL5895-909-34-TM-25

Figure 4-1. Linear detect and threshold circuit card assembly, HTA-3A6A1A1, A2A1 parts location.

SECTION II. MAINTENANCE OF LINEAR DETECT AND THRESHOLD CIRCUIT CARD ASSEMBLY HTA-3A6A1A1 and HTA-3A6A2A1

4-3. General. This section provides troubleshooting, replacement, adjustment, and testing procedures for general support maintenance of the linear detect and threshold circuit card assembly.

4-4. Troubleshooting. Troubleshooting of the linear detect and threshold circuit card assembly consists of accomplishing the performance test (para 4-7) until a malfunction is discovered. Use the linear detect and threshold circuit card voltage and resistance values listed in table 4-1, and general troubleshooting procedures as outlined in paragraph 3-3, to isolate the trouble to a faulty part. Figure 4-1 shows the location of individual components.

4-5. Removal and Replacement. Replace faulty part by using the general repair instructions (para 3-4). After replacement, test the circuit card for performance as outlined in paragraph 4-7. Return the circuit card to stock upon successful completion of the performance test.

4-6. Adjustment. The linear detect and threshold circuit card assembly is adjusted during the performance test, as outlined in paragraph 4-7.

4-7. Performance Test. This paragraph contains procedures for performance testing the linear detect and threshold circuit card assembly. All procedures must be performed in the sequence given. Set controls carefully to ensure accurate test conditions. If all performance standards are met, the circuit card can be returned to stock.

a. Test Equipment. Table 4-2 is a list of test equipment required for the performance test.

b. Test Connections and Conditions (fig. FO-14). Perform test procedure on the bench with the linear detect and threshold circuit card assembly removed from receiver gain monitor HTA-3A6. After making initial control settings (subparagraph c. below), connect test equipment to the circuit card as shown in figure FO-14. After all equipment is connected, set dual-output power supply ON/OFF switch to ON.

c. Initial Control Settings. Connect test equipment to the power source and apply power. Allow a 10 minute warmup before performing tests. Set test equipment controls as follows.

(1) ***Multifunction meter.***

Control	Position
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT

(2) ***Power supply.***

(a) Adjust both CURRENT LIMITER controls fully clockwise.

(b) Adjust OUTPUT VOLTAGE control of left-side power supply for +15 :0.1 V as measured on multifunction meter.

(c) Adjust OUTPUT VOLTAGE control of right-side power supply for -28 +0. 1 V as measured on multifunction meter.

(d) Set ON/OFF switch to OFF, then connect power supply to circuit card as shown in figure FO-14.

(3) ***Volt-ohm-milliammeters (2).***

Control	Position
FUNCTION switch	+DC
RANGE switch	500 mA.

(4) ***Oscilloscope***.

Control	Position
POWER	ON (pull out)
VOLTS/DIV (CH1)	2
VERT MODE	CH1
AC-GND-DC	AC
HORIZ DISPLAY	A LOCK KNOBS
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CHI
TIME/DIV and DELAY TIME	50 microseconds
TIME/DIV variable	Calibrated detent (full cw)

(5) ***Test oscillator.***

Control	Position
FREQUENCY	7.5
RANGE	X1K
OUTPUT ATTENUATOR	-60 dBm
AMPLITUDE +2±1 dBm on meter scale	

d. Performance Test Procedure. Perform test procedure sequentially as listed in table 4-3. Set test equipment controls exactly as directed in the table. Proceed to the next step only if test requirements are met. If requirements are not met, perform troubleshooting procedures as specified in paragraph 4-4. After fault correction, repeat the performance test.

Table 4-3. Linear Detector and Threshold Circuit Card Assembly HTA-3A6AIAI,A2AI Performance Test

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1			While observing oscilloscope, adjust test setup potentiometer R5 for 8 V pp signal.	8 ±I V pp
2	Test oscillator: Adjust		While observing oscilloscope, ad- for -46 dBm. for 8 V p-p signal.	8 ±I V p-p just test setup potentiometer R5
3	Test oscillator: Adjust		While observing oscilloscope, ad- for -52 dBm. for 8 V p-p signal.	8 ±1 V p-p just test setup potentiometer R5
4		a. Center potentiometers R62 and R74 (12 turns from stop).	a. Adjust test setup potentiometer R5 for 0 o100 mV on multifunction meter.	a. Multifunction meter indicates 0 100 mV.
	b. Test oscillator: Adjust for -46 dBm.		b. Adjust potentiometer R62 as close as possible to +5 V on multifunction meter. If stop is reached, back off one turn and adjust test setup potentiometer R5 for +4 V.	
	c. Test oscillator: Adjust for -52 dBm.		c. Adjust potentiometer R62 for 0 ±100 mV on multifunction meter.	
	d. Test oscillator: Adjust for -46 dBm.		d. Adjust test setup potentiometer RS for +4.9 :±100 mV.	
	e. Test oscillator: Adjust for -52 dBm.		e. Adjust potentiometer R74, then R62, then test setup potentiometer R5 if needed for 0 I100 mV.	
	f. Test oscillator Adjust for -46 dBm.		f. Adjust test setup potentiometer R5 for 5 O0.1 V.	
	g. Test oscillator: Adjust for -52 dBm.		g. Adjust potentiometer R74 for 0 ±100 mV.	
	h. Test oscillator: Adjust for -4 dBm.		h. Adjust potentiometer R62 for +5 ±0.1 V.	
	i. Test oscillator: Adjust for -58 dBm.			i. Multifunction meter indicates -2.5 ±1.0 V.
5	Test oscillator: Adjust for -52 dBm.		Observe multifunction meter. Adjust test setup potentiometer RS as required.	0.0 ±0.1 V
6	Voms: Set both range switches to 1 mA.		Observe both voms.	0.0 ±I mA.
7	Voms: Set both range switches to 500 mA.		While observing multifunction meter, adjust test oscillator OUTPUT ATTENUATOR and AMPLITUDE controls for +5 ±0-.1 V on multifunction meter.	None
8	Voms: Set both range		Observe both voms.	+1.0 ±.1 mA

Table 4-3. Linear Detector and Threshold Circuit Card Assembly HTA-3A6AIAI,A2AI Performance Test - Continued

Step no.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
	switchs to 1mA			
9	Vom: Set both range switches to 500 mA and function switches to -D.C.		While observing multifunction meter, adjust test oscillator OUTPUT ATTENUATOR and AMPLITUDE controls for -2.5 1I.0 V on multifunction meter.	None
10	On both voms, set range switch 1 mA.		Observe both voms. Adjust AMPLITUDE FINE control as required for -1.0 ±0.1 mA on both vons.	-1.0 4 ±0 1 mA
11	On both vom set range switch to 500 mA.		Using test lead 2241-C-36 and adapter 3560, connect oscldloscope to connector J2-4. While observing oscilloscope, adjust test setup potentiometer R3 for logic 0 and no oscillation.	0 ±0. 5 V
12			While observing mltifunction me-None ter, adjust oscillator AMPLITUDE controls for 5.0 0O.1 V on multifunction meter.	
13			While observing oscilloscope, adjet test setup potentiometer R4 for logic 0 and no scillation.	
14			While observing multifunction meter adjust test oscillator AMPLITUDE controls for -1.3 tO.1 V on multifunction meter.	None
15			Connects oscilloscope to connector pin J2-6. While observing oscil-oscope, adjust test setup poten-tiomer R1 for logic 0 and no oscillation.	O +0.5 V
16			While observing multifunction meter, adjust teat oe'iltor AMPLITUDE controls for +1.0 V on multifunction meter.	None
17			While observing oscilloscope, adjust test setup potentiometer R2 for logic 0 and no oscillation	0 ±0.5 V
18			Connect test oscillator to J2 pin A2 and adjust for -58 dBm. Connect oscilloscope to TP2	None
19			While observing oscilloscope, ad--just test setup potentiometer R6 for an 8 V p-p s	8 ± 1 V p-p
20	Test oscillator: Adjust for -46 dB		While observing oscilloscope, adjust test setup potentiometer R6 for an 8 V p-p signal.	8 ±1 V p-p

Table 4-3. Linear Detector and Threshold Circuit Card Assembly HTA-3A6A1A1,A2A1 Performance Test -Continued

Step no.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
21	Test oscillator: Adjust for -52 dBm.		While observing oscilloscope, adjust test setup potentiometer R6 for an 8 V p-p signal.	8 41 V p-p
22			Move multifunction meter to pin J6-23.	
23		a. Center potentiometer R64 and R75 (12 turns from stop).	a. Adjust test setup potentiometer R6 for 0 ±100 mV on multifunction meter.	a. Multifunction meter indicates 0 ±100 mV.
	b. Test oscillator: Adjust for -46 dBm.		b. Adjust potentiometer R64 as close as possible to +5 V on multifunction meter. If stop is reached, back off one turn and adjust test setup potentiometer R6 for +4 V.	
	c. Test oscillator: Adjust for -52 dBm.		c. Adjust potentiometer R64 for 0 ±100 mV on multifunction meter.	
	d. Test oscillator: Adjust for -46 dBm.		d. Adjust test setup potentiometer R6 for +4.9 i100 mV.	
	e. Test oscillator: Adjust for -52 dBm.		e. Adjust potentiometer R75, then R64, then test setup R6, if needed for 0 1l00 mV.	
	f. Test oscillator: Adjust for -46 dBm.		f. Adjust test setup potentiometer R6 for +5 i0.1 V.	
	g. Test oscillator: Adjust for -52 dBm.		S. Adjust potentiometer R75 for 0 ±100 mV.	
	h. Test oscillator: Adjust for -46 dBm.		h. Adjust potentiometer R64 for +5 ±100.1 V.	
	i. Test oscillator: Adjust for -58 dBm.			i. Multifunction meter indicates -2.5 ±1.0 V.
24	Test oscillator: Adjust for -52 dBm.		Observe multifunction meter. Adjust test setup potentiometer R6 as required.	0.0 0.1 V
25	Voms: On both volt-ohm-milliammeter, set function switches to +D.C	None	Connect vom No. I red lead to connector pin J6-22 and black lead to pin J6-21 (return). Connect vom No. 2 red lead to connetor pin J1-10 and black lead to pin J1-9 (return).	
26	Voms: On both vomnn, set range switch to 1 mA.		Observe both voms.	0 ±0.1 mA
27	Voms: Set both range switches to 500 ma.	None	While observing multifunction meter, adjust test oscillator OUTPUT ATTENUATOR and AMPLITUDE controls for +5 *0.1 V on multifunction meter.	
28	Vom: Set both range switches to 1mA.		Observe vom.	+ 1.0 ±0.1 mA
29	Voms: Set both range switches to 500 mA and function switches to DC.	None	While observing multifunction meter adjust test oscillator OUTPUT ATTENUATOR and AMPLITUDE controls for -2.5 i1.0	

Table 4-3. Linear Detector and Threshold Circuit Card Assembly HTA-3A6A1A1,A2A1 Performance Test-Continued

Step no.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
				V on multifunction meter.
30		-1.0 ±0.1 mA	On both voms, set range witch to 1 mA.	Observe both voms: Adjust AMPLITUDE FINE control as required for -1 ±0.1 mA on both
31		0 ±0. 5 V	On both voms, ad range switch to 500 mA. While observing oscilloscope, adjust test setup potentiometer R3 for logic 0 and no oscillation.	Using test lead 2241C-V 36 and adapter 3560, connect oscilloscope to connector pin J2-2.
32		None	ter, adjust test isolator AMPLITUDE controls for +5 i0.1 V on multifunction meter.	While observing multifunction me-
33		0 ±0. 5 V	j- for logic 0 and no oscillation.	While observing eoilloscope, ad- tat setup potentiometer R4
34		None	ter, adjust tea oscillator AMPLITUDE controls for -1.3 V ±0.1 V on multifunction meter.	While observing multifunction me-
35		0±0.5 V	pin J2-J. While observing oscilloscope , adjust tat setup potentiometer R1 for logic O and no	Connect oscilloscope to connector
36		None	ter, adjust test oscillator AMPLITUDE controls for +1.0 V on multifunction meter	While observing multifunction me-
37		0 ±0. 5 V	just test setup potentionmeter R2 for logic 0 and no oscillation.	While observing oscilloscope, ad-

APPENDIX

REFERENCES

The following is a list of applicable references that are available to the repairman of Receiver Gain Monitor (RGMU) Equipment.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders
DA Pam 310-7	US Army Index of Modification Work Orders
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies, and Equipment Used by the Army
SC 5180-91-CL-RO7	Tool Kit Electronics Equipment TK-105/G
SM I 1-4-5180-SO5	Tool Equipment TE-SOB
TB SIG 291	Safety Measures to be Observed When Installing and Using Whip Antennas, Field Type Masts, Towers, Antennas, and Metal Poles That are Used with Communication, Radar, and Direction Finder Equipment (TO 31P5-I-1)
TB 43-0118	Field Instructions for: Painting and Preserving Electronics Command Equipment
TB 43-0139	Painting Instructions for Field Use
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 740-90-1	Administrative Storage of Equipment
TM 750-244-2	Procedures for Destruction of Electronics Material to Prevent Enemy Use (Electronics Command)
TM 5-4120-343-14	MOAC 336 Air Conditioner, Operation and Service Manual
TM 5-4120-343-24P	MOAC 336 Air Conditioner, Repair Parts Manual
TM 11-5895-898-12 NAVELEX 0967-LP-546-6010 TO 31 R5-2FSC78-1	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN/FSC-78(V)
TM I -5895-898-20P NAVELEX 0967-LP-546-6020 TO 31R5-2FSC78-4	Organizational Maintenance Repair Parts, and Special Tools List for Satellite Communication Terminal AN/FSC-78(V)
TM I 1-5895-899-12 NAVELEX 0%7-LP-546-5010 TO 31 R5-2 FSC79- 1	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN/FSC-79
TM I 1-5895-899-20P NAVELEX 0%7-LP-546-5020 TO 31 R5-2FSC79-4	Organizational Maintenance Repair Parts, and Special Tools List for Satellite Communication Terminal AN/FSC-79
TM 11-5895-900-34 NAVELEX 0967-LP-546-6030 TO 31R5-2-102	Direct and General Support Maintenance Manual for Antenna and Microwave Equipment including: Feed Assembly AS-2941/FSC; Feed Assembly AS-2941A/FSC; Dehumidifier, Desiccant, Electric HD-988/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79

