ARMY TM 11-5895-912-34

NAVY 0967-LP-546-6390

AIR FORCE 31R5-2G-212

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINENANCE MANUAL TRANSMITTER POWER MONITOR EQUIPMENT INCLUDING MONITOR, RADIO FREQUENCY MX-9472/G (NSN 5895-00-239-4788) CONTROL-INDICATOR C-9841/G (NSN 5895-01-007-9450) FOR SATELLITE COMMUNICATION TERMINAL AN/FSC-78(V) AND AN/FSC-79

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

JUNE 1978

WARNING

When performing jumpering procedures at signal interconnecting box 21A1, do not touch the chassis, groundbar, or another receptable.

TM 11-5895-912-34
NAVELEX 0967-LP-546-6380
TO 31R5-2G-212

TECHNICAL MANUAL
No. 11-5895-912-34
TECHNICAL MANUAL
NAVELEX 0967-LP-546-6390
TECHNICAL ORDER
TO 31R5-2G-212

DEPARTMENTS OF THE ARMY,

THE NAVY, AND THE AIR FORCE

WASHINGTON, DC *16 June 1978*

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL TRANSMITTER POWER MONITOR EQUIPMENT INCLUDING: MONITOR, RADIO FREQUENCY MX-9472/G; (NSN 5895-00-239-4788) CONTROL-INDICATOR C-9841/G, (NSN 5895-01-007-9450) FOR SATELLITE COMMUNICATION TERMINALS AN/FSC-78(V) AND AN/FSC-79

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CHAPTER 1
INTRODUCTION

SECTION I. GENERAL

1-1. Scope. This manual contains direct and general support maintenance instructions for the transmitter power monitor equipment of Satellite Communication terminals AN/FSC-78(V) and AN/FSC-79. Included are discussions on how the equipment functions, and procedures for troubleshooting, testing, and adjusting the equipment. Maintenance instructions arc included for repairing the equipment and for replacing specified maintetance parts. Also included are lists of tools, materials, and test equipment required for direct and general support maintenance.

1-2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 8-750 (Army). Air Force personnel will use AF M 66-I or maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting. Navy personnel will report maintenance performance 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 DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/ NAVSUPINST4030.29/AFR71-l3/MCOP4030.29A. and DSAR 4145.8.

Discrepancy in Shipment *Report (DISREP) (SF* 3611. Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/ NAVSUPINST 4610.33A/AFR 75-18/MCO P4610.19B and DSAR 4500.15.

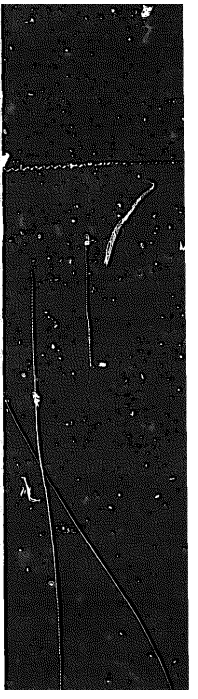
SECTION II. DESCRIPTION AND DATA

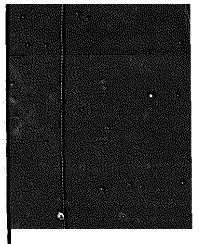
1-5. General Description The transmitter power monitor equipment is part of the transmit (uplink) function described in Operator and Organizational Manual or Satellite Communication Terminals AN/FSC-78(V), TM 11-5895-898-12, and AN/FSC-79, TM 11-5895-99-12. The transmitter power monitor equipment consists of Radio Frequency Monitor MX-9472/G (feed power monitor HTA-3A9) and Control-Indicator C-841/G (transmitter power monitor power 14A27).

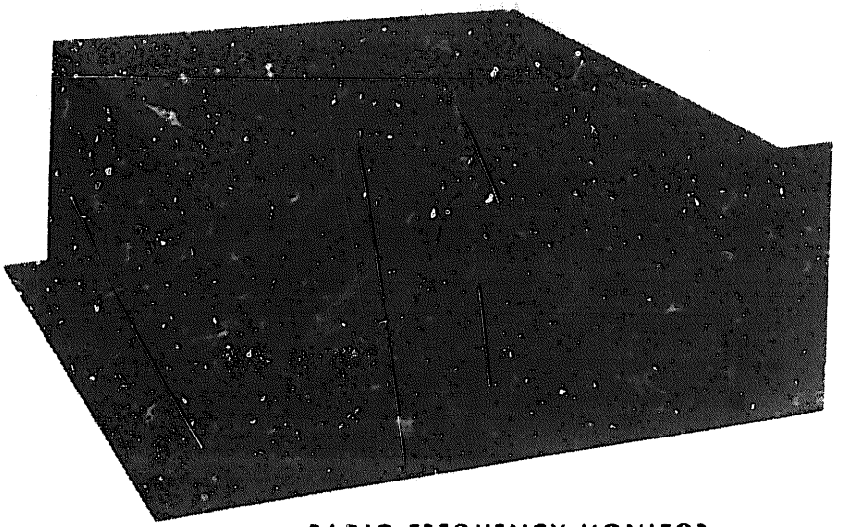
a. Purpose and Use. The transmitter power monitor equipment monitors the rf transmitte (uplink) energy present at the outputs of Radio Frequency Amplifier OG-131A/MSC or OG-132A/MSC and in Feed Assembly S-2941( )/FSC (feed assemoly HTA-1A1) and converts the rf sample into the analog signal required for direct reading on the FEED POWER meter of the transmitter power monitor panel.

b. Transmitter Power Monitor Equipment Configuration for AN/FSC-78(V) and AN/FSC-79. Transmitter power monitor equipment for the AN/FSC-78(V) and the AN/FSC-79 configurations is shown in figure I-I.

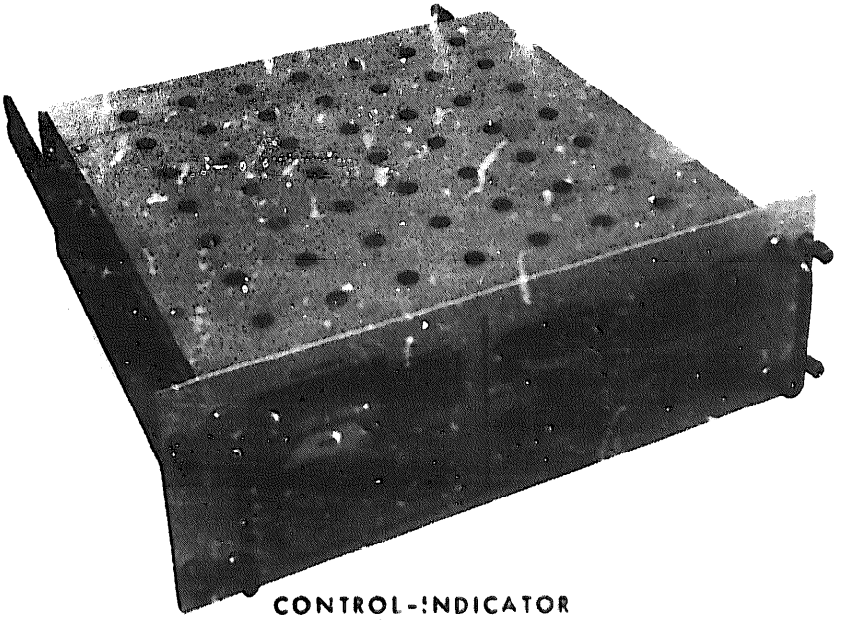
1-6. Feed Power Monitor HTA-3A9(fig. *W).* Feed power monitor HTA-3A9 converts a sample of the uplink rf power present at the input of feed assembly HTA-1A1 into a 0 to +5 V dc analog signal for monitoring by the transmitter power monitor panel. The feed power monitor can be adjusted at the front panel to measure the sampled power over a 40 dB range within the limits of -36 dBm to +20 dBm. The feed power monitor contains autoranging circuits that produce a power range signal for one of four range indication circuits in the transmitter power monitor panel. Additionally, the feed power monitor can be automatically zeroed by application of a signal from the transmitter power monitor panel. Built-in dc power sources are included; therefore, only a 120 V ac source is required for operation. Rf-to-analog voltage conversion is obtained by an integral chopper-stabilized dc amplifier. Autoranging signals are provided by comparator and digital logic counter-decoder circuits.





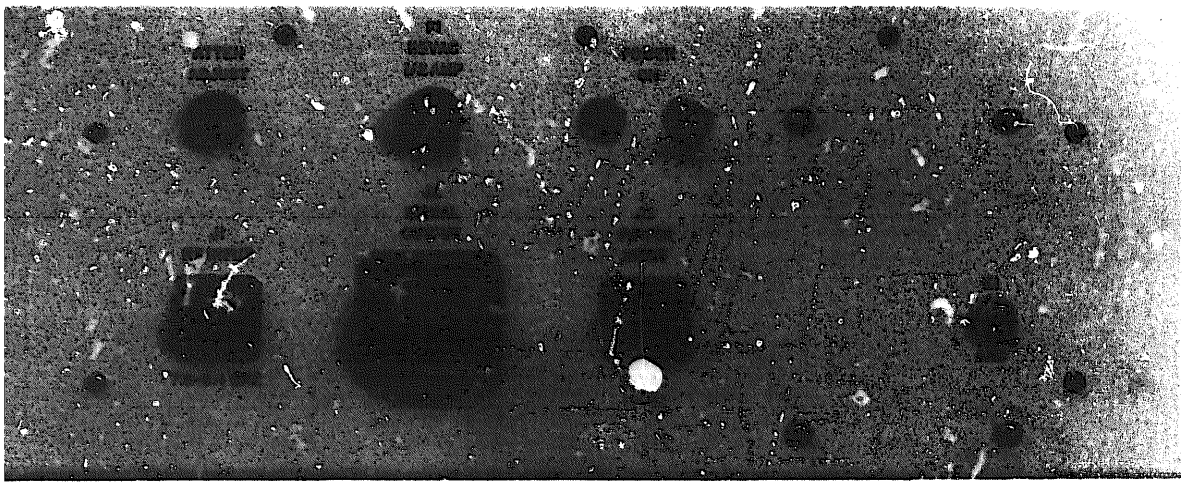


RADIO FREQUENCY MONITOR
MX-9472/G
(FEED POWER MONITOR
HTA-3A9)



CONTROL-INDICATOR
C-9841/G
TRANSMITTER POWER MONITOR PANEL
14A27)

Figure 1-1. Transmitter power monitor equipment.



EL 5895-912-34-TM-3

Figure l-2. Feed power monitor HTA-3A9.

1-7. Transmitter Power Monitor Panel 14A27 (fig. 1-3). Transmitter power monitor panel 14A27 is a 19-inch console mounted chassis. It contains component= which activate front-panel power monitoring displays. These consist of three meters and three sets of power range indicators. The three meters, in conjunction with he range indicators, monitor the rf power present at the input of feed assembly HTA-1A1, online Radio Frequency Amplifier OG-l31A / MSC (low power amplifier nit 31 or 32 (AN/FSC-78(V)) or OG-132A/MSC high power amplifier unit 31 or 32 (AN/FSC-79) nd standby low or high power amplifier (unit 31 or 2). The three circuits are essentially the same, xcept that the feed power monitoring meter incorporates adjustable low and high limit settings by neans of front panel control knobs. The feed power neter also has an internal meter relay circuit that rovides an alarm signal if either limit is exceeded. Transmitter power monitor panel 14A27 also includes four pushbutton switches; three of these are used for shutting down the power amplifiers individually or simultaneously. The fourth switch signals to the feed power monitor to initiate autozeroing. Calibrating potentiometers, one for each meter, are accessible at the front panel. Both dc and ac operating voltages are supplied by external sources.

1.8 Tabulated Data. This paragraph provides a tabulation of technical characteristics and a cross-reference index for the transmitter power monitor equipment. The technical characteristics include physical data and electrical characteristics. The cross-reference index relates equipment reference designations to functional group numbers.

a. Physical Data. Table 1-1 lists the physical characteristics of the transmitter power equipment.

Table 1-1 Dimensions and Weights

Ref des	Equipment	Qty	Dimensions (inches)			Weight (pounds)
			Height	Width	Depth	
ITA-3A9	Feed power monitor	1	5.8	14.0	13.8	15
4A27	Transmitter power monitor panel	1	7.0	19.0	17.3	21

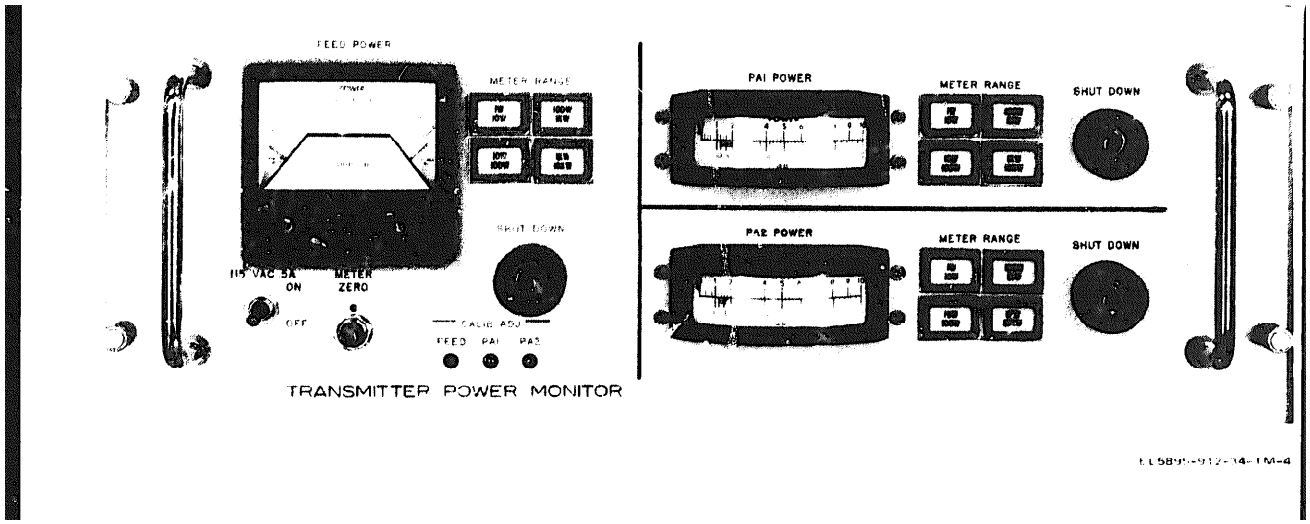


Figure 1-3. Transmitter power monitor panel 14A27.

b. Electrical Characteristics. Table 1-2 lists the technical characteristics for the assemblies in the transmitter power monitor equipment. The characteristics include power requirements, operating levels, and other pertinent data.

Table 1-2 Electrical Characteristics

Characteristic	Specification
Feed power monitor HTA-3A9	
Input signals	
Frequency range	7.9 to 8.4 GHz
VSWR	1.5:1 (max)
RF power	Adjustable 40 dB range within limits of +36 ± 3 dBm to +70 ± 3 dBm
Output signals	
Analog signal	0 to +5 V dc at 10 mA (max)
Automatic ranging discrete signals	+28 V dc at 100 mA (max)
Accuracy	±2.5 pct (nominal)
Response time	5 seconds (max)
Power requirements	120 V ac ±10 pct, 50 to 60 Hz
Transmitter power monitor panel 14A27	
Input signals	

TABLE 1-2 Electrical Characteristics-Continued

Characteristic	Specification
Autoranging status	+28 V dc on one of four selected ranges from three discrete rf power converters
Analog signal	0 to +5 V dc into 5000 ohms from three discrete rf power converters
Output signals	
Autoranging status	Contact closures, +28 V dc at 200 mA
Analog signal	0 to +5 V dc
Feed power auto-zero switch closure	28 V dc return
Power requirements	
Dc power	+28 V dc
Ac power	120 V ac, 50 to 60 Hz

c. *Cross-Reference Index.* Table 1-3 provides a cross-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
14A27	Transmitter power monitor panel	1401
14A27A1	Resistor assembly	140101
14A27A2	Semiconductor device assembly	140102
14A27M1, M3	Meter	140103
14A27M2	Meter	140104
HTA-3A9	Feed power monitor	1402
HTA-3A9A401	Rf sensor	140201
HTA-3A9PS401	Power supply	140202
HTA-3A9PS402	Power supply	140203
HTA-3A9S402	Switch, rf	140204
HTA-3A9AT401	Pin attenuator	140205
HTA-3A9A1	Dc amplifier assembly	140206
HTA-3A9A1A1	Auto-zero pcb assembly	14020603
HTA-3A9A1A3	Power supply/counter decoder pcb assembly	14020602

Table 1-3 Cross-Reference Index-Continued

Ref des	Common name	FGN
HTA-3A9A1A5	Chopper driver and relay 1 pcb assembly	14020604
HTA-3A9A1A6	Amplifier no. 2 pcb assembly	14020605
HTA-3A9A1A7	Amplifier no. 1 pcb assembly	14020606
HTA-3A9A2	Relay pcb assembly	140207
HTA-3A9A4	Autorange logic pcb assembly	14020601

CHAPTER 2
FUNCTIONING OF TRANSMITTER POWER MONITOR EQUIPMENT

SECTION I. FUNCTIONAL ANALYSIS

2-1. Introduction. This chapter explains the functioning of the transmitter power monitor equipment as an aid in understanding the maintenance instructions prescribed in chapters 3 and 4. Section I provides interface information and a functional analysis of the transmitter power monitor equipment. Section II contains detailed circuit analyses of the subassemblies.