TM 11-5895-900-34P .... NAVELEX 0967-LP-546-6040 TO 31 R5-2- 104	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Antenna and Microwave Equipment including: Feed Assembly AS-2941/FSC; Dehumidifier, Desiccant, Electric HD-988/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-901-34.................... NAVELEX 0967-LP-546-6060 TO 3 1 R5-2G- 112	Direct and General Support Maintenance Manual for Up and DownConverter Racks including: Rack Electrical Equipment MT-4773/G; Rack, Electrical Equipment MT-4774/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM I 1-5895-901-34P .... NAVELEX 0967-LP-546-6070 TO 31R5-2G-1 14	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Up and Down-Converter Racks including: Rack, Electrical Equipment MT-4773/G; Rack, Electrical Equipment MT-4774/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-902-34.................... NAVELEX 0967-LP-546-6090 TO 31R5-2G-122	Direct and General Support Maintenance Manual for Tracking Receiver Equipment including: Scanner, Signal TD-l 104/GSC; Power Supply PP-6976/G; Converter, Frequency Electronic CV-3131/G; Demodulator MD-922/G; Control-Indicator ID-191 1/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM I 1-5895-902-34P .... NAVELEX 0967-LP-546-6100 TO 31R5-2G-124	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Tracking Receiver Equipment including: Scanner, Signal TD-l104/GSC; Power Supply PP-6976/G; Converter, Frequency, Electronic CV-3131/G; Demodulator MD-922/G; Control-Indicator ID-1911/G for Satellite Communication Terminals AN/FSC-78(V) and A N/FSC-79
TM 11-5895-903-34.................... NAVELEX 0967-LP-546-6120 TO 31 R5-2G-132	Direct and General Support Maintenance Manual for Parametric Amplifier Group OG-133/G for Satellite Communication Terminal AN/ FSC-78(V)
TM 11 -5895-903-34P .... NAVELEX 0967-LP-546-6130 TO 31R5-2G-134	Direct Support, General Support Maintenance Repair Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Parametric Amplifier Group OG-133/G for Satellite Communication Terminal AN/FSC-78(V)
TM 11-5895-904-34.................... NAVELEX 0967-LP-546-6150 TO 31R5-2G-142	Direct and General Support Maintenance Manual for Interfacility Link Amplifier Equipment including: Amplifier, Radio Frequency AM-6628/ G; Amplifier, Radio Frequency AM-6629/G; Amplifier, Radio Frequency AM-6644/G; Amplifier, Radio Frequency AM-6788/FSC-79; Control-Monitor C-9400/G; Amplifier-Monitor OG150/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM I -5895-904-34P .... NAVELEX 0967-LP-546-6160 TO 3 IR5-2G- 144	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Interfacility Link Amplifier including: Amplifier, Radio Frequency AM-6628/G; Amplifier, Radio Frequency AM-6629/G; Amplifier, Radio Frequency AM-6644/G; Amplifier, Radio Frequency AM6788/FSC-79; Control-Monitor C-9400/G; Amplifier, Monitor Group OG-150/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79

TM 11-5895-905-34.................... NAVELEX 0967-LP-546-6180 TO 31R5-2G-152	Direct and General Support Maintenance Manual for Frequency Generation Equipment including: Generator Group, Signal OV-64/G; Amplifier Group OG-151/G for Satellite Communication Terminals AN/ FSC-78(V) and AN/FSC-79
TM I 1-5895-905-34P .... NAVELEX 0967-LP-546-6190 TO 31R5-2G-154	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Frequency Generation Equipment including: Generator Group, Signal OV-64/G; Amplifier Group OG-151/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-906-34.................... NAVELEX 0967-LP-546-6210 TO 31R5-2-112	Direct and General Support Maintenance Manual for Radio Frequency Amplifier Equipment including: Amplifier, Radio Frequency OG131A/MSC; Amplifier, Radio Frequency OG-132A/MSC; Cooler, Liquid, Electron Tube HD-955A/GR for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-906-34P .... NAVELEX 0967-LP-546-6220 TO 31R5-2-114	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Radio Frequency Amplifier Equipment including: Amplifier, Radio Frequency OG-131A/MSC: Amplifier, Radio Frequency OG132A/MSC; Cooler, Liquid, Electron Tube HD-955A/GR for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-907-34.................... NAVELEX 0967-LP-546-6240 TO 31R5-2G-162	Direct and General Support Maintenance Manual for Status and Alarm Equipment including: Power Supply Assembly PP-6958/G; ControlMonitor C-9861/G; Control-Monitor C-9854/G; Indicator, Channel Frequency ID-2030/G; Control-Indicator ID-2028/G; Control-Indicator ID-2033/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-907-34P .... NAVELEX 0967-LP-546-6250 TO 31R5-2G-164	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Status and Alarm Equipment including: Power Supply Assembly PP-6958/G; Control-Monitor C-9861/G; Control-Monitor C9854/G; Indicator, Channel Frequency ID-2030/G; Control-Indicator ID-2028/G; Control-Indicator ID-2033/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM I 1-5895-908-34.................... NAVELEX 0967-LP-546-6270 TO 31R5-2G-172	Direct and General Support Maintenance Manual for Radio Frequency Monitor and Test Group including: Interconnecting Group ON-148/G; Interconnecting Group ON-149/G; Amplifier Assembly AM-6625/G; Monitor Test Group OA-8836/G; Control-Indicator C-9404/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM I 1-5895-908-34P .... NAVELEX 0967-LP-546-6280 TO 31R5-2G-174	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Radio Frequency Monitor and Test Group including: Interconnecting Group ON-148/G; Interconnecting Group ON-149/G; Amplifier Assembly AM-6625/G; Monitor Test Group OA-8836/G; Control Indicator C-9404/G for Satellite Communication Terminals AN/FSC78(V) and AN/FSC-79

TM I 1-5895-99-34P .... NAVELEX 0967-LP-546-6310 TO 3 1 R5-2G- 184	Direct Support General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Receiver Gain Monitor Equipment including: Monitor, Radio Frequency ID-1935/G; Monitor, Pilot Carriers ID-1916/G for Satellite Communication Terminal AN/FSC-78(V)
TM 11-5895-910-34.................... NAVELEX 0967-LP-546-6330 TO 31R5-2G-192	Direct and General Support Maintenance Manual for Receiver Radio Frequency Noise Measurement Equipment including: Test Set, Radio Frequency Noise TS-3376/G; Monitor, Noise Temperature ID-1915/G for Satellite Communication Terminal AN/FSC-78(V)
TM 11-5895-910-34P .... NAVELEX 0967-LP-546-6340 TO 31R5-2G-194	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Receiver Radio Frequency Noise Measurement Equipment including: Test Set, Radio Frequency Noise 1 S-3376/G; Monitor, Noise Temperature ID-1915/G for Satellite Communication Terminal AN/FSC-78(V)
TM 11-5895-911-34.................... NAVELEX 0967-LP-546-6360 TO 31R5-2G-202	Direct and General Support Maintenance Manual for Carrier Level Control and Monitor Equipment including: Control-Monitor Group OK-299/G; Control-Monitor C-9851/G; Power Supply Assembly PP6960/G; Detector, Radio Frequency CV-3288/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-911-34P .... NAVELEX 0%7-LP-546-6370 TO 31R5-2G-204	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Carrier Level Control and Monitor Equipment including: Control-Monitor Group OK-299/G; Control-Monitor C-9851/G; Power Supply Assembly PP-6960/G; Detector, Radio Frequency CV-3288/G for Satellite Communication Terminals AN/FSC-78(V) and AN/ FSC-79
TM 11-5895-912-34.................... NAVELEX 0967-LP-546-6390 TO 31R5-2G-212	Direct and General Support Maintenance Manual for Transmitter Power Monitor Equipment including: Monitor, Radio Frequency MX9472/G; Control-Indicator C-9841/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79
TM 11-5895-912-34P .... NAVELEX 0967-LP-546-6400 TO 31R5-2G-214	Direct Support, General Support Maintenance Repair Parts and Special Tools Listing (Including Depot Maintenance Repair Parts and Special Tools) for Transmitter Power Monitor Equipment including: Monitor, Radio Frequency MX-9472/G; Control-Indicator C-9841/G for Satellite Communication Terminals AN/FSC-78(V) and AN/ FSC-79
TM 11-5895-913-34.................... NAVELEX 0967-LP-546-6420 TO 31 IR5-2G-222	Direct and General Support Maintenance Manual for Translator, Signal Data CV-3098/G for Satellite Communication Terminal AN/FSC-78(V)
TM 11-5895-913-34P .... NAVELEX 0967-LP-546-6430 TO 31 R5-2G-224	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Translator, Signal Data CV-3098/G for Satellite Communication Terminal AN/FSC-78(V)

APPENDIX A - Continued

TM 11-5895-914-34 NAVEI-EX 0967-l1P-546-6450 TO 31RS-2G-232	Direct and General Support Maintenance Manual for Ancillary Equipment Including: Control-Monitor ID-1914 G (NSN 5895-00-279-8483) for Satellite Communication Terminals AN FSC-78(V) and AN FSC-79
TM 11-5895-914-34P NAN LlE0967-11P'-546-6460 T0 31 R5-2G-234	Direct Support and General Support Maintenance Repair Parts and Special Tolls List (Including Depot Maintenance Repair Parts and Special Tools) for Ancillary Equipment Including: Control-Monitor 11)-1914 i for Satellite Communication Terminals AN FSC-78(V) and AN FSC-79
TM 11-5895-915-34	Direct Support and General Support Maintenance Manual: Servo and Control Equipment Including: Control, Antenna, C-9402 G (NSN 5895-00-257-8168); Indicator, Antenna, Position-Status, 11)1912 G (5895-00-251-8071); Power Supply Assembly PP-6959 G (5895-00-251-8106); Control Direct Current C-9849 FSC (58954)1-020-2825): Drive Assembly, Electromechanical, Antenna, TG232 FSC (5895-01-007-9402): Synchro Antenna, SN498 FSC (5990-01-0079483) and SN-482 FSC (5895-00-237-2453) and Control-Indicator, ID-1936 G (5895-00-241-9369) for Satellite Communication Terminals, AN FSC-78(V) and AN FSC-79
TM11-5895-915-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Servo and Control Equipment including: Control, Antenna C-9402 G (5895-00257-6168); Indicator, Antenna, Position-Status ID-1912 G (5895-00-251-8071); Power Supply Assembly PP-6959 G (5895-00-251-8106): Control, Direct Current C-9849 GSC (5895-014-20-2825); Drive Assembly Electromechanical, Antenna TG-232 FSC (5895-01-007-9402): Synchro Antenna SN498 FSC (5990-01-007-9483) and SN482 FSC (5895-00-237-2453); Control-Indicator ID-1936 G (5895-00-241-9369) for Satellite Communication Terminals AN FSC-78X(V) and AN FSC-79 (NAVEL EX 0967-L-P-546-6490; TO 31R5-2124)
TM 11 -5895-1043-12	Operator', and Organizational Maintenance Manual for Satellite Communication Terminal AN GSC-39(V)2 (NSN 5895-01-077-6249)(NAVEI EX 0967-LP-6253010: TO 31R5-2GSC39-11)
TM 11-5895-1043-20P	Organizational Maintenance Repair Parts and Special Tool List for Satellite Communication Terminal AN GSC-39(V)2 (NSN 5895-01-077-6249) (NAVELEX 0967-LP-625-3020: TO 31 R5-2GSC39-14)
TM 11-5895-1050-12	Operator's and Organizational Maintenance Manual: Satellite Communication Terminal A N GSC-39(V)I (NSN 5895-01 -70-5685) (NAV E LEX 0967-LP-643-A-5 9010: TO 31R5-2GSC39-1)
TM 11-5895-1050-20P	Organizational Maintenance Repair Parts and Special Tools List for Satellite Communications Terminal, AN GSC-39(V)I (NSN 5895-01-070-5685) NAVELEX 0967-LP-643-9020: TO 31 R5-2GSC394)
TM 11-5985-358-14	Operator's, Organizational Direct Support and General Support Maintenance Manual for Antenna Group OE-222 G (NSN 5985-01-076-9947)
TM 1 1-59X5-358-24P	Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for TM 11-5895-909-34/NAVELEX 0967-LP-546-6300/TO 31R5-2G-182 Antenna Group OE-222 G (NSN 5985-01-076-9947)

GLOSSARY

A

ACQ .... Acquisition The condition in which tracking equipment is locked to the satellite beacon and the antenna is following satellite movement

AFSCF .... Air Force Satellite Control Facility The DOD element satellite programs that include tracking monitoring and commanding satellites

ALC .... Automatic Level Control

ANGLE MODULATION .... The modulation process in which the angle of a sine wave carrier is varied from the normal value

B

BASEBAND .... The composite information signal modulated on a chosen carrier Built In Test

BITE .... Equipment The test equipment in the operating equipment rack for ongoing monitoring and test use

C

CHANNEL .... In electronic communication, a channel is:

- a A path for transmitting electric signals, usually in distinction from other parallel paths, not necessarily a pair of metallic conductors
- b The number of independent channels on a system (or trunk) is measured by the number of separate communications facilities that it can provide
- c. The smallest subdivision of a trunk by which a single type of communications service is provided, i.e, voice channel, teletypewriter channel, or data channel

CIRCUIT .... The complete electrical path over which telecommunications are provided between end terminal instruments comprising send and receive channels

CMA .... Control Monitor and Alarm The equipment that provides alarm circuits and controls signal paths throughout the AN/FSC-78(V) and AN/FSC-79

D

DCA .... Defense Communications Agency The cognizant DOD agency responsible for exercising operational control over DOD communication service.

DOD .... Department of Defense

DSCS .... Defense Satellite Communications System The elements of the defense communications system which support:

- a Requirements of the worldwide military command and control system
- b Establishing, extending, and upgrading communications in direct support of combat forces
- c Communications requirements resulting from changes in deployment and mission of forces
- d Long-distance trunking networks

E

EER .... Elevated Equipment Room The enclosure located at the elevation yoke that houses the rf plate and associated equipment

ERP .... Effective Radiated Power. The power radiated from the antenna, that is, the antenna power input multiplied by the gain of the antenna

F

FB .... Fleet Broadcast. The operating portion of the Navy fleet satellite program that provides simplex transmit functions to selected naval sea and air forces

FET .... Field Effect Transistor. A semiconductor in which the resistance between two terminals, the source and the drain, depend upon a field produced by a voltage applied to the third terminal, the gate

FPA... Final Power Amplifier. The final stage of amplification in the uplink-a traveling wave tube (TWT) for the AN/FSC-78(V) and a klystron tube for the AN/FSC-79

FULL-DUPLEX OPERATION..... A type of operation in which simultaneous two-way conversations, messages, or information may be passed between two or more points

H

HALF-DUPLEX OPERATION .... A circuit in which signals are transmitted alternately in either direction, usually because of limitations of the terminal equipment

I

IC .... Integrated Circuit. A combination of interconnected circuit elements within a continuous substrate

IF .... Intermediate Frequency. The 70 or 700 MHz baseband signal utilized in satellite communications systems

IFLA... Interfacility Link Amplifier. A solid state amplifier which provides power gain to overcome cable and interconnect losses between major equipment elements within the AN/FSC-78(V) terminal

ISOTROPIC RADIATOR .... A hypothetical antenna radiating or receiving equally in all directions

IPA... Intermediate Power Amplifier. The equipment that provides required power gain to the uplink signal for application to the final power amplifier (FPA)

L

LINK... A link is:

- a A portion of a communication circuit
- b A channel or circuit designed to be connected in tandem with other channels or circuits
- c A radio path between two points, called a radio link; the resultant circuit may be unidirectional, half duplex, or duplex.

LNA... Low Noise Amplifier. An amplifier that operates with an inherently higher signal-to-noise ratio than is usually available from a standard amplifier

M

MONOSCAN .... A tracking antenna feed containing five-horns; all tracking functions are handled by the four outer horns and communications is handled by the center horn

N

Any 40 MHz rf segment of the military satellite communication frequency band

NARROWBAND

P

PA .... Power Amplifier. The equipment within the AN/FSC-78(V) and AN/FSC-79 that provides high power amplification to the uplink carrier

PBI .... Push Button Indicator. An indicator switch; i. e, a switch that contains an indicator that displays the position in which the switch is placed

PCB .... Printed Circuit Board. An insulated board that contains a circuit in which wires connecting discrete components have been replaced by conductive printed, painted, or etched strips

PIN .... P (positive donor) I (intrinsic) N (negative donor) A diode made by diffusing the semiconductor with P material from one side and N material from the other side, so controlled that this region separates the P and N region. The storage time of the diode is too long to rectify at microwave frequencies, consequently it acts as an attenuator at these frequencies

PS .... Power Supply. A unit that changes ac to dc and maintains a constant preset voltage or current output

R

RCVR .... Receiver. The portion of a communication system that converts a high frequency into a lower frequency

RGMU .... Receiver Gain Monitor Unit. A unit unique to the AN/FSC-78(V) that automatically switches the standby receiver into operation when a receiver gain fault occurs

S

SCR .... Silicon Controlled Rectifier

SONALERT .... A device that emits an audible alarm in response to a system fault condition

SSLU .... System Status Logic Unit. Equipment located in unit 15 which performs system logic processing and provides command interface between the FSSP and the various terminal equipment

T

TWT .... Traveling Wave Tube. An electron tube in which a beam of electrons interact repeatedly with a guided E-H wave moving in sync with it and in such a way that a net transfer of energy occurs between the beam and the traveling wave

U

UJT .... Unijunction Transistor

V

VCO .... Voltage Controlled Oscillator

W

W/G .... Waveguide. A transmission line comprising a hollow conducting tube within which electromagnetic waves are propagated

WIDEBAND .... The full 500 MHz rf bandwidth of the DSCS system between the frequencies of 79 to 84 GHz

X

X-BAND .... The military SATCOM band of radio frequencies, from 7.25 to 8.4 GHz.