2-2. Transmitter Power Monitor Equipment Interface Information (fig. FO-2). The transmitter power monitor equipment, which consists of feed power monitor HTA-3A9 and transmitter power monitor panel 14A27, interfaces with coaxial directional coupler (directional coupler HTA-3A5DC1) in radio frequency equipment group HTA-3 and with low power amplifier units 31 and 32 or high power amplifier units 31 and 32.

a. The transmitter power monitor equipment monitors the rf uplink (transmit) power present at the input of feed assembly HTA-1A1 and the output of the two redundant low power amplifiers (units 31 and 32) used in the AN/FSC-78(V) or the two redundant high power amplifiers (units 31 and 32) used in the AN/FSC-79. This redundancy is provided so that one unit will be in the online mode while the other unit is in a standby mode. On transmitter power monitor panel 14A27, the two redundant units are identified as power amplifier no. 1 (PA1) and power amplifier no. 2 (PA2) (para 2-8).

b. Feed power monitor HTA-3A9 converts the transmit test sample from directional coupler HTA-3A5DC1 into a 0 to +5 V dc analog output signal. It also provides an analog ranging signal for application to the feed power monitor circuit in transmitter power monitor panel *14A27.* Rf power sampling circuits in power amplifier no. 1 and 2 provide a power conversion function similar to that of feed power monitor HTA-3A9 and apply the same type of signals to transmitter power monitor panel 14A27.

c. In addition to monitoring the three uplink power points, transmitter power monitor panel 14A27 provides an auto-zero signal to feed power monitor HTA-3A9. Transmitter power monitor panel 14A27 also provides power shutdown signals to power amplifier no. 1 and 2. Of the 16 output signals from the transmitter power monitor panel to Control-Monitor C-9861/G (AN/FSC-78(V) system status logic unit 15A5) or C-9854/G (AN/FSC-79 system, status logic unit 15A5), only the feed power meter limit alarm signal is active. Three 0 to +5 V dc analog output signals and 12 autoranging signals are provided but not used. The feed power meter limit alarm signal is generated if preset feed power high or low limits are exceeded. System status logic unit 15A5 then transfers an output power fault signal to Control-Indicator ID-2028/G (AN/FSC-78(V) fault and system status panel 14A16) or Control-Indicator ID-2033/G(AN/FSC-79 fault and system status panel 14A16) which provides both visual and audible minor alarms.

d. The functional analyses of feed power monitor HTA-3A9 and transmitter power monitor panel 14A27 are given in paragraphs 2-3 through 2-11. For a detailed functional description of interfacing equipment, refer to the technical manuals listed in table 2-1.

Table 2-1 Interface Equipment Reference Manuals

Ref des	Common name	Manual no.
HTA-1A1	Feed assembly	TM 11-5895-900-34
HTA-3	Rf equipment group	TM 11-5895-900-34
HTA-11	Antenna waveguide group	TM 11-5895-900-34
Unit 15	System status logic unit rack	TM 11-5895-907-34
Unit 31, 32	Low power amplifier	TM 11-5895-906-34
Unit 31, 32	High power amplifier	TM 11-5895-906-34

2-3. Food Power Monitor HTA-3A9 Functional Analysis (fig. FO-3, sh 1). Feed power monitor HTA-3A9 consists of four major circuits: the rf input attenuating, switching, and sensing circuit; dc amplifying circuit; autoranging circuit; and auto-zero circuit. These circuits arc described functionally in paragraphs 2-4 through 2-7. Feed power monitor HTA-3A9 also includes dc power sources that provide -15 V dc, + 15 V dc, +28 V dc, and +5 V dc which are discussed in section II. Circuit Analysis.

2-4. RF Input Attenuating, Switching, and Sensing Circuit. The transmit test sample at connector J1 of feed power monitor HTA-3A9 is applied to pin diode attenuator AT401 which is manually preset by ATTEN ADJUST potentiometer R403 to calibrate the reading of power meter 14A27M2. From pin diode attenuator AT401 the sample is coupled through pin diode switch S402 to power sensor A401. Switch S402, which removes rf power during automatic zeroing of the FEED POWER meter. is controlled by contact closure of relay K405 which, in turn, is operated by the METER ZERO switch. Power sensor A401 is a thin-film thermoelectric (tft) power head which converts the rf power to a dc level before application to the dc amplifier.

2-5. DC Amplifying Circuit. This circuit is a chopper-stabilized dc amplifier that measures the average power absorbed by the power sensor and provides a thermally stabilized, low noise, 0 to +5 V dc analog signal over four automatically selected power ranges (para 2-6). Included is a circuit that provides for remotely commanding a zero amplifier output with no dc input from the power sensor (para 2-7).

a. Input Circuitry. During normal operation, the dc output of power sensor A401 is applied to modulator G1-A, T1. This circuit consists of one-half of a mechanical chopper which is connected across center-tapped transformer T1. The chopper is driven by modem driver Q5 through Q8 which is an astable multivibrator that free-runs at 100 Hz. The square-wave output of the chopper is stepped up by transformer T1 and applied to low-noise preamplifier Q1, AR2. The square-wave signal is amplified in this circuit and coupled to filter amplifier AR3. Here much of the noise and spurious frequencies are filtered out, resulting in an amplified sine wave that is then connected to phase splitter Q2, Q3. This circuit provides the phase-splitting function required by full-wave demodulator G1-B. The demodulator, which is the other half of the mechanical chopper and, therefore, is synchronously driven with modulator G1-A, T1, recovers the dc input signal at a greatly amplified level which is then applied to integrating amplifier AR4, Q4.

b. Output Circuitry. The integrated output of integrating amplifier AR4, Q4 is connected to a network in power sensor A401 that compensates for power sensor sensitivity and effective efficiency at the channel frequency being measured. Also, the integrating amplifier output is fed back to modulator G I -A, TT via range select gain control circuit K1 through K4. The latter circuit provides amplifier gain control as a function of automatic range selection. The compensated output is returned to the dc amplifier where it is polarity-reversed by inverting amplifier AR1 to produce the 0 to +5 V dc analog signal at pin M of connector J2.

2-6. Auto Ranging Circuit. The feed power monitor is used to measure power over four ranges: 1 W to 10 W, 10 W to 100 W, 100 W to 1 kW, and 1 kW to 10 kW. Automatic selection of the correct power range (auto. ranging) is provided by feedback circuitry that functions as described in the following subparagraphs.

a. Sensing Circuit. The output of inverting amplifier AR1 is sensed by comparator and trigger stage A101, A105, Q102 through Q104 which provides range-switching trigger pulses to counter decoder A102, A104, Q105 through Q108 when the output is less than +0.45 V dc or more than +5 V dc. The range-switching triggers are inhibited if the sensed output is within this level range, if the unit is in the most sensitive range and the output level is below ±0.45 V dc, or if the unit is in the least sensitive range and the output level is above +5 V dc. The range-switching triggers are applied to counter decoder A102, A104, Q105 through Q108 when range switching is required. Switching occurs only between adjacent ranges in either the forward (higher) or reverse (lower) direction until the proper range level is reached or the switching is inhibited as previously described.

b. Decoding Circuit. The counter decoder consists of two-stage binary counter A104, NOR gates A102, and relay drivers Q105 through Q108 which combine to operate one of four relays in range select status circuit K401 through K404 and also the specific relay in range select gain control circuit K1 through K4 that corresponds with the proper power level range. The selected relay stage in the range select gain control circuit provides the correct degree of degenerative feedback and, therefore, accurate control of amplifier gain. The selected relay stage in the range select status circuit provides +28 V dc on the applicable status line at pin J(1 W - 10 W), S(10 W - 100 W), P(100 W - 1 kW), or E(1 kW - 10 kW).

2-7. Auto-Zero Circuit. When METER ZERO switch S4 on transmitter power monitor panel 14A27 is pressed, a ground is applied to one side of relay coil K405 via auto-zero input pin K of connector J2, and relay K405 is energized. Operation of K405 removes the rf power output from pin diode switch S402 and causes the auto-zero circuit (AR201, K205, Q201) to establish the proper reference voltage level to provide a zero signal output from feed power monitor HTA-3A9 when the input rf power is zero. The reference voltage level is retained after the auto-zero process is completed to provide the correct power level meter indication. Therefore, the feed power monitor must be zeroed each time an accurate power level meter reading is to be obtained.

2-8. Transmitter Power Monitor Panel 14A27 Functional Analysis (fig. FO-3, sh2 and 3). Transmitter power monitor panel 14A27 provides the console operator with precise indication of the rf power present at the feed assembly. power amplifier no. 1, and power amplifier no. 2. This is done by means of analog meters and visual indicators that indicate the rf power range being measured. The feed power measuring circuit receives its input from feed power monitor HTA-3A9. The two power amplifier measuring circuits receive their inputs from power amplifiers no. 1 and no. 2. Power amplifiers no. 1 and no. 2 are either low power amplifier unit 31 or 32 or high power amplifier unit 31 or 32. Low power amplifier unit 31 or 32 is part of Satellite Communication Terminal AN/FSC-78(V). High power amplifier unit 31 or 32 is part of Satellite Communication Terminal AN/FSC-79. Power amplifier no. 1 is low or high power amplifier unit 31. Power amplifier no. 2 is low or high power unit 32. Paragraphs 2-9 through 2-11 provide functional descriptions of the power measuring circuits. Transmitter power monitor panel 14A27 receives all operating power from external sources: +26 V dc for indicator illumination from Control-Monitor ID-1914/G (prime power monitor and status panel 14A24), and 120 V ac from an electrical plugmold (fig. FO-3, sh 2), both located in control console unit 14.

2-9. Feed Power Analog Signal Circuit (fig. FO-3, sh 2). The 0 to +5 V dc analog signal that is derived from the feed assembly rf power sample enters transmitter power monitor panel 14A27 at pin M of connector J2. Here it is applied through resistive networks to internal FEED POWER meter M2 and to pin Y of connector J3. METER ZERO switch S4 initiates the auto-zeroing of feed power monitor HTA-3A9. When METER ZERO switch S4 is pressed, it applies a ground to the winding of auto-zero relay K405 in feed power HTA-3A9. FEED CALIB ADJ potentiometer R23 is used to calibrate meter M2. Potentiometer R9 provides a similar function for the analog output. Circuit breaker CB1 and line filter FL1, FL2 connect ac power to the meter relay circuit. The output of this relay is an open circuit under normal operating conditions; that is, when the pointer of meter M2 is within the preset limits. If either limit is exceeded, the relay provides a contact closure across pins W and X of connector J3 to generate the feed power meter limit alarm signal.

2-10. Feed Power Meter Range Circuit (fig. FO-3, sh 2). The autoranging circuit of feed power monitor HTA-3A9 (para 2-6) applies +28 V dc on the selected range line at pin J, S. P or E of connector A9J2. This +28 V dc is sent through distribution box assembly HTA-3A1, connector assembly HTA-A1 signal interconnecting box 21A1 and connector panel 14A22 to transmitter power monitor panel 14A27. At transmitter power monitor panel 14A27, the +28 V dc range status signal operates the applicable relay. The selected relay then applies 28 V dc to its associated indicator. The indicator lights to display the legend corresponding to the rf power being measured at the antenna feed,

2-11. Power Amplifier Display and Power Shutdown Circuits (fig. FO-3, sh 3). The meter range and analog signal circuits for power amplifier no. 1 and 2 (units 31 and 32) are shown on sheet 3 of FO-3. These circuits are essentially the same as described for the feed power circuits (para 2-9 and 2-10), differing only in that the meters do not have limit alarm or auto-zero circuits. Also shown on this sheet are the power shutdown circuits used by the console operator to terminate operation of power amplifier no. 1, 2, or both. Pressing PA1 POWER SHUT DOWN pushbutton switch S1 shuts down power amplifier no. 1, pressing PA2 POWER SHUT DOWN pushbutton switch S2 shuts down power amplifier no. 2, and pressing FEED POWER SHUT DOWN switch S3 shuts down both power amplifiers no. 1 and no 2. Pressing any of these switches causes a momentary contact opening which, in turn, causes disconnection of the selected power amplifier(s).

SECTION II. CIRCUIT ANALYSIS

2-12. General. Circuit analysis of the power monitor equipment is divided into discussions of feed power monitor HTA-3A9 and transmitter power monitor panel 14A27. Explanations are keyed to pertinent detailed schematic diagrams. Only nonconventional circuits, or nonconventional use of a component, are explained in detail in these discussions. Paragraphs 2-13 through 2-22 provide circuit analyses for feed power monitor HTA-3A9 circuits. Paragraphs 2-23 through 2-26 provide circuit analyses for transmitter power monitor panel 14A27 circuits.

2-13. Food power Monitor HTA-3A9 Circuit Analysis (fig. FO-4). Feed power monitor HTA-3A9 is functionally divided into four major signal processing and control circuits and two power supplies: pin diode attenuator AT401, pin diode switch S402, power sensor A401, dc amplifier assembly HTA-3A9A1 and power supplies PS401 and PS402. Each of these subassemblies is discussed in paragraphs 2-14 through 2-17, respectively.

2-14. Pin Diode Attenuator AT401 (fig. FO-4, sh 1). Pin diode attenuator AT401 is a nonrepairable, solid-state assembly of pin diodes that operate as a matched attenuator over any continuous 40 dB range within the

limits of -36 dBm to +20 dBm. Initial setting of this continuously variable attenuator is accomplished with ATTEN ADJUST potentiometer R403 which provides the proper amount of bins to the pin diodes to establish the desired range of attenuation. In its forward-biased state, the pin diode behaves as a resistive element over a large range of the microwave spectrum. However, by controlling the bias **current.** the rf resistance is changed. typically from about 1000 ohms to between **1** and 2 ohms. This attenuator uses three pin diode chips configured as a modified T-pad. This arrangement permits operation of the attenuator as a bilaterally matched device. The attenuation is controlled by the values of R402 through R404 which control the bias current through the internal shunt and series elements.

2-15. Pin **Diode Switch S402 (fig. FO-4, sh 1).** Pin diode switch S402 is a nonrepairable, solid-state assembly of pin diodes which acts as an rf switch by the application or nonapplication, of +28 V dc bias via relay K405 (para 2-4). Applying +28 V dc to switch S402 causes positive bias current to flow and the diodes to behave as a very low resistance that shunts the rf line. This causes almost total reflection of the incident rf power. Conversely, removing the +28 V dc restores the normal transmission characteristic by removing the positive bias current.

2-16. Power Sensor A401 (fig. 2-1). Power sensor A401 incorporates a thin-film thermoelectric (tft) element which, acting as a well-matched termination, absorbs the incident rf power and then, by the resultant temperature rise, generates a thermoelectric emf that is proportional to the rf energy. The power sensor is used to measure a sampled rf power within the frequency range from 7.9 to 8.4 GHz. The maximum power that can be applied to the power sensor is 1 mW. Exceeding this power can burn out the thin-film transistor element. The element load consists of bismuth and antimony sections that are deposited on a thin dielectric substrate in a geometric pattern that produces the required configuration of thermoelectric junctions. The temperature differential between the junctions is very small so that the device performs a true square law (rms) function. The dc power output is directly proportional to the absorbed rf power. Inductors L1 and L2 with capacitors C1 and C2, respectively, filter out residual rf frequency components. The compensation network, when connected to the dc amplifier module (para 2-17), compensates for the sensitivity of the specific power sensor and for its effective efficiency at the frequency being measured. Thermistor RT1 stabilizes the output over ambient temperature variations. EFF potentiometer R4 is calibrated directly in terms of effective efficiency. When set to the measured or interpolated value of effective efficiency for the frequency in use, automatic correction of the efficiency error occurs. CAL potentiometer R3 is used to adjust the output signal to the correct level when a known rf level from a standard signal source is applied to the input of the power sensor.

2-17. DC Amplifier Assembly HTA-3A9A1 (fig. FO-4). This assembly consists of six printed circuit boards (pcb). Three dc amplifier printed circuit boards have reference designations assigned in the 1 to 99 block. These three circuit boards include the chopper driver and relays pcb A1A5, integrating and inverting pcb A1A7, and low-noise preamplifier and filter pcb A1A6. The autorange logic pcb A4 and the power supply/counter decoder pcb A1A3 have reference designations assigned to the 101 to 199 block. The auto-zero pcb A1A1 has reference designations assigned in the 201 to 299 block. Paragraphs 2-18 through 2-20 discuss these discrete circuits and associated chassis-mounted parts.

2-18. DC Amplifying (fig. FO-4, sh2). This circuitry is discussed in the following subparagraphs.

a. Modulator and Input Transformer G1-A, T1. The dc input signal is applied via pin 1 of connector J5 to a moving arm of modulator G1-A. G1-A is one half of a mechanical chopper. The dc amplifier feedback signal from emitter-follower Q4 is applied to the center-tap of the primary of input transformer T1 (R11, R13, R15, or R17). Therefore, the difference between the input and feedback offset signals is alternately applied to each half of the transformer primary, producing a square-wave signal that is stepped up in the transformer secondary before being applied to low-noise preamplifier Q1, AR2.

b. Low-Noise Preamplifier Q1, AR2. The square-wave signal from the modulator and input transformer stage is amplified in low-noise preamplifier Q1, AR2 before coupling to the following filter stage. The gain of the AR2 stage is controlled by a voltage divider consisting of series resistor R36 and the automatically selected range resistor (R72, R73, R74, or R75).

c. Filter Amplifier AR3. The AR3 stage is an active bandpass filter centered at 110 Hz. Fine tuning is provided by potentiometer R39. This stage converts the square-wave input from the low-noise preamplifier to a sinusoidal signal.

d. Phase Splitter and Demodulator Q2, Q3, G1-B. Pnp transistors Q2 and Q3 form a phase-splitting circuit which provides biphase signals to the two fixed contacts of demodulator G1-B by means of conventional biphase configuration. The moving arm of demodulator G1-B is synchronously driven with modulator G1-A at the 110 Hz rate. This eliminates much of the asynchronous noise and other spurious frequency components normally present in the carrier.

e. Integrating Amplifier AR4, Q4. The output of the demodulator is applied to solid-state amplifier AR4 which together with emitter-follower A4, feedback resistor R57, and capacitor C23 forms an integrating amplifier. Amplifier gain is determined by the R56/R57 ratio while capacitor C33 sets the bandwidth of the dc amplifier.