XMTR .... Transmitter. Equipment used to generate and amplify an rf carrier, modulate the carrier, and radiate the modulated rf carrier from an antenna.

INDEX

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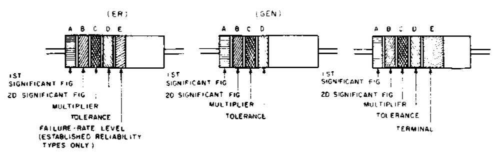
Units org under fo1 TOE: (2)
29-207
29-610

NG: None

USAR’ None

For explanation of abbreviations used see AR 310-50.

*U.S. GOVERNMENT PRINTING OFFICE : 1991 - 281-486 (42572)



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

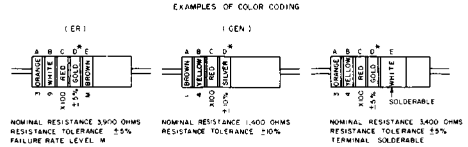
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS
(THESE ARE NOT COLOR CODED)

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

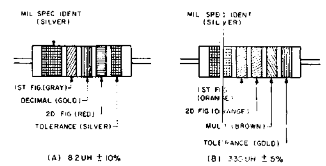
EXAMPLES OF COLOR CODING



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



(A) 8.2UH ± 10%   (B) 330UH ± 5%

COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CH[illegible] AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN [illegible] THE COLOR BANDS FOR A 330UH INDUCTOR ARE ILLUSTRATED

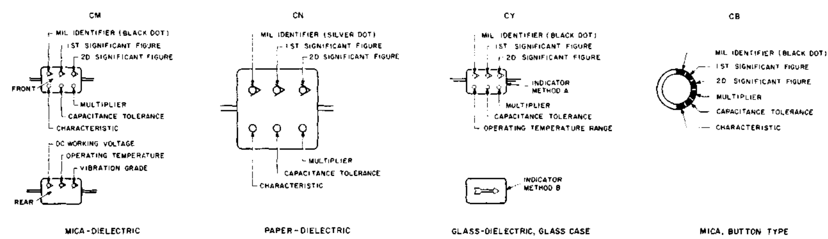
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES

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



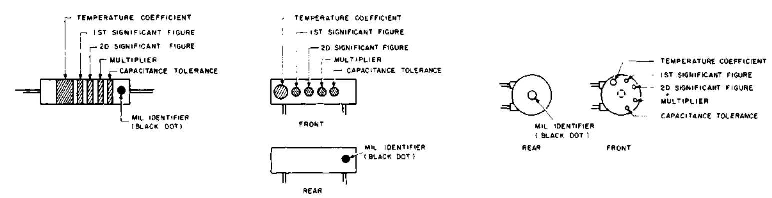


TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

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	10-55 HZ
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											
GRAY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN			0.01	±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				
GRAY		8	8	0.01*			
WHITE		9	9	0.1*	±10%		
GOLD	+100			0.1		±1.0 UUF	
SILVER				0.01			

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

* OPTIONAL CODING WHERE METALLIC PIGMENTS ARE UNDESIRABLE.

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

ESC-FM 913-73

Figure FO-1. Color code marking for MIL-STD resistors, inductors, and capacitors.

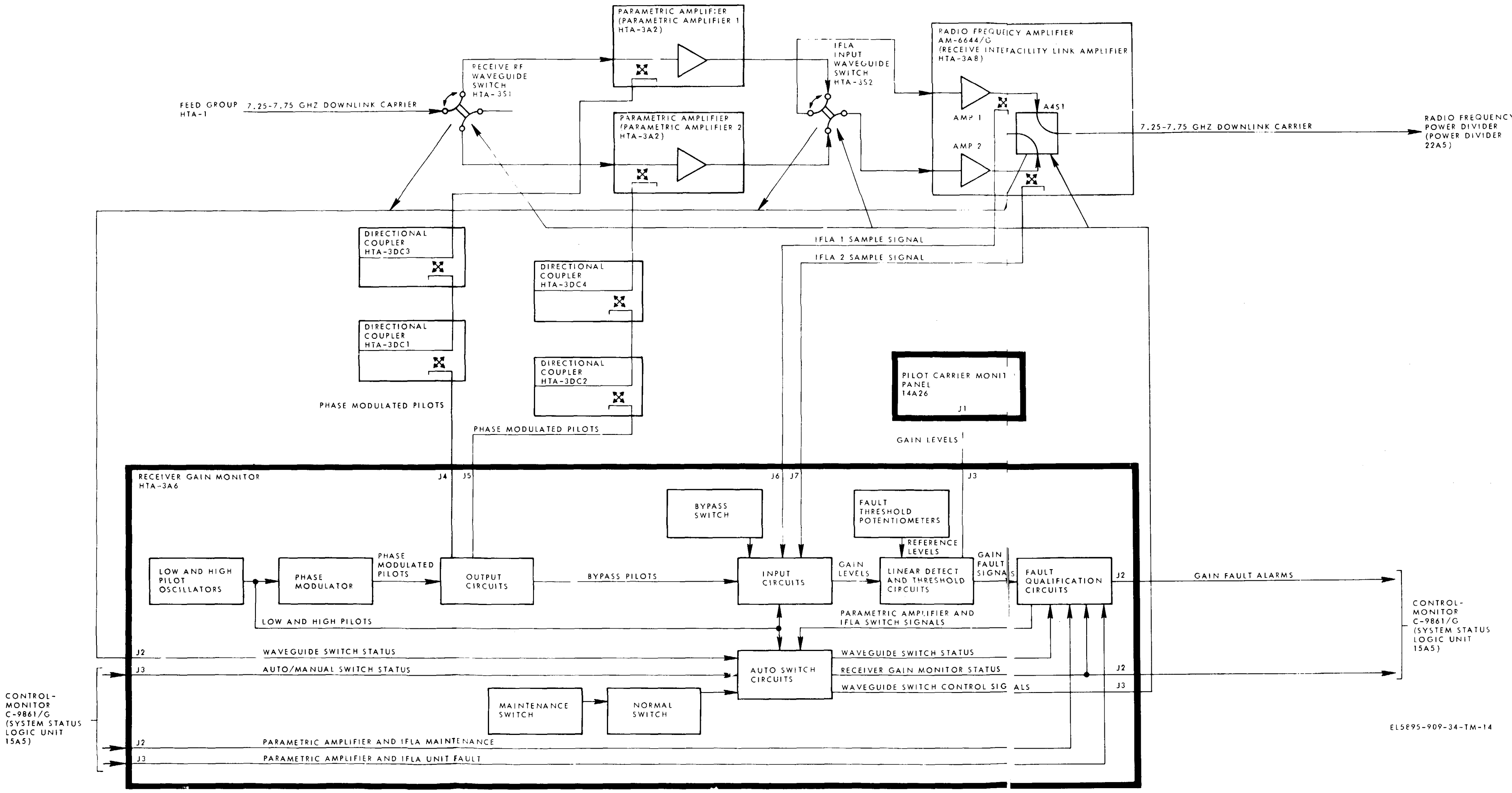


Figure FO-2. Receiver gain monitor equipment, HTA-3A6 functional block diagram.

s

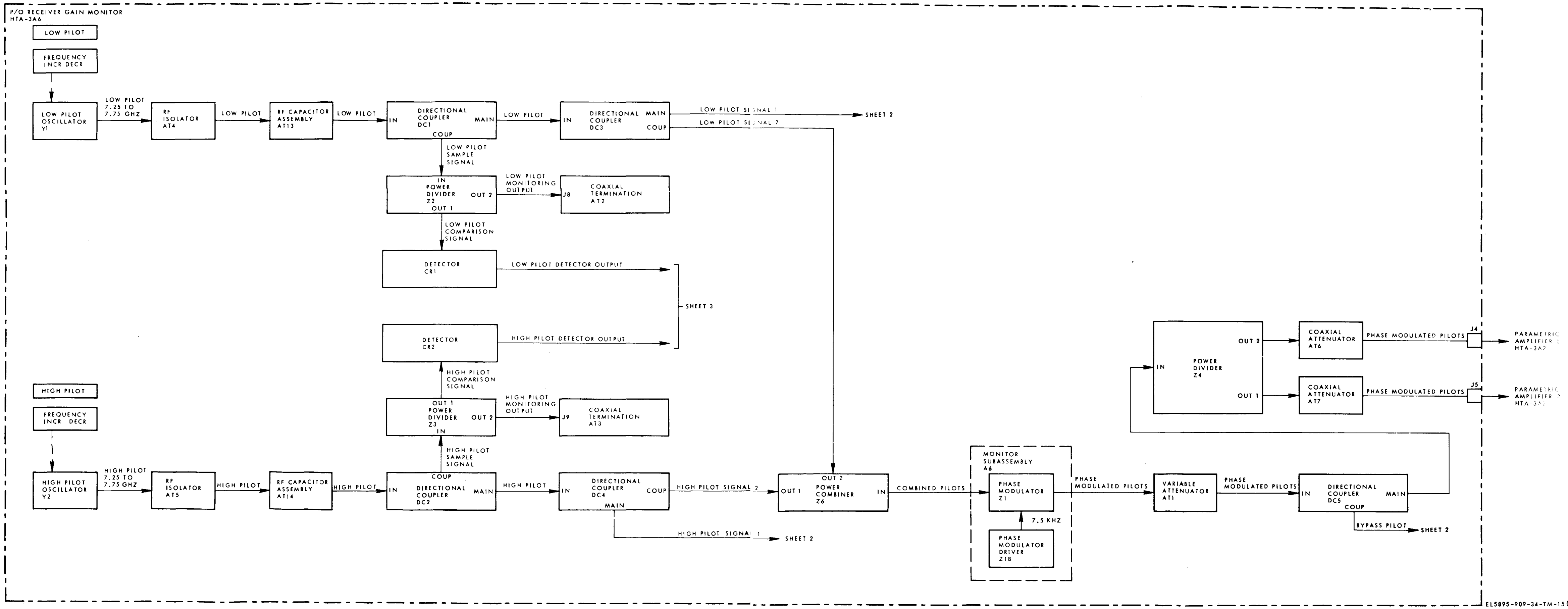


Figure FO-3. Receiver gain monitor equipment, HTA-3A6 functional block diagram (sheet 1 of 3)

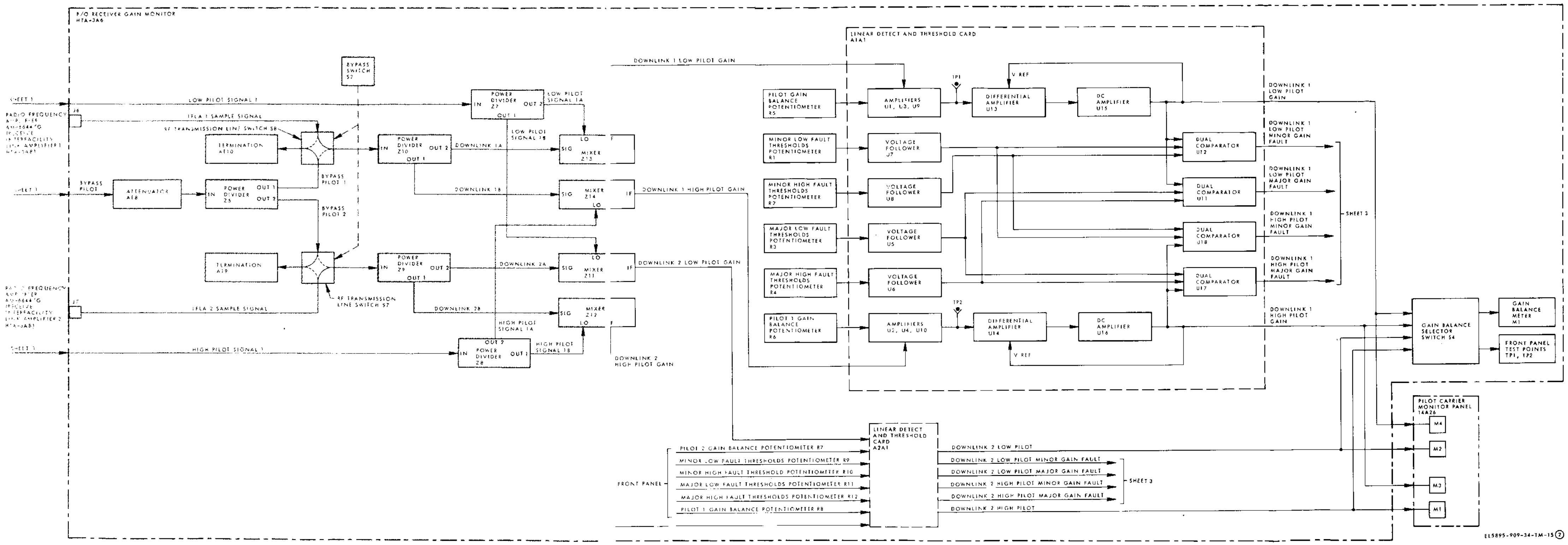


Figure FO-3. Receiver gain monitor equipment, HTA-3A6 functional block diagram (sheet 2 of 3).

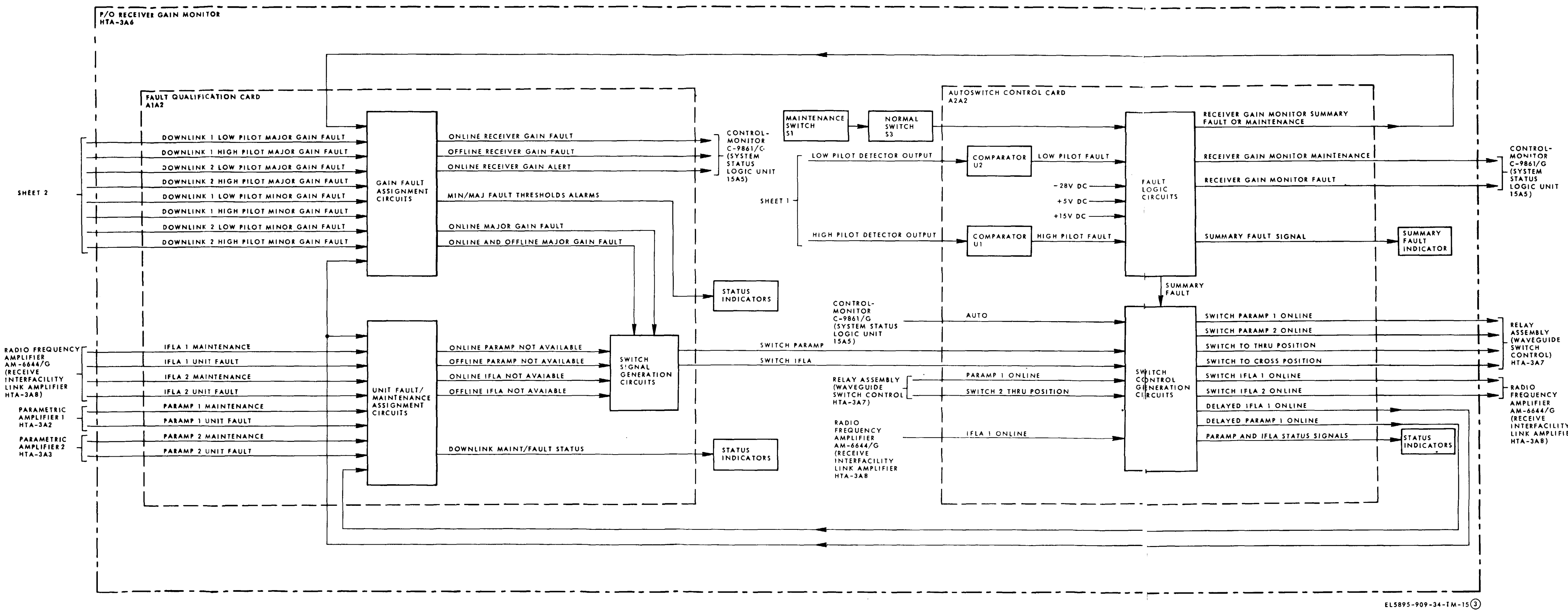


Figure FO-3. Receiver gain monitor equipment, HTA-3A6 functional block diagram (sheet 3 of 3).