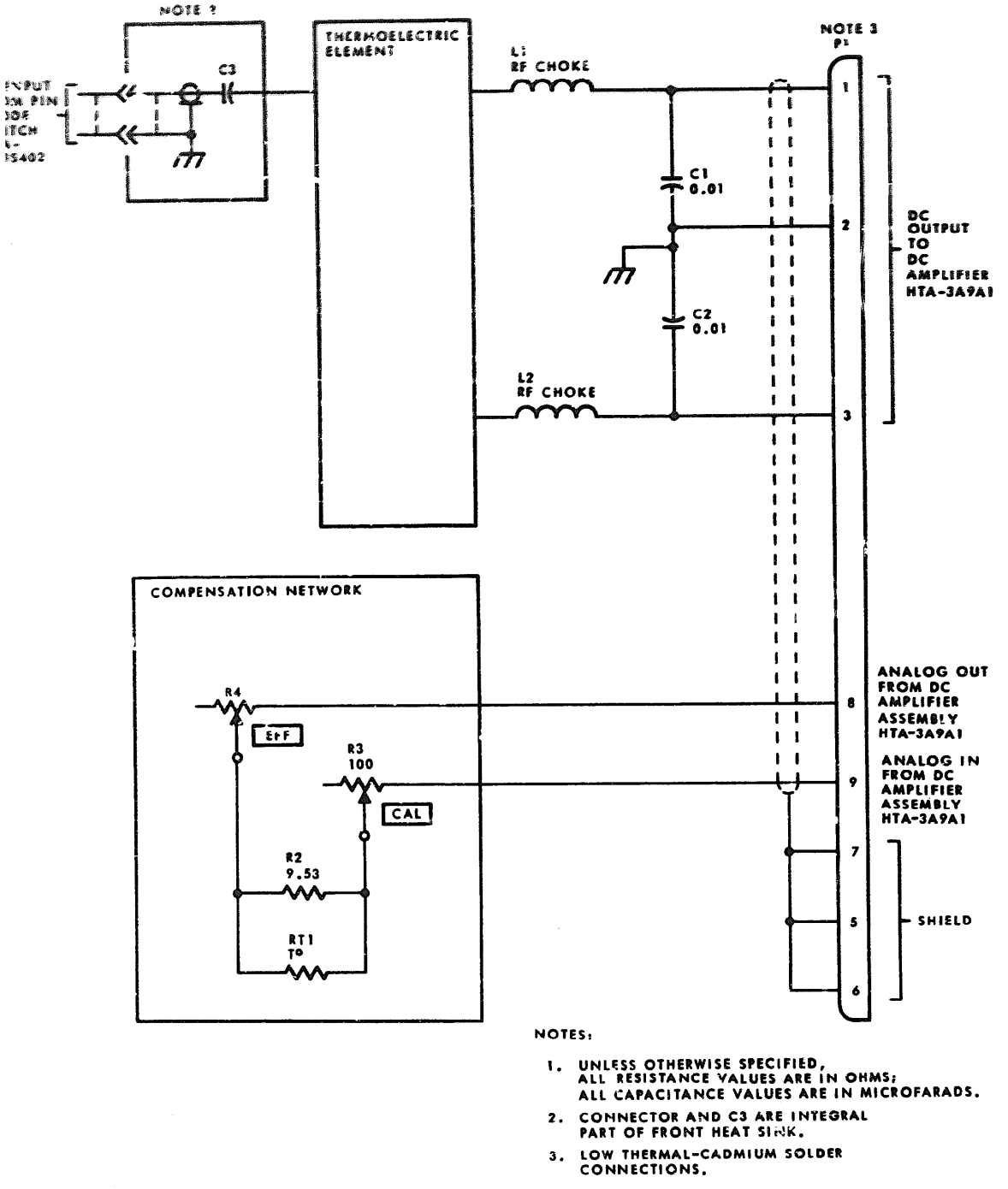


Figure 2-1. Power sensor A401, schematic diagram

f. Feedback Network Q1 Through Q4. Stabilization and gain control are provided by feeding a sample of the integrating amplifier output back to the dc amplifier input through feedback resistors R11, R13, R15, and/or R17. The combination of resistors inserted in the feedback path is a function of the autoranging circuit (para 2-19). The feedback path is from the emitter of Q4 through R62 to the selecting network (R11, R13, R15, R17 and contacts 5 and 6 of relays K4, K3, K2 and K1). The feedback path goes from the selecting network to the primary winding centertap of T1 and through R26 to ground. The voltage drop across R26 and the input signal from power sensor A401 determine the current through the primary of T1. Thus the magnitude of the feedback signal, and therefore the dc amplifier gain, is determined by the ratio of the selected resistor(s) and resistor R26. For example. at range 1 (1 W to 10 W), the feedback path is from R62 through R11, R13, R10, R17 and contacts 5 and 6 of the K1 to R26 and the primary winding centertap of T1. The integrating amplifier output is also connected through a compensation network in power sensor A401 (para 2-16) on pin 8 of connector J5. returning via pin 9 to the input of inverting amplifier AR1. Potentiometer R1 provides dc offset adjustment for this stage. The amplifier output is an analog voltage that varies from 0 to +5 V dc at pin M of connector J2.

g. Chopper Driver Q5 Through Q8. The 110 Hz oscillator that provides the synchronous drive for modulator G1A and demodulator G1B consists of pnp transistors Q5 through Q5 and associated detail parts. This stage is configured as a conventional astable multivibrator that is connected across the mechanical chopper drive coil which is center-tapped to ground. The oscillator frequency is adjusted to I IO Hz by means of potentiometer R35. Test jack TP2 is provided as a convenient point for checking the driver output.

2-19. Autoranging Circuit (fig. FO-4). The autoranging circuit consists of the circuits on the autorange logic pcb A4 (fig. FO-4, sh 1), the power supply/counter decoder pcb A1A3 (fig. FO-4, sh 1), and the K1 through K4 relay/resistor network on the chopper driver and relay pcb A1A5 (fig. FO-4, sh 2). These circuits arc described in detail in the following subparagraphs.

a. Comparator A101. Integrated circuit A101 and associated parts (fig. FO-4, sh 1) form a double-ended limit detector that functions as a range-level comparator to provide a nominal +3 V dc output level (logic 1) when the analog output level at pin M of connector J2 is less than +0.45 V dc or more than +5 V dc. Conversely, it provides a nominal zero output level (logic 0) if the analog signal is between these limits. The output is inverted at inverter A105-12 and applied to the base of common-emitter switch Q103. If the comparator output is a logic 0, Q103 saturates to discharge capacitor C106 and, thereby, prevent a range change.

b. Range-Switching Rate Network Q104. This network consists of unijunction transistor Q104, resistor R113, capacitor C106, and pulse-shaping network A105. The network functions as a conventional 300 ms relaxation oscillator when comparator A101 outputs a logic 1 and capacitor C106 is not clamped. If C106 is clamped to ground. range switching in inhibited. Range switching is inhibited in one of three ways: first, when common-emitter switch Q103 is saturated; second, when the circuit is in its most sensitive range (1 W to 10 W) and the analog signal remains below +0.45 V dc; or third, when the circuit is in its least sensitive range (1 kW to 10 kW) and the analog signal remains above +-5 V dc.

c. Range-Switching Network. The range-switching network consists of counter A104 and associated parts. The network is essentially a two-stage binary counter with input/output logic that permits the selection of a specific relay driver under prescribed conditions. For convenience, the A104 stage with pins 1 through 6 is referred to as counter stage A, while the Al04 stage with pins 8 through 13 is referred to as stage B. Either stage will change state only when a positive-going pulse is applied to its input terminal. Switching occurs only between adjacent ranges and can occur in either direction. Table 2-2 is a binary truth table for range selection. The input/output logic functions required to obtain these combinations are discussed in the subparagraphs that follow the table. Upon initial turnon, the assembly can be in any range. If required, automatic switching will then occur until the proper range is reached. The following discussion assumes that the circuit is in the range 2 state (10 W to 100 W) (A=1, B=0) and that the analog signal exceeds +5 V dc.

Table 2-2. Autoranging Binary Truth Table

Stage A	Stage B	Range no.	Range level
0	0	1	1 W to 10 W
1	0	2	10 W to 100 W
0	1	3	100 W to 1 kW
1	1	4	1 kW to 10 kW

(1) First. the high analog signal is applied to comparator A101. A101 outputs a logic 1 that unclamps common-emitter switch Q103. Capacitor C106 charges toward +15 V dc, and the relaxation oscillator/pulse-shaping network stage generates a pulse. The pulse causes counter A104 stage A to change to a logic 0. Simultaneously. the high analog signal is applied to the base of Q102. Q102 acts as a common-emitter switch, to output a logic 0 that disables A103 (4-6) NAND gate and enables A103 (8-10) NAND gate. The transition of the counter A104 stage A (5) from logic 1 to 0 is applied to A103 (9), which generates a positive-going step voltage. The positive-going step voltage is applied tocounter A104 stage B (11). causing stage B output to change to a logic 1 state. The A=0, B=1 output from binary counter A IO4 is decoded as range 3 by NOR logic gate A102 (4-6). Relay driver Q106 turns on to operate relay K3 in the autoranging circuit and relay K403 in the range selector status circuit. If the analog signal is now within the +0.45 to +5 V range, comparator A101 produces a logic 0, capacitor C106 is discharged through saturated switch Q103. and further range switching is inhibited. If, however, the analog signal is still above +5 V dc. capacitor C106 remains unclamped. After approximately 300 ms, the relaxation oscillator/pulse-forming network stage produces another pulse at A104A (3). Thw low-to-high transition causes A104A to change state. The code is now A=1, B=1, which is decoded as range 4 by NOR gate A102 (1-3). and relay driver Q105 is turned on. The transition of counter stage A102 (1-3) is not coupled to counter stage A104B because the logic 0 output of NAND gate A103 (8-10) and the wired-OR connection at the A103 (8-10) and A103 (4-6) junction is clamped to the logic 0 state. NAND gate A103 (11-13) now clamps capacitor C106 to ground and further switching is inhibited.