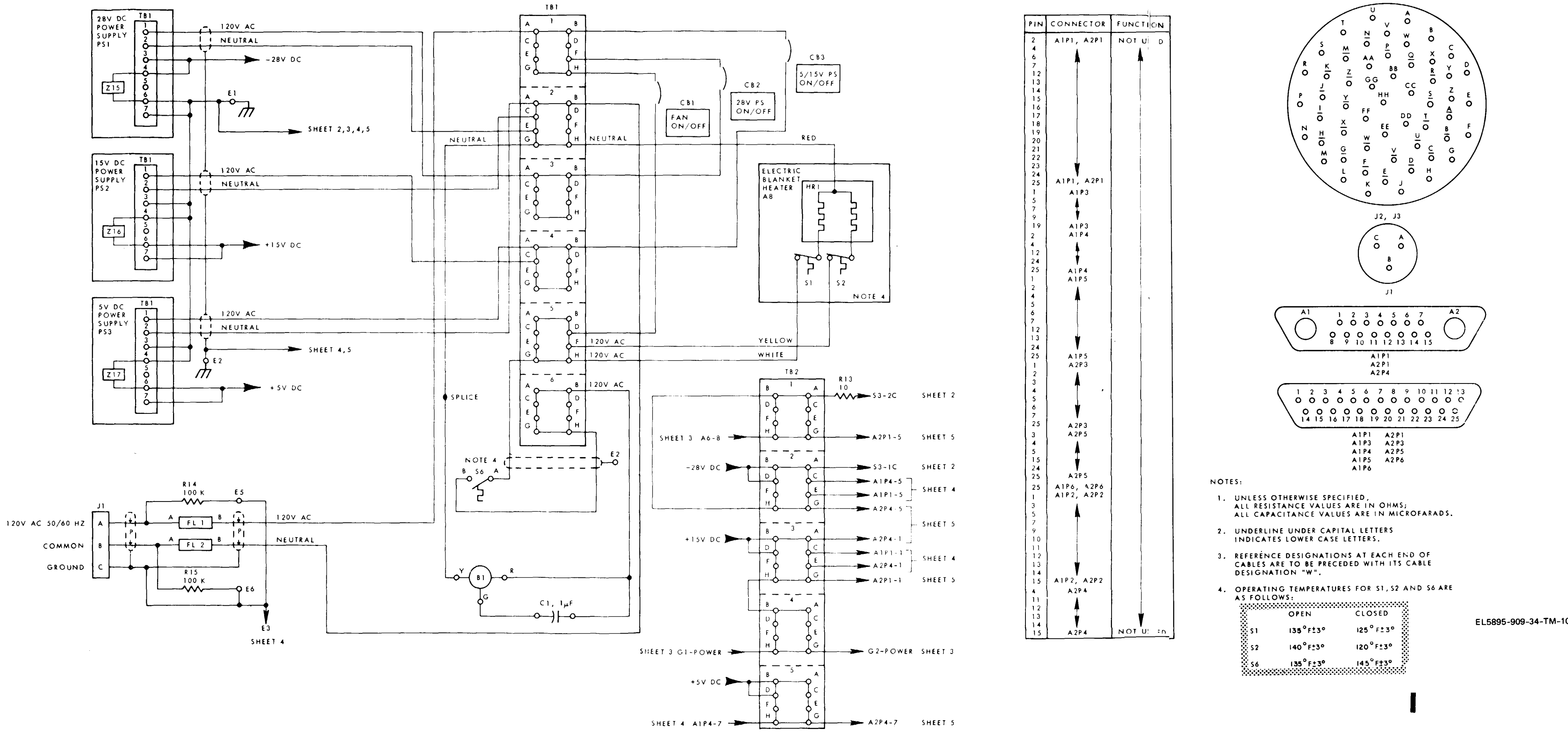


Figure FO-4. Receiver gain monitor HTA-3A6 schematic diagram (sheet 1 of 5).

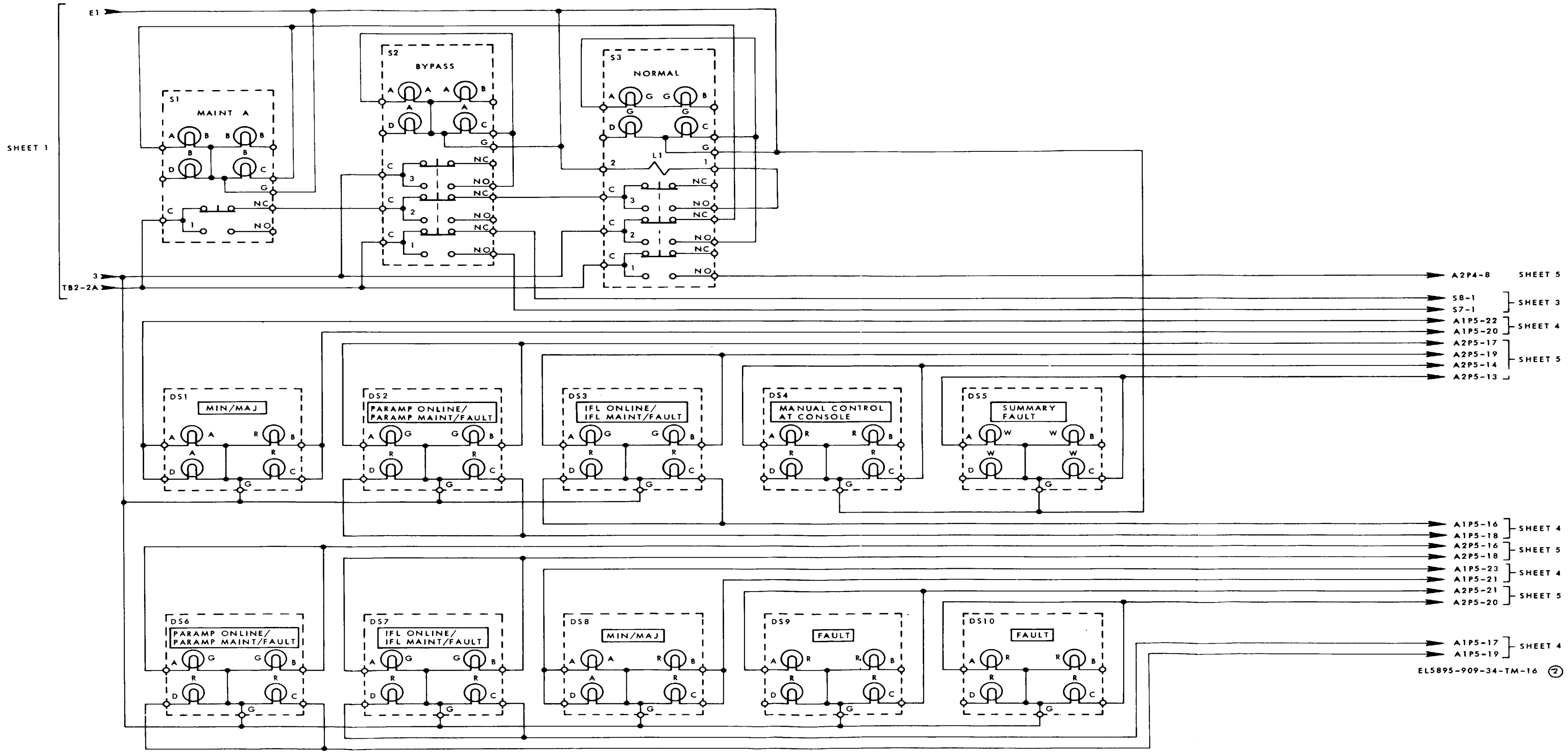


Figure FO-4. Receiver gain monitor HTA-3A6, schematic diagram (sheet 2 of 5).

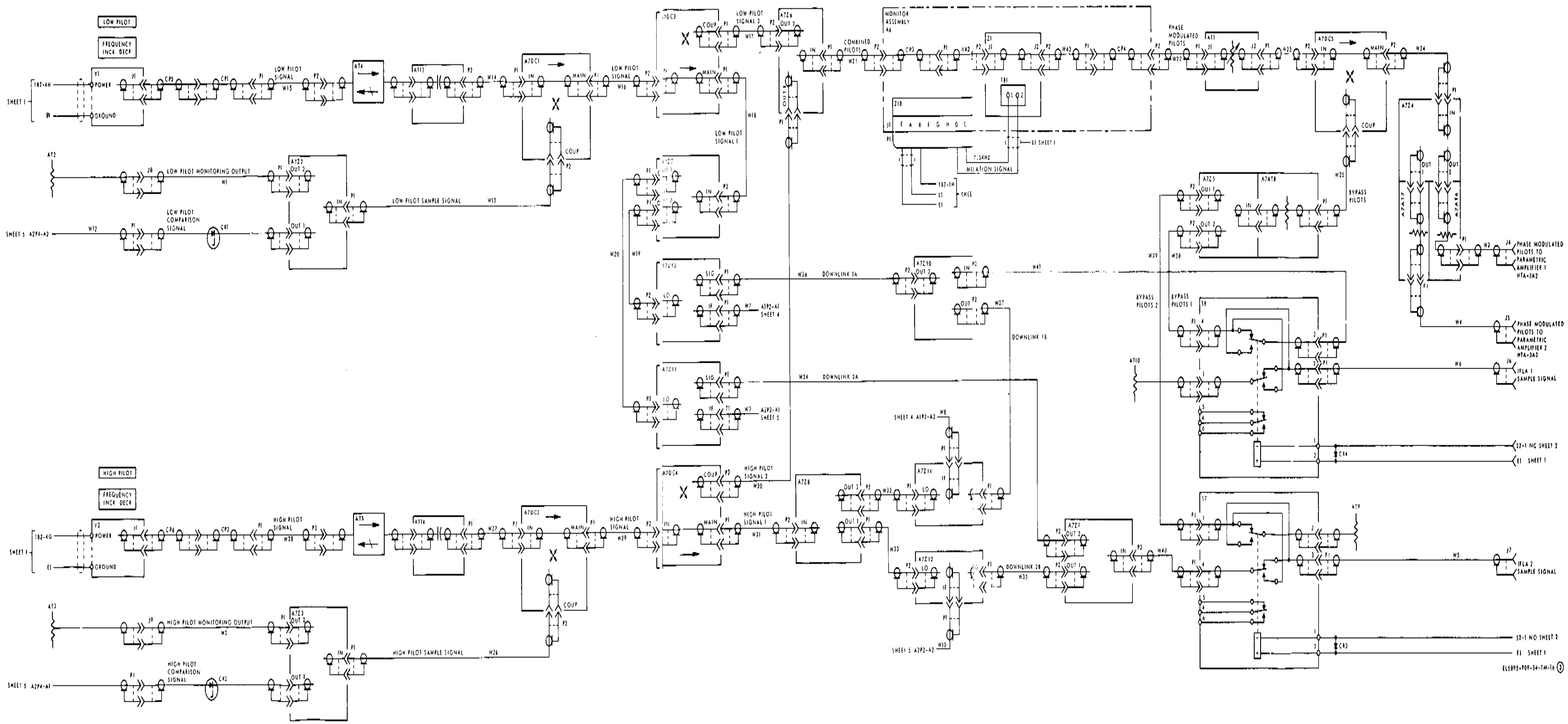


Figure FO-4. Receiver gain monitor HTA-3A6, schematic diagram (sheet 3 of 5).

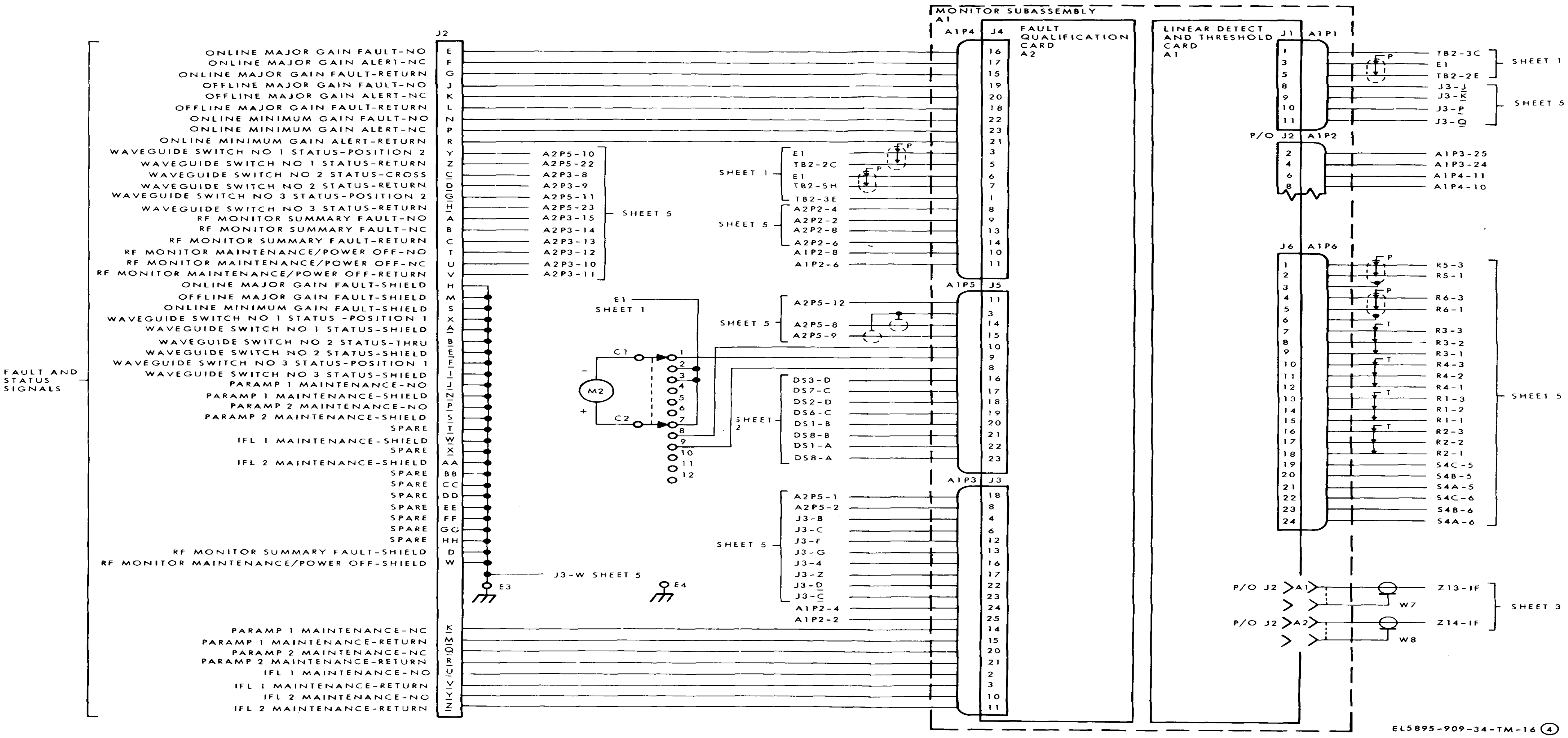


Figure FO-4. Receiver gain monitor HTA-3A6, schematic diagram (sheet 4 of 5).