(2) For range switching to lower ranges, switch Q102 is turned off. NAND gate A103 (8-10) is disabled and NAND gate Al03 (4-6) is enabled. Comparator A101 outputs a logic I, and range switching reverses direction. If the range-switching function reaches range I, NAND gate (A103 (1-3) clamps capacitor C106, thereby preventing further range switching until measured power exceeds the upper limit of range 1.

d. Range Status Circuit Q105 Through Q108. In addition to selecting the appropriate relay/resistor combinations in the automatic ranging feedback circuit (subparagraph c above), relay drivers Q105 through Q108 also select the appropriate range selector status relay (K401 through K404) which operates to connect a +28 V dc status signal to the applicable output pin of connector J2 (pin J, S, E, or P).

e. Zener *Regulated +5 V dc Power Supply.* Common-base transistor Q101 with zener diode CR101 and associated components comprise a series-regulated power supply. It supplies +5 V dc for the ttl logic on the comparator and trigger pulse logic pcb and the counter decoder pcb. Stage Q101 acts as the variable impedance in series with load fluctuations, while zener diode CR101 and resistor R102 provide the reference voltage.

2-20. Auto-Zero Circuit (fig. FO-4). The auto-zero circuit includes relay K405 (fig. FO-4, sh 1), pin diode switch S402, comparator AR201 (fig. FO-4, sh 2), relay K205, fet stage Q201, and associated parts. Comparator AR201 continuously samples the analog signal output level at pin M of connector J2 (fig. FO-4, sh 1) and compares this level with ground. When METER ZERO switch S4 at transmitter power monitor panel 14A27 is pressed, the control line at pin K of J2 is grounded, and relay K405 (fig. FO-4, sh 1) is energized. Normally open contacts 7 and 8 close to connect ground to pin I of relay K205 (fig. FO-4, sh 2). Since pin 2 of K205 is connected to + 15 V dc. this relay is energized, and capacitor C204 charges to the output level of the comparator through K205 contacts 3 and 4. High impedance fet stage Q201 couples this degenerative sample back to the dc amplifier input. When relay K205 is restored, capacitor C204 retains the charge which provides the degenerative feedback to produce the correct output voltage level for the measured power level.

2-21. Duel 15 V DC Power Supply PS401. Dual +15 V dc, -15 V dc power supply PS401 receives a 120 V ac input via connector J3. The +15 V dc and -15 V dc outputs from PS401 go to pin diode attenuator AT401 and to the dc amplifier. No discussion of the internal circuitry of this power supply is provided since this is a sealed unit which is to be repaired at the factory.

2-22. +28 V DC Power Supply PS401. The +28 V dc power supply, PS402, receives 120 V ac input via connector J3. The +28 V dc output from PS402 goes to relay K405 and to autoranging relays K401 through K404. No discussion of the internal circuitry of this power supply is provided since this is a sealed unit which is to be repaired at the factory.

2-23. Transmitter Power monitor Panel 14A27 Circuit Analysis (fig. FO-6). The circuit analysis of transmitter power monitor panel 14A27 is divided into three parts. Paragraph 2-24 describes the automatic ranging indicator circuits; paragraph 2-25, the feed and power amplifier metering circuits; and paragraph 2-26, the meter zeroing and power shutdown circuits.

2-24. Autoranging Indicator Circuits (fig. FO-4). This circuit consists of the three automatic power range indicators for feed power, power amplifier no. 1, and power amplifier no. 2 measurements. Each indicator is divided into four segments, one of which lights to indicate the power range being monitored. Each segment is marked in increments of 10X over a total range from 1 W to 10 kW. Illuminations of the 12 indicator lamp segments (DS1 through DS12, fig. FO-4, sh 1) is controlled by relays K1 through K8 and K13 through K16 (fig. FO-4, sh 2) which connect +28 V dc to the lamps and. also. ttl logic return to the applicable pin on connector J3, The +26 V dc that operates a particular relay in the FEED POWER METER RANGE indicator circuit is automatically selected by the autoranging circuit in feed power monitor HTA-3A9 (para 2-19). Relay operating voltages for the PA1 and PA2 METER RANGE indicator circuits arc provided by range selection circuits in low or high power amplifier units 31 and 32. The relationship between the input connector pins, the relays, the indicators, and the output connector pins for each of the four power range arc provided in table 2-3.

Table 2-3 Meter Range Circuit Data

Range	Input	Return	Relay	Ind	Output
FEED POWER meter M2					
1 W - 10 W	J2-J	J2-T	K7	DS6	J3-F
10 W - 100 W	J2-S	J2-R	K5	DS8	J3-C
100 W - 1 kW	J2-P	J2-C	K8	DS5	J3-H
1 kW - 10 kW	J2-E	J2-F	K6	DS7	J3-E
PA1 Power meter M1					
1 W - 10 W	J4-b	J4-W	K3	DS2	J3-i
10 W - 100 W	J4-Y	J4-W	K1	DS4	J3-f
100 W - 1 kW	J4-d	J4-W	K4	DS1	J3-k
1 kW - 10 kW	J4-a	J4-W	K2	DS3	J3-h
PA2 Power meter M3					
1 W - 10 W	J4-h	J4-K	K15	DS10	J3-t

Table 2-3 Meter Range Circuit Data-Continued

Range	Input	Return	Relay	Ind	Output
10 W - 100 W	J4-e	J4-K	K13	DS12	J3-q
100 W - 1 kW	J4-j	J4-K	K16	DS9	J3-a
1 kW - 10 kW	J4-q	J4-K	K14	DS11	J3-s

2-23. Food and power Amplifier Metering Circuits **(fig. FO-6, sh 1)**. The metering circuits for feed. power amplifier no. 1. and power amplifier no. 2 display the proportional power derived from each of the power sensing points. The PA1 POWER and PA2 POWER metering circuits are iderrtical. The FEED POWER metering circuit is essentially the same. except the meter includes high and low limit settings. FEED POWER meter M2 is a scaled assembly that contains a meter, light emitting diodes. photo detectors, amplifiers and relays. Two light emitting diodes and two photo diodes are used to detect low and high limits of the meter pointer movement. The *ition of each light emitting diode and photo diode &txtor is controlled by a knob on the front of the meter. The output of each photo diode detector is applied to a transistor amplifier which operates a relay. When the meter pointer reaches either limit, a relay contact closure signal occurs at pins W or X of connector J3. The meter relay cbrcuits obtain ac operating voltage from connector pins J5-A and JS-B via circuit breaker CB1 and line filters FLI and FL2. In addition to being applied to the meters on transmitter power monitor panel 14A27, the analog signals are routed to connector 13. Current-limiting resistors, including *a* series potentiometer, are included in each analog input and output path. The relationship between the input connector pins. the calibrating potentiometer for the output analog signal. and the output pins for the analog signals are tabulated in table 2-4.

Table 2-4 *Analog* Signal *Data*

Transmitter power monitor panel 14A27 signals				System status logic unit signals	
Power meter	Input pin	Potentiometer	Meter ref des	Potentiometer	Output pin
FEED	J2-M	R23	M2	R9	J3-Y
PA1	J4-D	R22	M1	R11	J3-MM
PA2	J4-G	R21	M3	R10	J3-w

2-26. Meter Zeroing and Power Shutdown Circuits **(fig. FO-6, sh 2).** The meter zeroing and power shutdown circuits cons'ist of momentary pushbutton switches that send a contact-closure signal to applicable circuits external to transmitter power monitor panel 14A27. When pressed, METER ZERO switch S4 shorts pins K and U of connector J2 which are connected to the feed power monitor HTA-3A8 auto-zero circuit (para 2-20). Pins K and U of the feed power monitor are connected through interface cabling to pins K and U on transmitter power monitor panel. This energizes K405. The FEED POWER SHUT DOWN. PA2 POWERSHUT DOWN, and PAI POWER SHUT DOWN switches (S3. S2 and S1, respectively) are interlocked so that power amplifier no. I or power amplifier no. 2 can be shut down independently by pressing Sl or S2, or shut down simultaneously by pressing FEED POWER SHUT DOWN switch S3. Pressing PAI POWER SHUT DOWN switch Sl interrupts contmuity a pins s and u of connector 54. Similarly, continuity at pins r and p is interrupted when PA2 POWER SHUT DOWN switch S2 is pressed. Continuity at both sets of pins is interrupted when FEED POWER SHUT DOWN switch S3 is pressed.