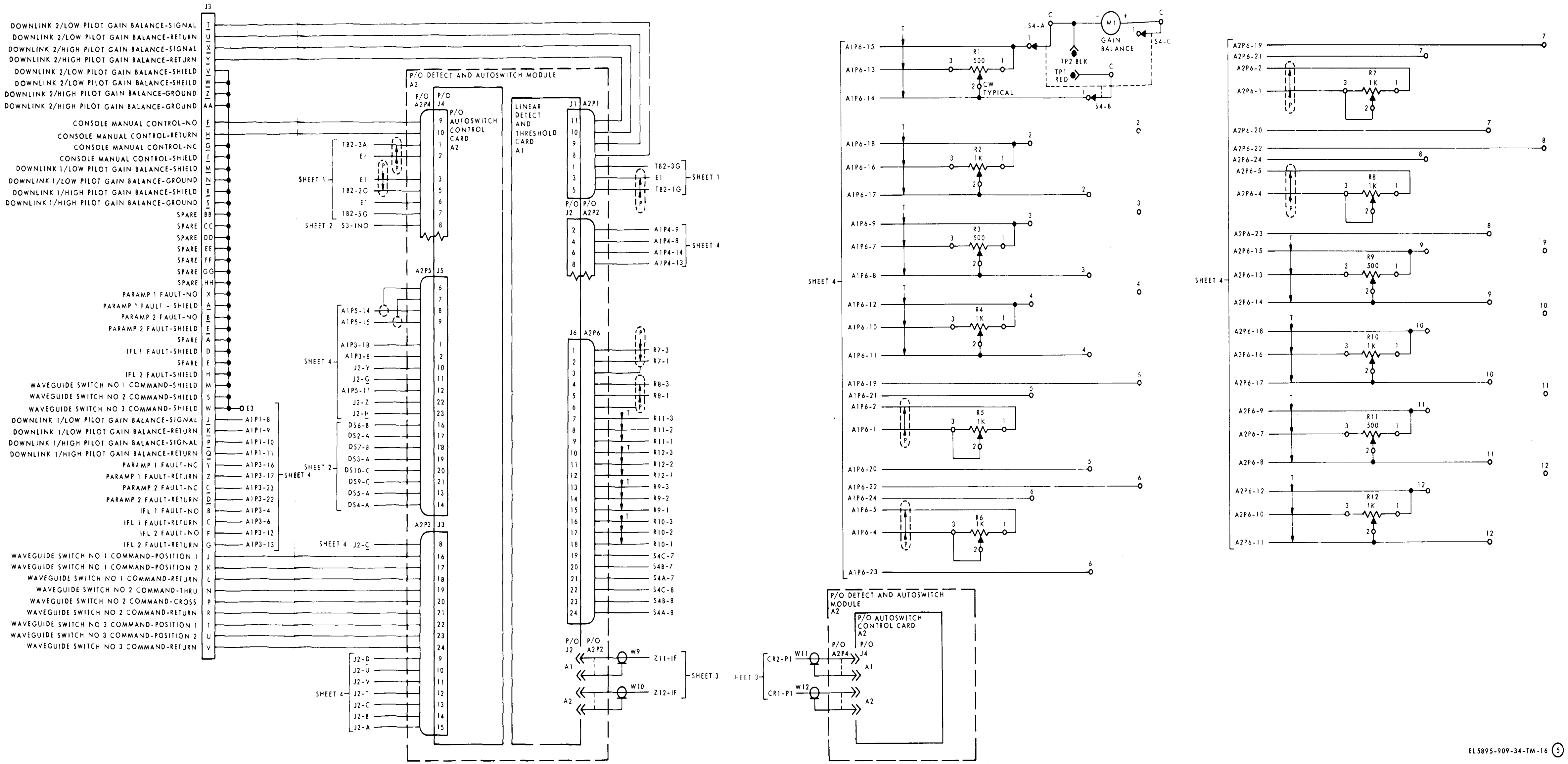
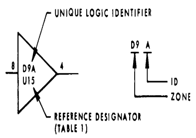


Figure FO-4. Receiver gain monitor HTA-3A6, schematic diagram (sheet 5 of 5).

TABLE 1

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
U1-4,9,10, 13,14	GENERAL PURPOSE OPERATIONAL AMPLIFIER	LM101AH
U5-8	HIGH PERFORMANCE OPERATIONAL AMPLIFIER	UA741
U11,12, 17,18	DUAL COMPARATOR	LM711
U15,16	LINEAR CURRENT AMPLIFIER	LH0002H



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS; ALL CAPACITANCE VALUES ARE IN MICROFARADS; ALL VOLTAGES ARE DC.
2. WHEN THIS CARD IS USED IN MODULE A1 (DOWNLINK 1), DELETE THE INFORMATION IN PARENTHESES. WHEN THIS CARD IS USED IN MODULE A2 (DOWNLINK 2), SUBSTITUTE THE INFORMATION IN PARENTHESES.

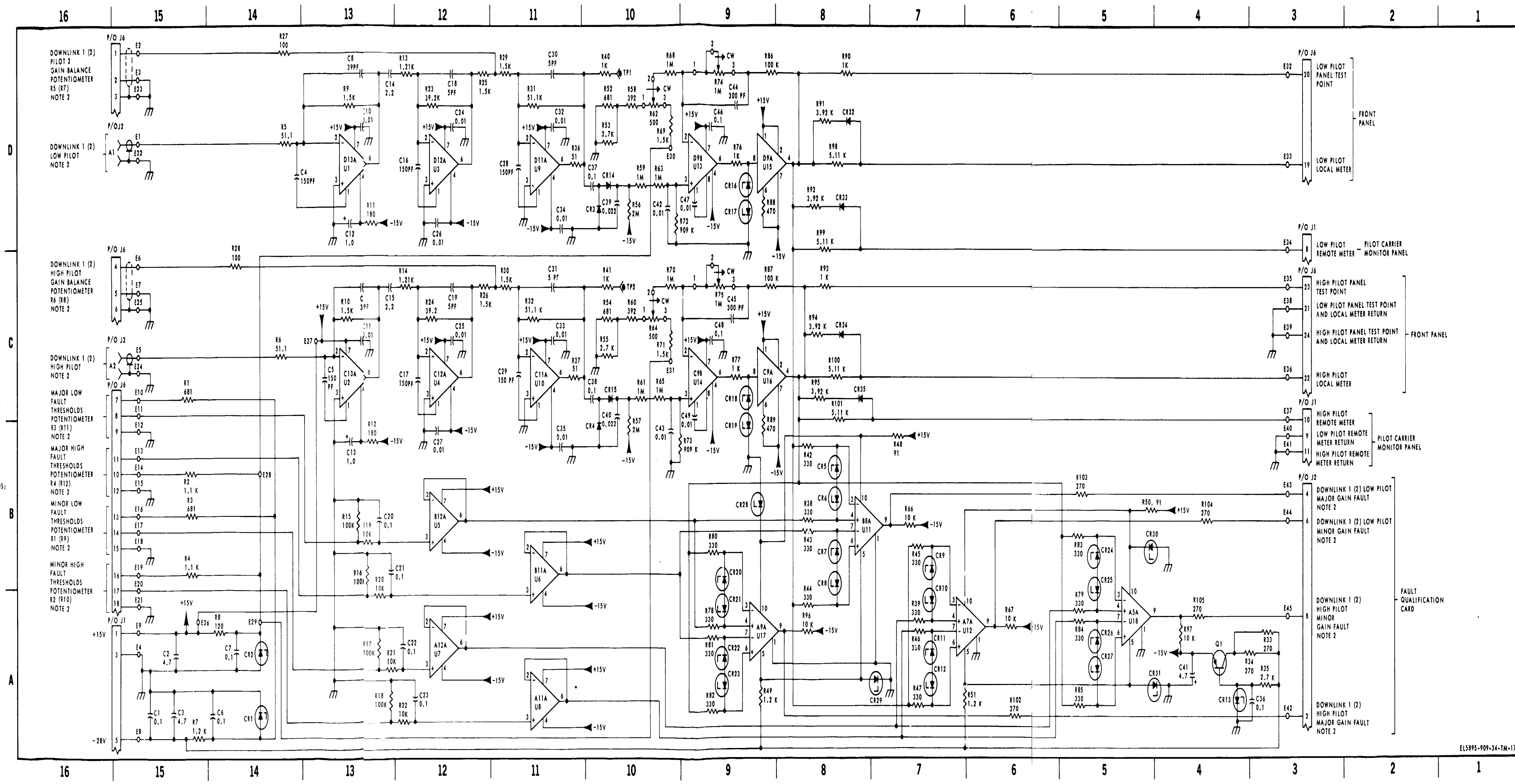
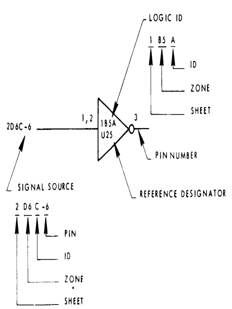


Figure FO-5. Linear detect and threshold card HTA-3A6A1A1, A2A1, schematic diagram.

TABLE 1

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
U1-3, 13, 14, 18, 27, 31,32	HEX INVERTER	SN5404J
U4-12, 15-17, 19-26, 28-30	QUAD 2-INPUT POSITIVE NAND LOGIC GATE	SN5400J



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS; ALL VOLTAGES ARE DC.
2. PIN 14 TO +5V DC AND PIN 7 TO GROUND ON ALL INTEGRATED CIRCUITS.

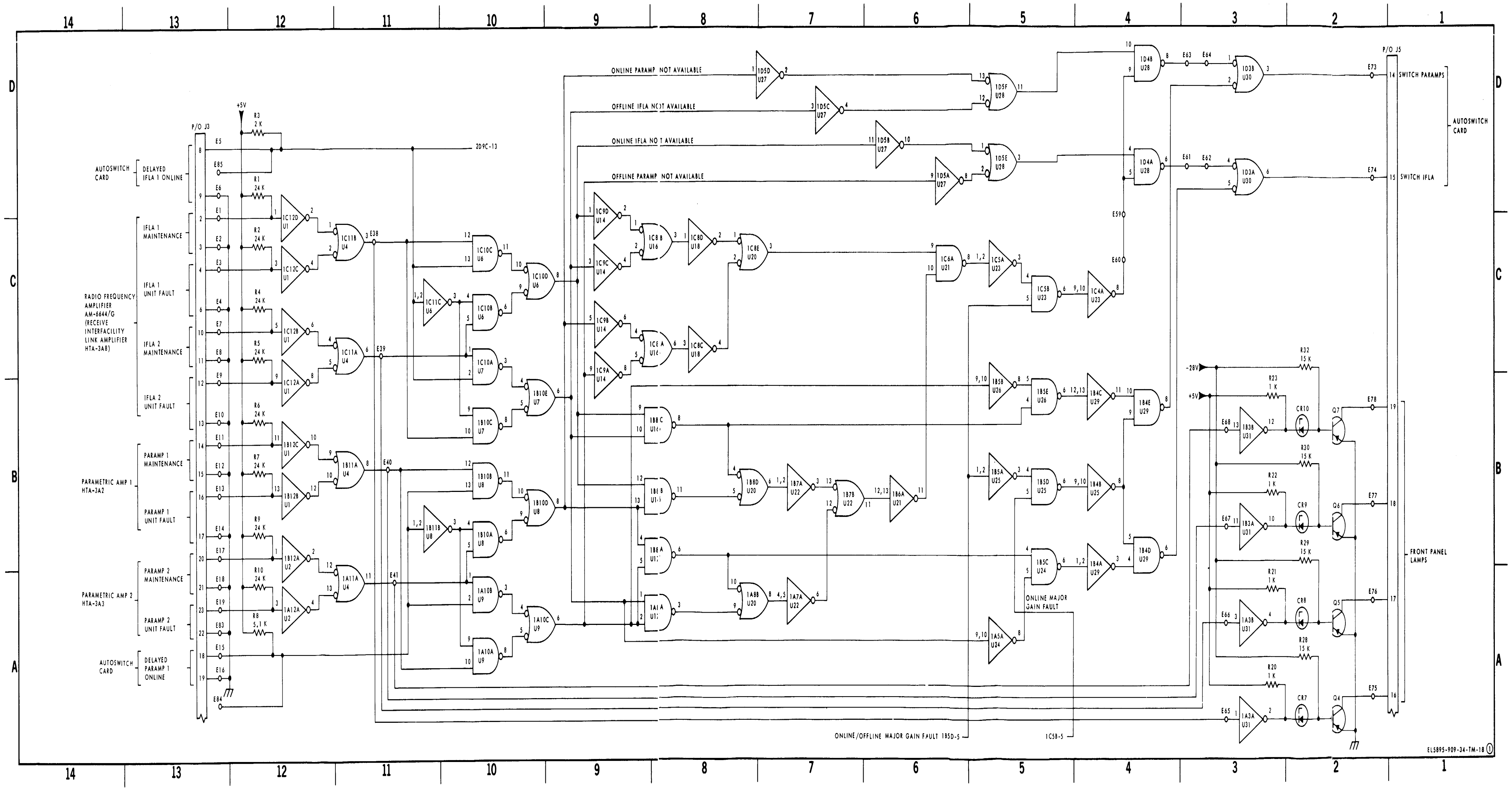


Figure FO-6. Fault qualification card HTA-3A6A1A2, schematic diagram (sheet 1 of 2).

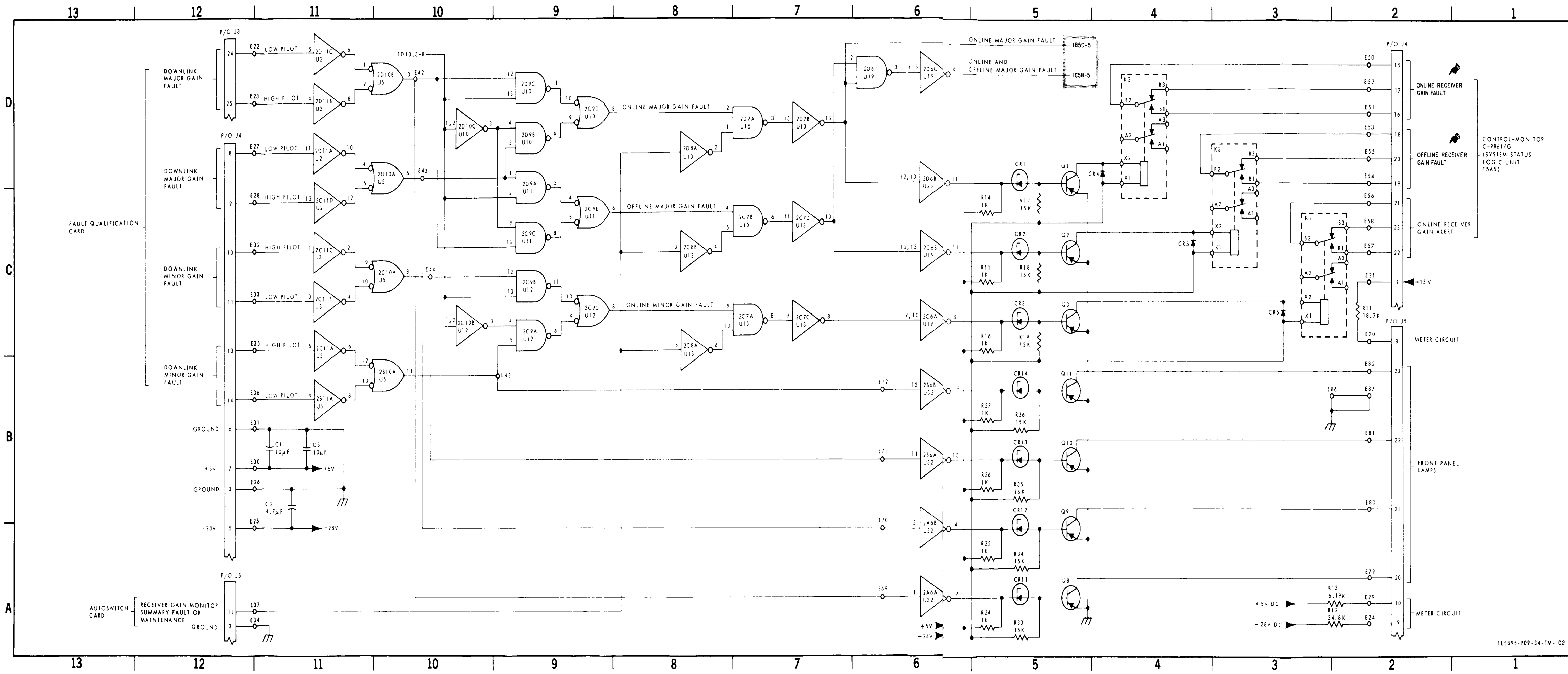


Figure FO-6. Fault qualification card HTA-3A6A1A2, schematic diagram (sheet 2 of 2)

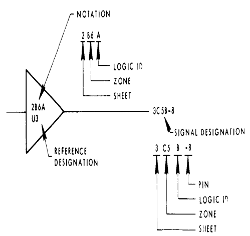
Change 1

TABLE 1

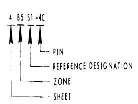
REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
U1, U2	DIFFERENTIAL COMPARATOR LINEAR AMPLIFIER	U5B77/10312
U3, U6, U11, U13	HEX INVERTER	SN5404J
U4, U5, U7, U9, U10 U12, U14, U15	QUAD 2-INPUT POSITIVE NAND LOGIC GATE	SN5400J
U8	TTL MONOSTABLE MULTIVIBRATOR	SN54121J
	TRIPLE 3-INPUT POSITIVE NAND GATE	SN5410J

LEGEND:

1. NOTATION AND SIGNAL DESIGNATION TAGGING BETWEEN LOGIC COMMENTS



2. TAGGING BETWEEN DISCRETE (NON-LOGIC) COMPONENTS



NOTES:

1. UNLESS OTHERWISE SPECIFIED,
   ALL RESISTANCE VALUES ARE IN OHMS;
   ALL CAPACITANCE VALUES ARE IN MICROFARADS;
   ALL VOLTAGES ARE DC.

2. ALL IC'S EXCEPT U1 AND U2, CONNECTED AS FOLLOWS,
   PIN 7 TO GROUND, PIN 14 TO + 5V DC.

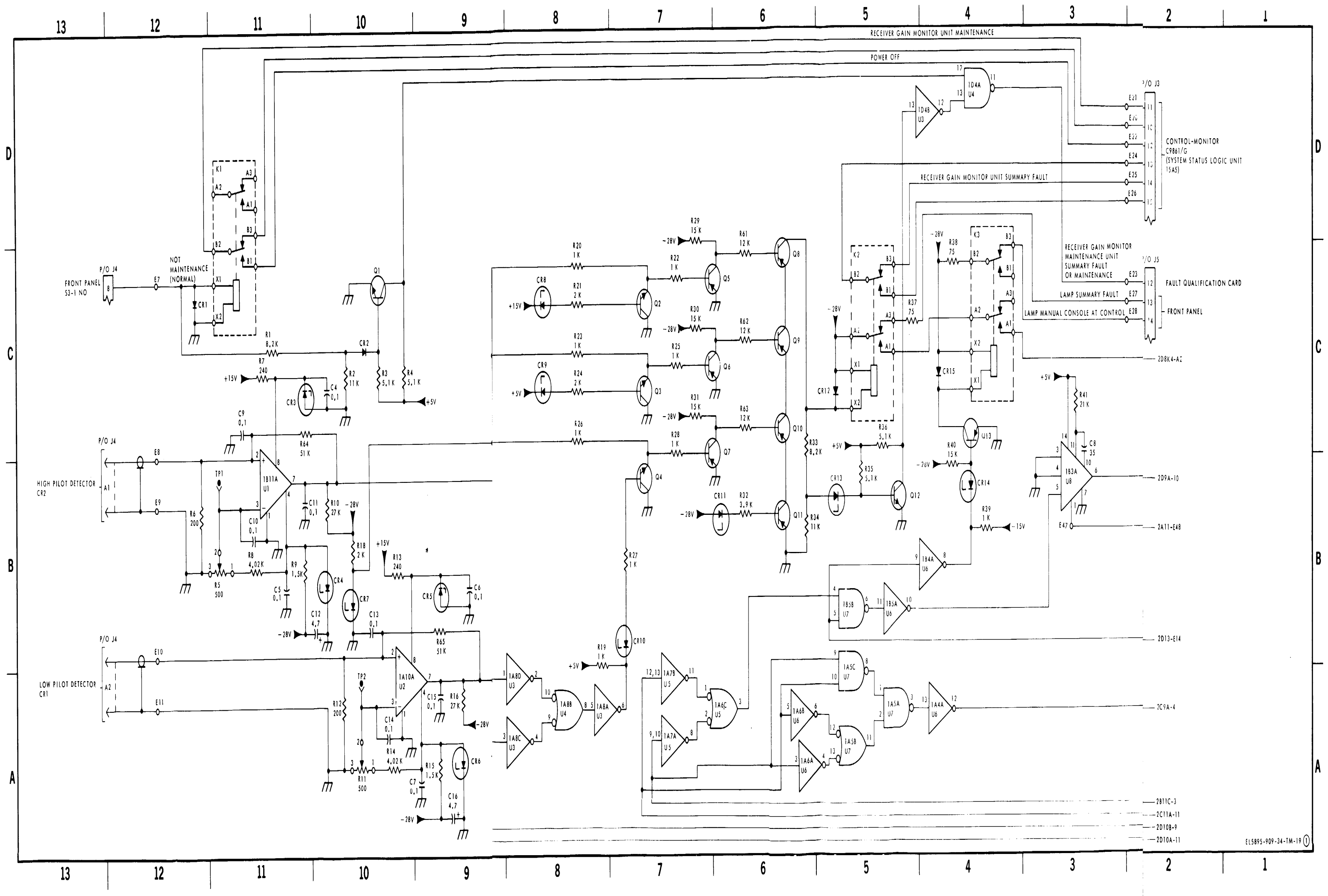


Figure FO-7. Autoswitch control card HTA-3A6A1A2, schematic diagram (sheet 1 of 2)

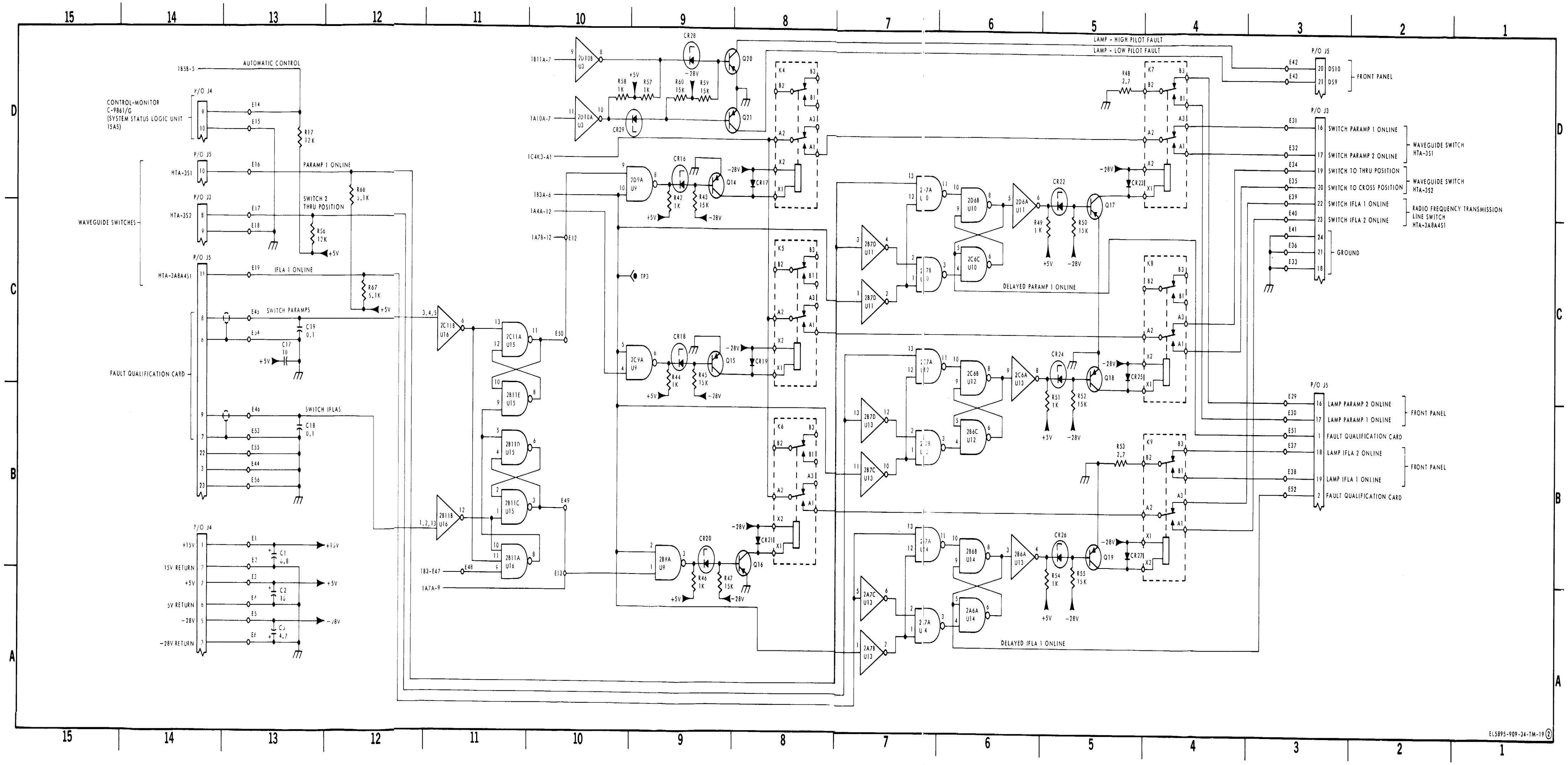


Figure FO-7. Autoswiitch control card HTA-3A6A1A2, schematic diagram (sheet 1 of 2)

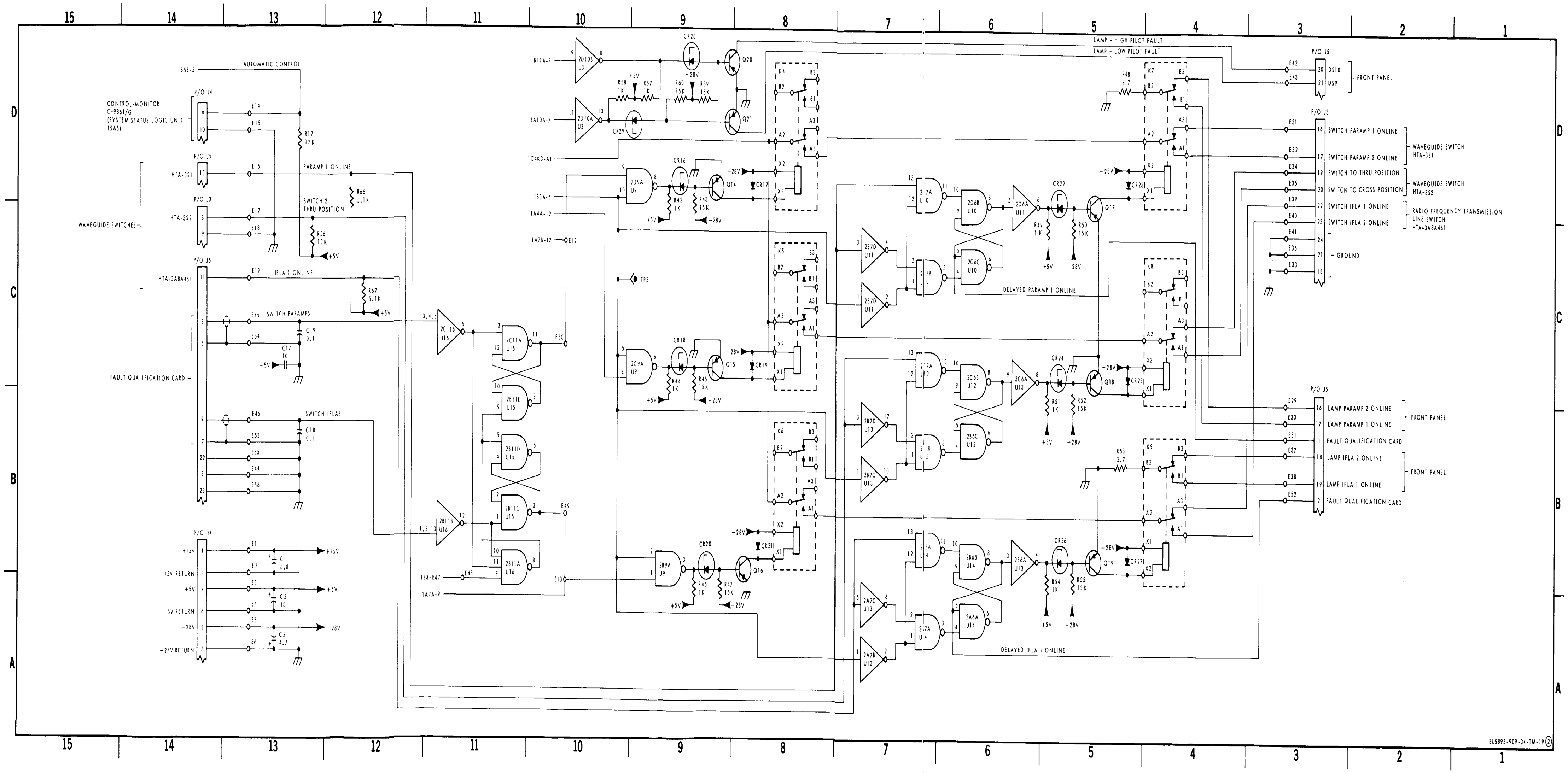


Figure FO-7. Autoswitch control card HTA-3A6A1A2, schematic diagram (sheet 2 of 2)