CHAPTER 3
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

SECTION I. GENERAL

3-1 General. This chapter contains troubleshooting maintenance, and testing procedures for direct support maintenance of the transmitter power monitor equipment which includes transmitter power monitor panel 14A27 and feed power monitor HTA-3A9. Section I describes the tools and equipment used in direct support maintenance of the transmitter power monitor panel 14A27 and the feed power monitor HTA-3A1 and provides general troubleshooting and repair instructions. Sections II, III, and IV provide troubleshooting, maintenance and performance test information for the transmitter power monitor panel 14A27. Sections V, VI, and VII provide troubleshooting, maintenance and performance test information for the feed power monitor HTA-3A9. Troubleshooting consists of, but is not limited to, locating a faulty subassembly, module, or component. Maintenance consists of removal and replacement of the faulty item and, when necessary, making adjustments on the replaced item. Performance testing consists of checking the transmitter power monitor panel 14A27 and the feed power monitor HTA-3A9 against specific performance standards to make certain these units perform properly before returning to service.

3-2. Voltage and Resistance Measurements. The voltage and resistance measurements required to perform maintenance on transmitter power monitor panel 14A27 and feed power monitor HTA-3A9 are contained in the troubleshooting and performance test tables of this chapter. General procedures for making voltage and resistance measurements are provided in paragraph 3-5.

3-3. Waveform. The waveform data required to perform maintenance on feed power monitor HTA-3A9 is shown on figure FO-4, sheet 2.

3-4. Tools and Equipment. Tools and test equipment required for maintenance are 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, Banana Jack to Size 16 Female Connector		3562	3	Pomona
Adapter, Banana Jack to Size 16 Male Connector		3563	11	Pomona
Adapter, Banana Jack to Size 20 Male Connector		3561	4	Pomona
Adapter, Elbow, OSM Plug to OSM Jack		219	1	Omni Spectra
Adapter, N Plug to N Plug		3842	1	Pomona
Adapter, OSM Plug to N Jack		21030	1	Omni Spectra
Adapter, Single Banana Plug to Binding Post		2894	3	Pomona
Coupler, Directional, 7 to 12 GHz 10 dB		3045C-10	1	Narda Microwave
Crimping Tool		46223-SH	1	
Extraction Tool		91012-1	1	
Fabricated Power Shutdown Inhibit Jumper			2	

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

Common name	Official nomenclature	Part/model no.	Qty	Manufacturer
Generator, Signal, SHF	Generator, Signal SG-944/U	620B	1	Hewlett-Packard
Insertion Tool		380430-2	1	AMP
Meter, Multifunction	Multimeter ME-482(P)/U	3450B,OPT 001,002	1	Hewlett-Packard
Meter, Power, Microwave	Test Set, Radio Frequency Power TS-3596/U	460B	2	General Microwave
Milliammeter, Volt-Ohm-	Multimeter ME-450/U	260-6	1	Simpson
Mount, Thermoelectric	Bolometer, R.F.	N422C	1	General Microwave
Power Supply, Precision	Power Supply, DC Voltage Calibration	2902	P1	Electronic Development
Test Lead, Banana Plug to Alligator Clip		1166-36-B	1	Pomona
Test Lead, Banana Plug to Alligator Clip		1166-36-R	1	Pomona
Test Lead, Banana Plug to Banana Plug		B-12	1	Pomona
Test Lead, Banana Plug to Banana Plug		B-48(B)	4	Pomona
Test Lead, Banana Plug to Banana Plug		B-48(R)	4	Pomona
Test Lead, Banana Plug to Mini Test Clip		3782-36-B	2	Pomona
Test Lead, Banana Plug to Mini Test Clip		3782-36-R	2	Pomona
Test Lead, Banana Plug to Test Probe		1986-36-B	1	Pomona
Test Lead, Banana Plug to Test Probe		1986-36-R	1	Pomona
Test Lead, N Plug to N Plug		1685-T-36	1	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

3-5. General Troubleshooting Instructions. This paragraph contains general procedures for voltage and resistance measurements as an aid to troubleshooting.

a. Voltage Measurements. In-circuit voltage measurements are useful in isolating a defective component or stage.

(1) 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 voltmeter or oscilloscope.

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

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

b. In-Circuit Resistance Measurments. In-circuit checking of components should be carried out as much as possible. Most components can be checked for open or shorted conditions, using the allocated multimeter. Use the 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, broken wires, etc. Continuity checks using the allocated 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. With diodes of type IN649 or similar. place the black (-) lead of multimeter on the cathode, and red (+) on the anode; the meter should

indicate approximately 400 ohms. Reverse the leads and a very high or infinite resistance should be obtained, depending upon the circuit configuration.

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 3-6*b* below), and check as described in subparagraph 3-5*b* above. Only one end need be disconnected in order to check diodes.

3-6. 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 thermal (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 perform the soldering operation quickly to avoid applying 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 the 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 soldering points, using ethyl or isopropyl alcohol.

(7) Remove the conformal coating from the joint to be soldered with a broad bladed 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 temperature to prevent unreliable joints and damage to parts. Use heat sinks such as longnose pliers, to protect the components.

(10) Allow the solder to cool at 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. Components Replacement. The following subparagraphs provide general instructions for replacement of chassis mounted components. For replacement of components mounted on printed circuit 'boards, refer to general support maintenance instructions, chapter 4.

(1) Tag electrical wires connected to component for identification. Unsolder leads from component by following approved unsoldering procedures (para 3-6*a* above).

(2) Remove component.

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

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

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

(6) When components are mounted on standoff terminals, allow sufficient slack in the component leads 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 strip ping 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). Ail portions of standard wire and components leads that will be soldered should be properly tinned before attachment.

(9) Use the correct type of insulated, heat-shrinkable sleeving when replacing a circuit breaker. Use a thermogun for shrinking the sleeving.

a. Component Replacement Procedure. Componenent replacement procedures are as follows:

(1) ***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 3-6*a* above).

(2) ***Small components (fig. FO-1).*** Small fixed capacitors, chokes, fixed resistors, varicaps, and diodes are all replaced following the general procedures described in subparagraph 3-6*b* above. Observe polarity on all types of diodes, varicaps, and electrolytic capacitors. Figure FO-2 illustrates color code markings for small components.

(3) ***Potentiometers.*** Replace the component following general procedures in subparagraph 3-6*b* above; refer to applicable paragraph for alignment procedures.

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

(1) Tag and disconnect cable to faulty connector.
(2) Remove screws, washers, and nuts securing connector to panel.
(3) Remove connector.
(4) Clean all wires of solder and ensure that the wires are properly stripped.
(5) Fill the pin cups on the replacement connector with a small amount of solder.
(6) Identify wires by tag and insert and solder wire ends into the pin cups.
(7) 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.
(8) Install the connector on the panel and secure to panel with screws, washers, and nuts.
(9) Identify cable 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 the connector nut and gasket over the cable and remove 5/16 inch of the outer covering of the cable.
(2) Comb the braid and fold it out.
(3) Pull the 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 the dielectric to the correct length so that the contact pin fits snugly against the center conductor.
(6) Solder the contact pin to the center conductor through the opening in the contact pin.
(7) Insert the cable end with the soldered contact into the connector body.
(8) Ensure that the contact pin is properly seated in the connector body. Tighten the 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 inch between the end of the contact and the top of the insulator.

SECTION II. TROUBLESHOOTING OF TRANSMITTER POWER MONITOR PANEL 14A27

3-7. General. This section contains preliminary procedures and troubleshooting procedures necessary for fault localization to a malfunctioning subassembly or part within transmitter power monitor panel 14A27 after referral by organizational maintenance. Preliminary procedures consist of obtaining the listed test equipment, making the prescribed test connections, and initially setting equipment controls to specified settings. These settings and all subsequent settings given in the troubleshooting table must be made carefully to ensure accurate test results. When a troubleshooting procedure specifies replacement or adjustment of a malfunctioning component, refer to section III in this chapter.

3-8 Tool Equipment and Material the test equipment required for troubleshooting transmitter power monitor panel 14A27.

Table 3-2. Test Equipment Required for Transmitter Power Monitor Panel 14A27 Maintenance

Common name	Part/model no.	Qty	Manufacturer
Adapter, Banana Jack to Size 16 Male Connector 3563	3563	2	Pomona
Adapter, Banana Jack to Size 20 Male Connector	3561	2	Pomona
Crimping Tool	46223-SH	1	
Extraction Tool	91012-1	1	
Fabricated Power Shutdown Inhibit Jumper		2	
Insertion Tool	380430-2	1	AMP
Meter, Multifunction	3450B	1	Hewlett-Packard
Power Supply, Precision	2902	1	Electronic Development
Test Lead, Banana Plug to Alligator Clip	1166-36-B	1	Pomona
Test Lead, Banana Plug to Alligator Clip	1166-36-R	1	Pomona
Test Lead, Banana Plug to Banana Plug	B-12	3	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
Test Lead, Banana Plug to Mini Test Clip	3782-36-B	1	Pomona
Test Lead, Banana Plug to Mini Test Clip	3782-36-R	1	Pomona

3-9. Fabrication of Power Shutdown Inhibit Jumpers.

This paragraph contains crimping tool adjustment procedures and fabrication of power shutdown inhibit jumpers required for troubleshooting.

a. Insulation Crimping Adjustment (fig. 3-2). To adjust crimping tool 46223-SH, proceed as follows:

(1) Set insulation crimping adjustment pins in the 3 (loose) position (part A, fig. 3-1).
(2) Place a tape pin in the crimping tool (part B, fig. 3-1) and insert an unstripped wire into insulation grip part of taper pin sleeve.
(3) Crimp taper pin and remove from tool.
(4) Bend wire back and forth one time. If wire pulls out, insert pins in the 2 (medium) position. Crimp another pin and check. If wire pulls out again, use the I (tight) position.