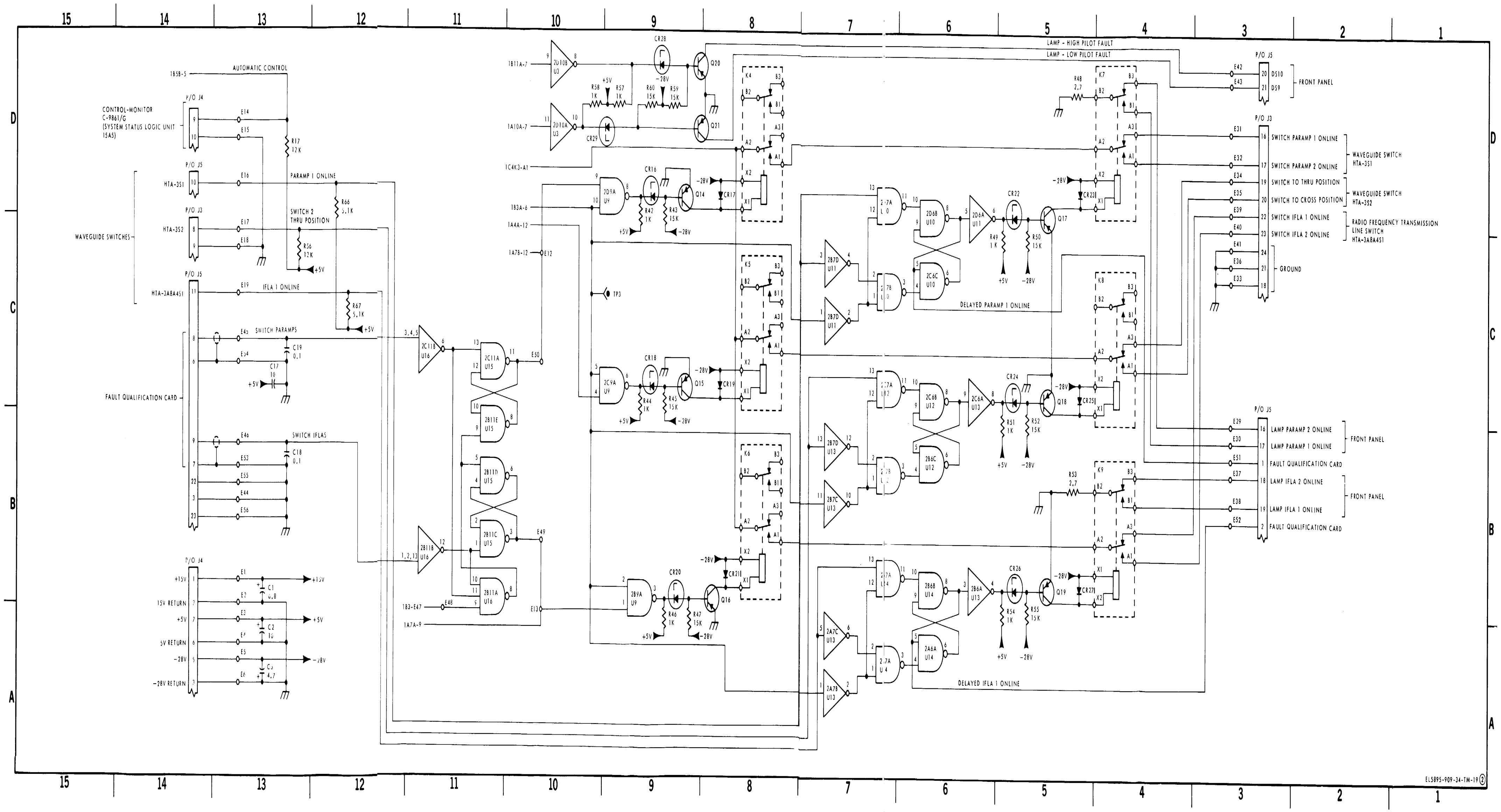


Figure FO-8. 28 V dc power supply HTA-3A6PS1, schematic diagram

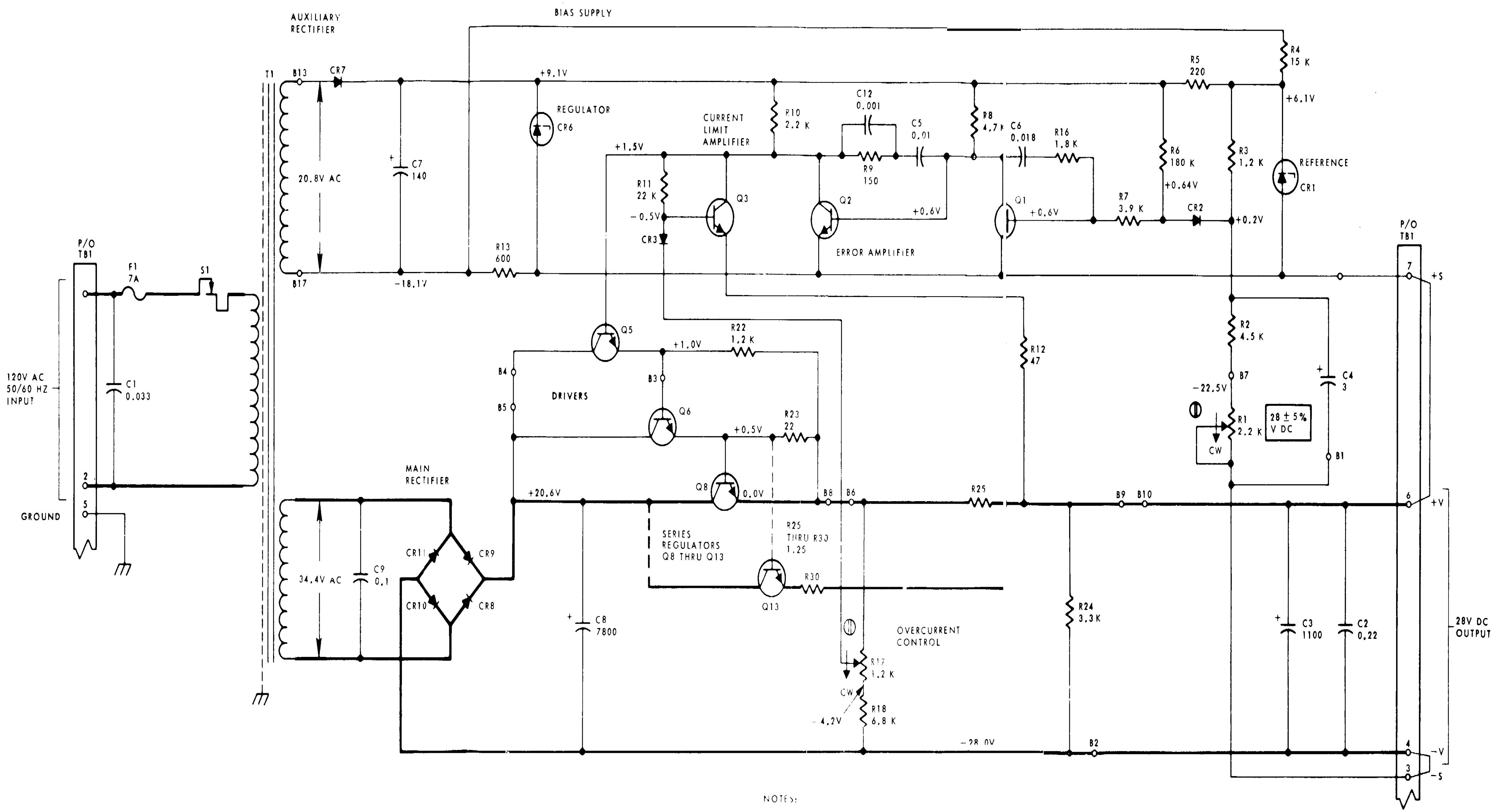
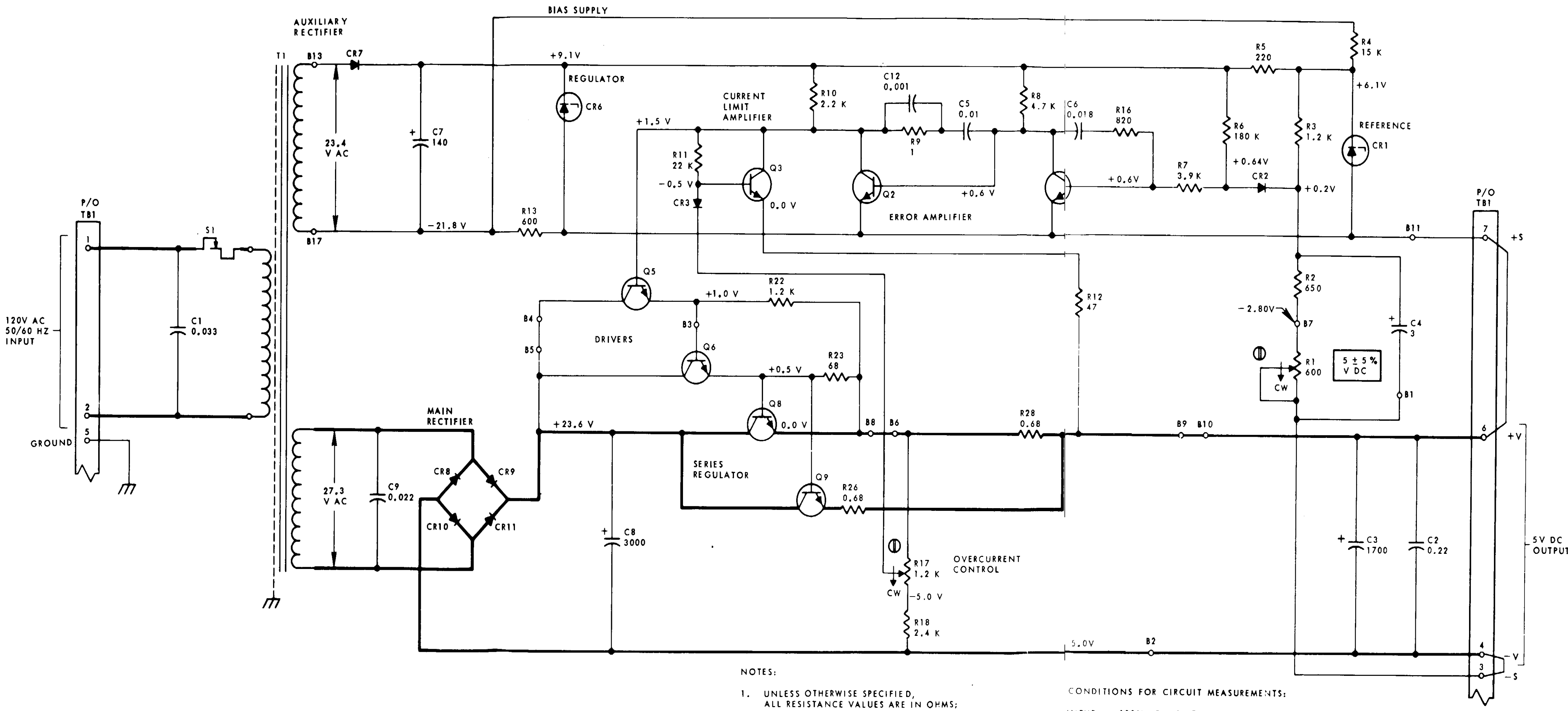


Figure FO-9. 15 V dc power supply HTA-3A6PS2, schematic diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS; ALL CAPACITANCE VALUES ARE IN MICROFARADS.
2. SYMBOLS:
   - -o- INDICATES TERMINAL ON PRINTED CIRCUIT BOARD B.
   - ⦸ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.

CONDITIONS FOR CIRCUIT MEASUREMENTS:

INPUT: 120V AC, 60 HZ.

OUTPUT: NOMINAL 5V DC.

INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC.

DC MEASUREMENTS TAKEN WITH 20,000 OHM/VOLT VOLTMETER BETWEEN +S (TERM 7) AND INDICATED POINTS.

-S AND +V SHORTED, -S AND -V SHORTED.

Figure FO-10. 5 V dc power supply HTA-3A6PS3, schematic diagram

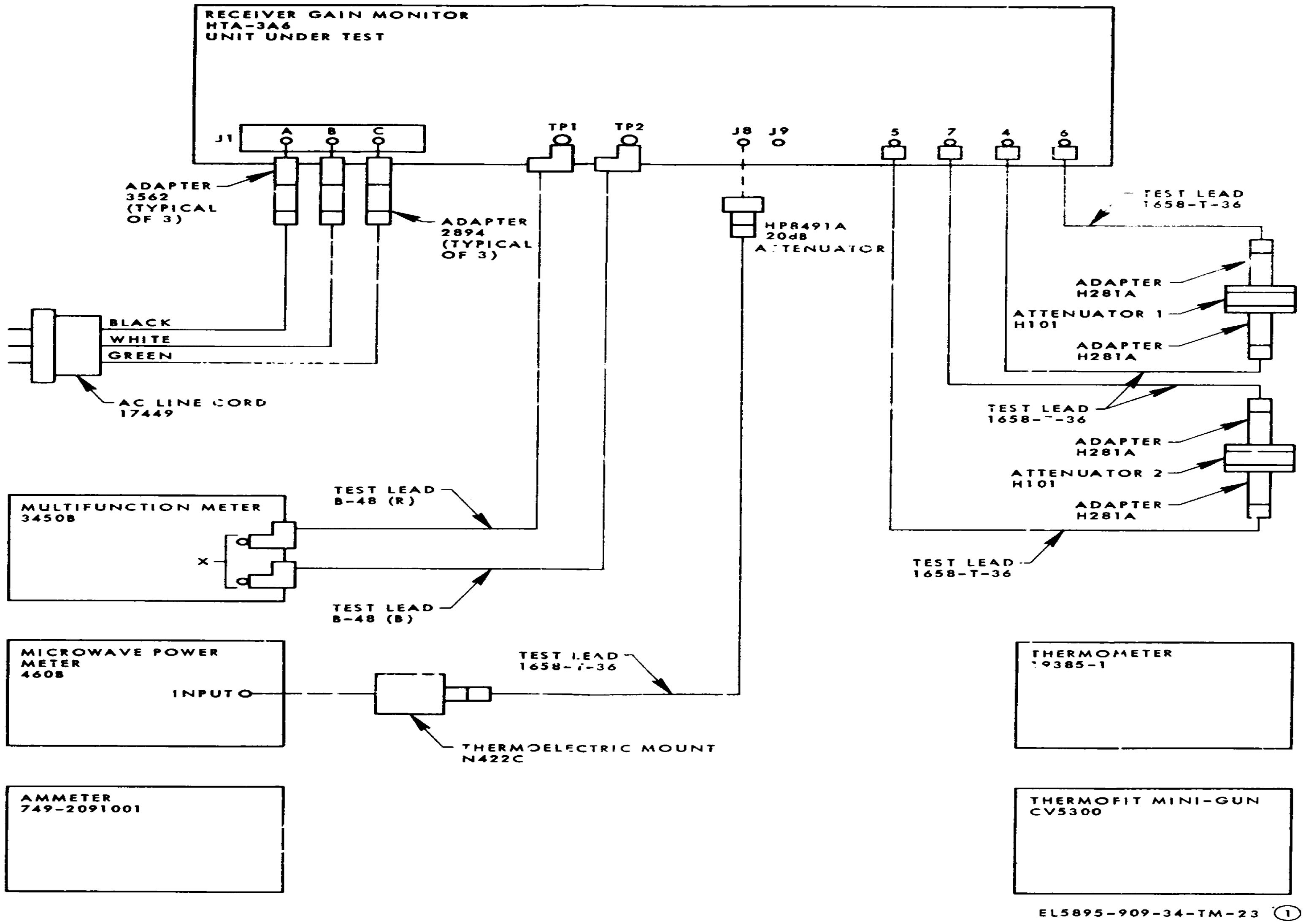


Figure FO-11. Receiver gain monitor HTA-3A6, troubleshooting test setup diagram (sheet 1 of 2)

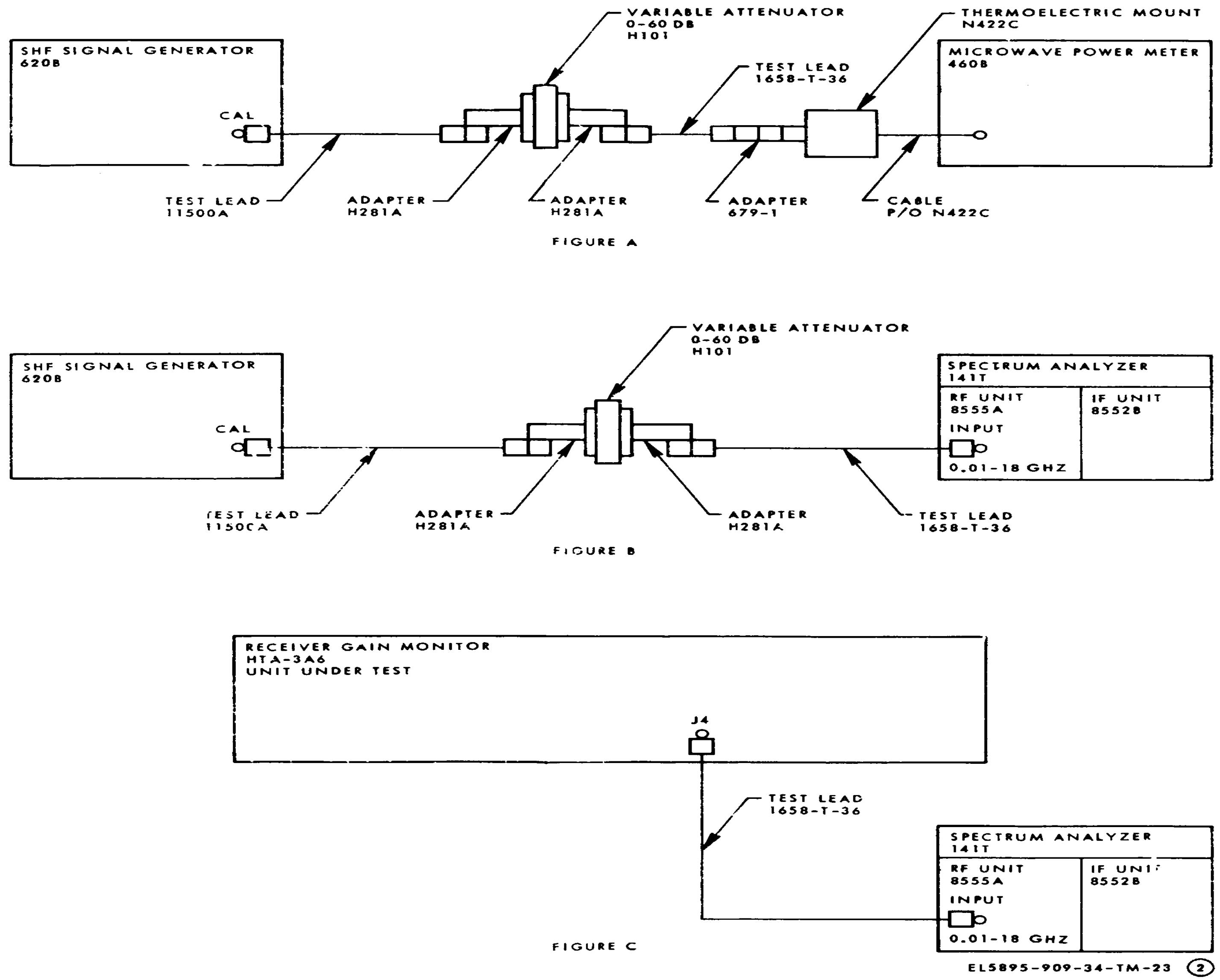


Figure FO-11. Receiver gain monitor HTA-3A6, troubleshooting test setup diagram (sheet 2 of 2).

Figure FO-11. Receiver gain monitor HTA-3A6, troubleshooting test setup diagram (sheet 2 of 2).

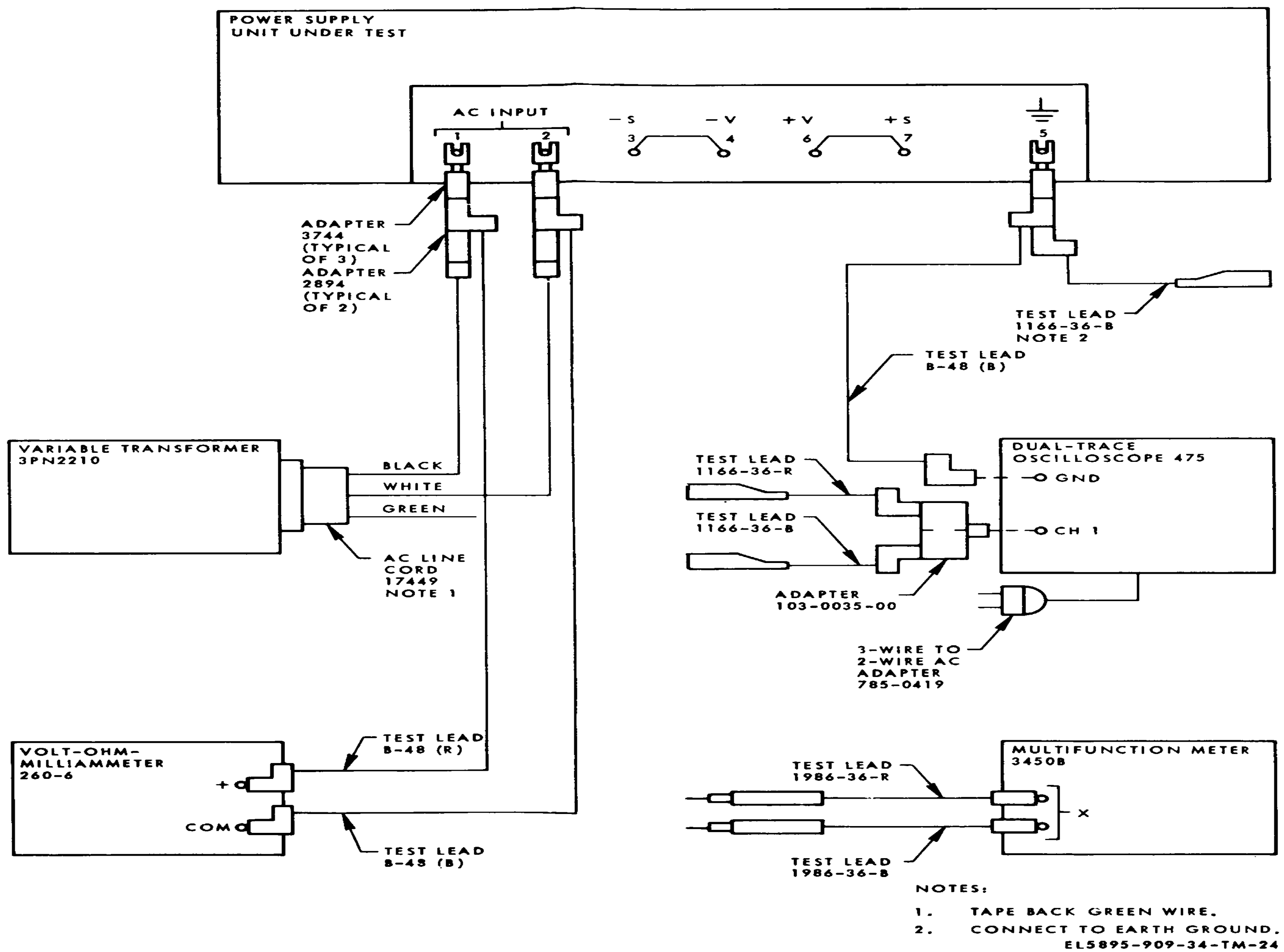


Figure FO-12. Power supply HTA-3A6PS3, troubleshooting setup diagram .

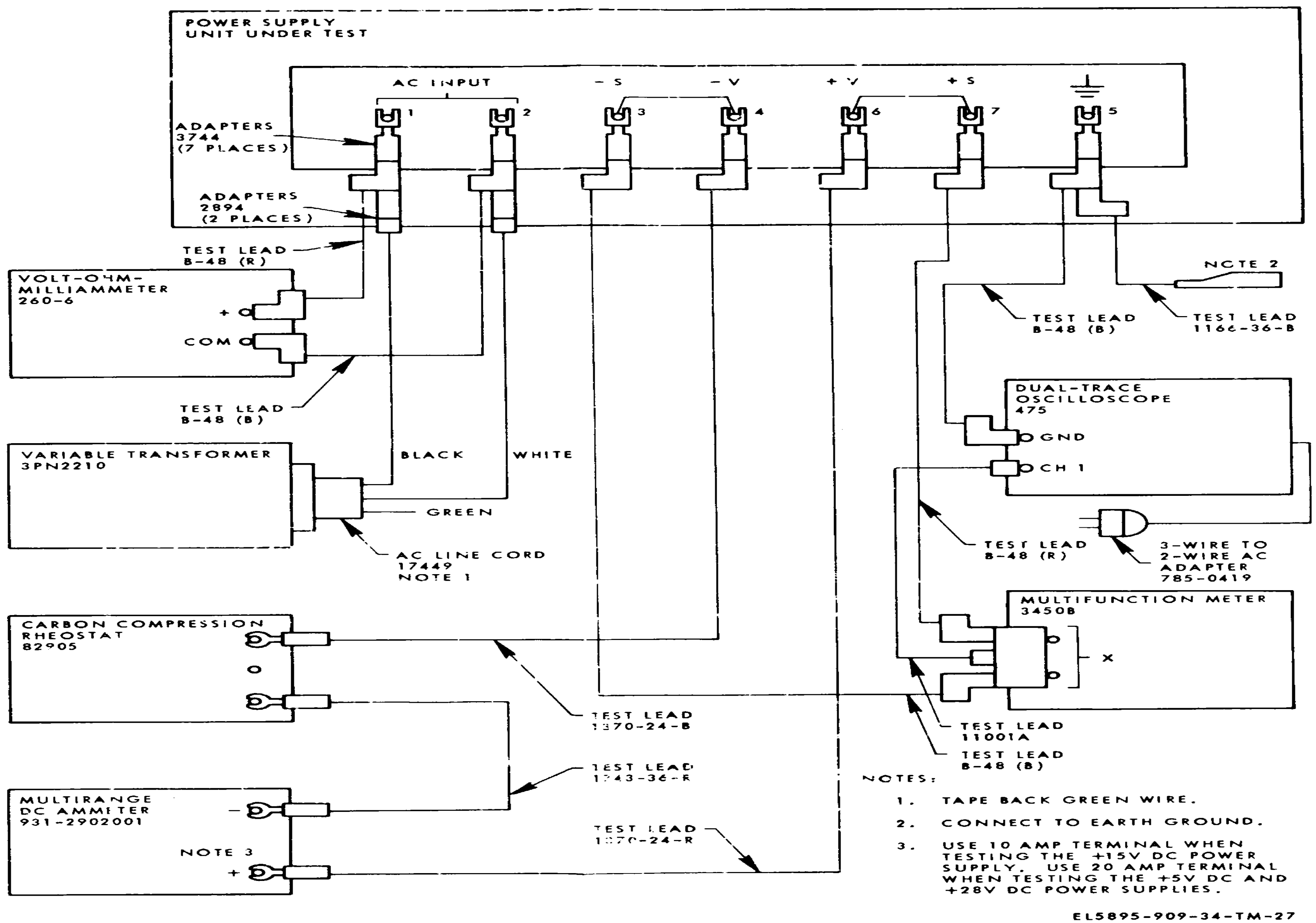


Figure FO-13. Power supply HTA-3A6PS1, 3A6PS2, 3A6PS3 test setup diagram .

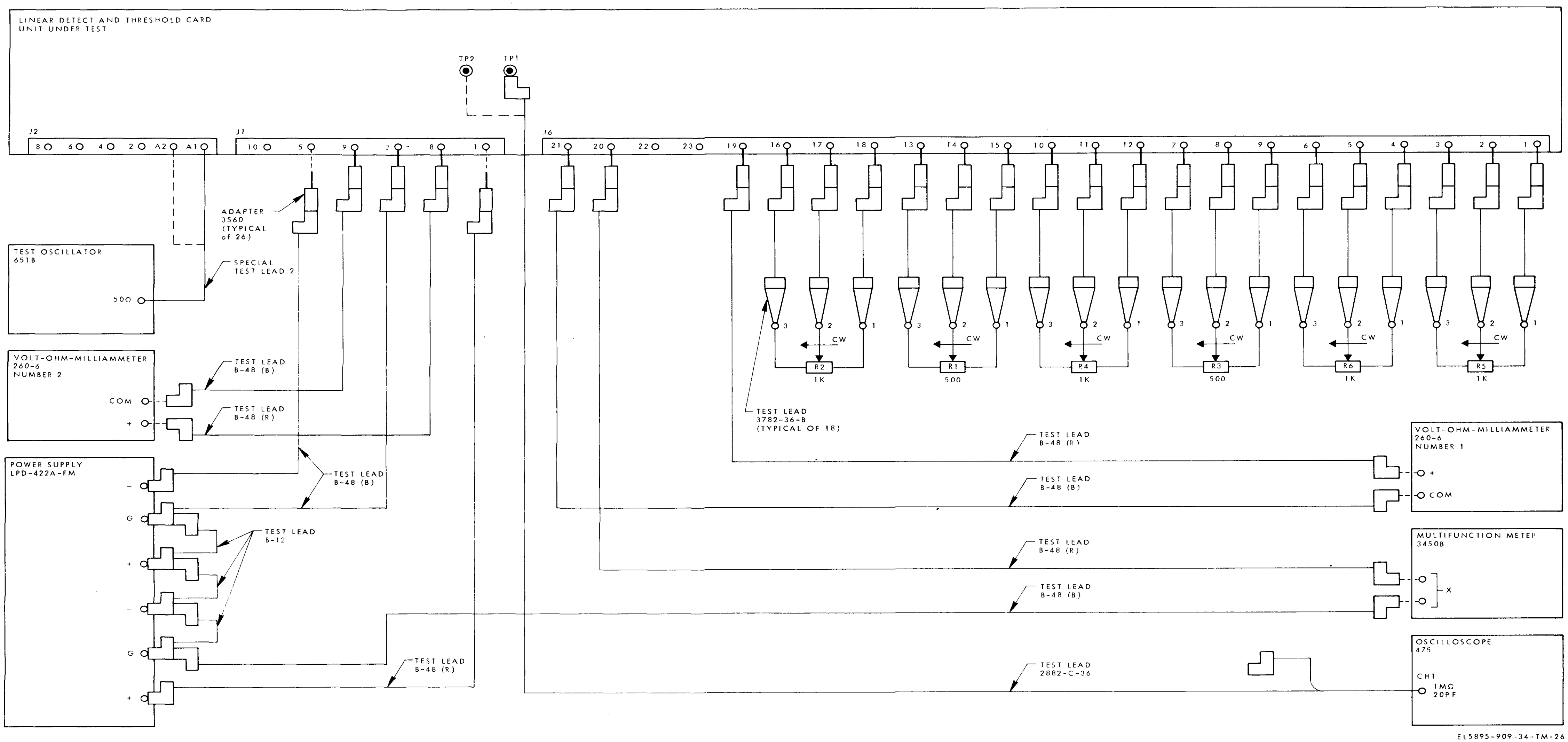


Figure FO-14. Linear detect and threshold circuit card assembly HTA-3A6A1A1, 3A6A2A1, test setup diagram .

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