6. Terminal Locator Adjustment (fig. 3-P). To adjust the terminal locator proceed as follows:

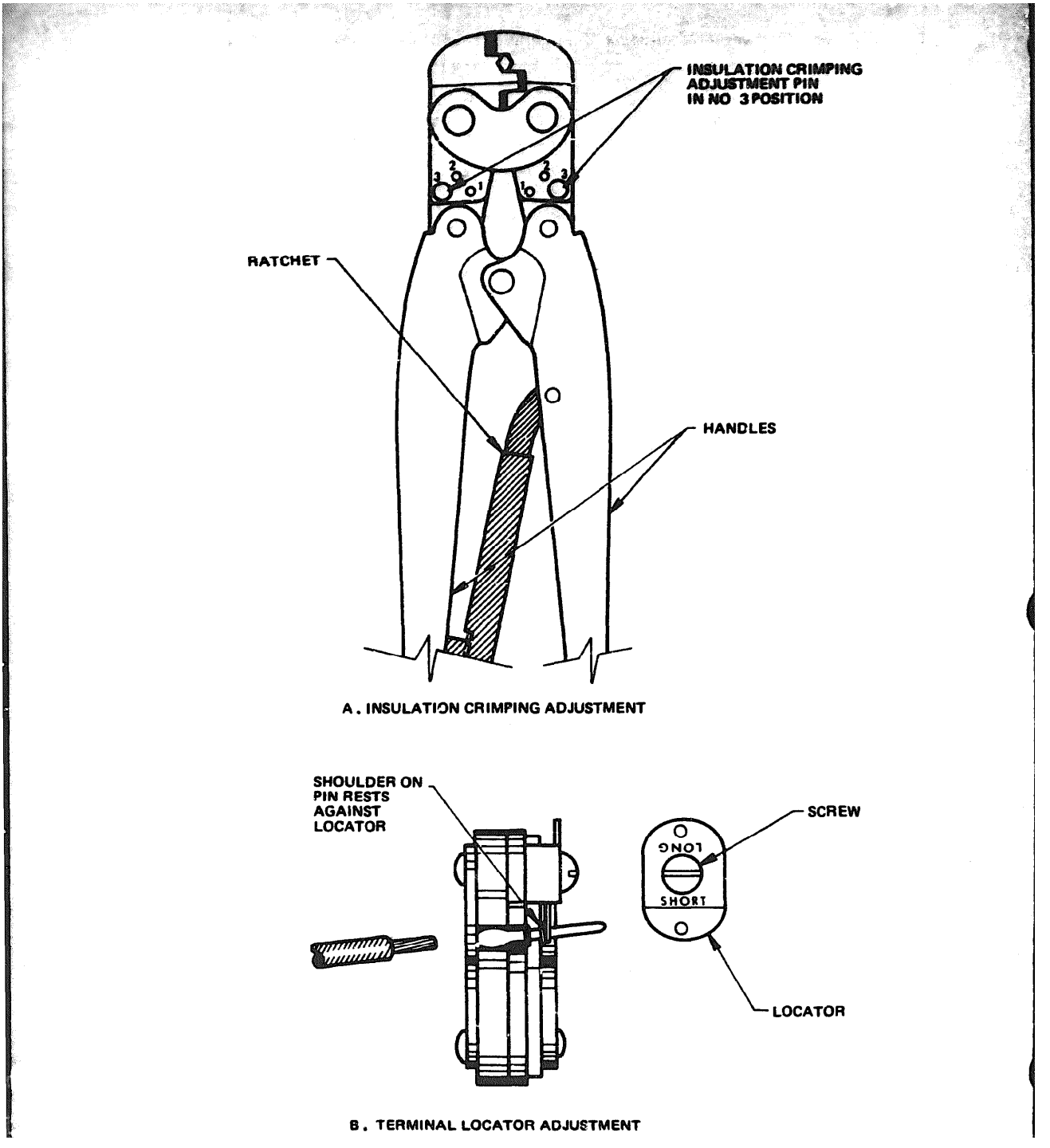
(1) Remove screw (part B, fig. 3-l).
(2) Set locator as shown to orient tool for crimping the 42575-3 taper pin (short shoulder).
(3) Install and tighten screws.

c. Crimping Procedure (fig. 3-l). To use crimping tool 46223-SH proceed as follows:

(1) Open tool handles (part A, fig. 3-1) and place taper pin in dies with tip of pin through locator (part B).
(2) Hold taper pin in place and squeeze tool handles until dies close on pin just enough to hold pin in place.
(3) Insert stripped wire in taper pin.
(4) Holding wire in place, squeeze handles until ratchet releases.
(5) Remove crimped taper pin from tool.

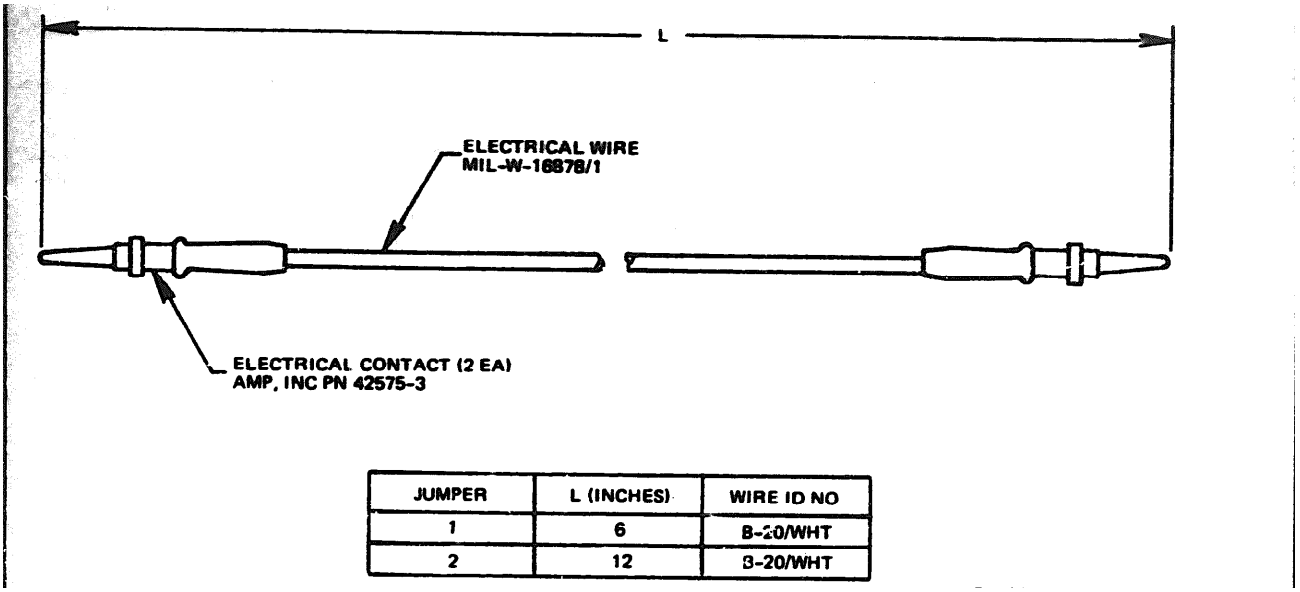
d. Jumper Fabrication (fig. 3-2). To fabricate the power shutdown inhibit jumpers shown in figure 3-2, proceed as follows:

(1) Cut two lengths of electrical wire MIL-W-16878/1 B-20 at 6 and 12 inches each.
(2) Strip 3/16 inch of insulation from each of the four wire ends.
(3) Install electrical contact 42575-3 on each stripped wire end, using crimping tool 46223-SH (fig. 3-l).



EL5895-912-34-TM-6

Figure 3-1. Crimping tool 46223-SH.



JUMPER	L (INCHES)	WIRE ID NO
1	6	B-20/WHT
2	12	B-20/WHT

EL5895-912-34-TM-7

Figure 3-2 Power shutdown inhibit jumper. fabrication diagram.

3-10. Test connections and Conditions (fig. 3-3). **Troubleshooting the transmitter power monitor panel is accomplished after disconnecting cable connector plugs that mate with connector receptacles J2, J3, and J4 on the rear of transmitter power monitor panel 14A27. To prevent system alarm or system shutdown conditions, disconnect these connector plugs only when directed to do so in** table 3-3.

a. Initial Preparations. Prior to troubleshooting the transmitter power monitor equipment, inform operations personnel that maintenance is to be performed. Instruct operations personnel to establish the manual mode of operation for the transmit interfacility link amplifiers 8A12, 8A13 and power amplifier circuits units 31, 32 and to monitor uplink levels on power amplifier meters 1 and 2. Refer to TM- 11-5895-898-12 and TM 11-5895-899-12 for illustrations depicting the equipment involved.

b. Inhibiting PA1 Power ***Shutdown (fig. 3-4).*** Disconnecting the interface connector plug that mates with transmitter power monitor panel 14A27 connector receptacle J4 normally shuts down both power amplifiers. To prevent shutdown, perform the following jumpering procedures at signal interconnecting box 21A1, using the 6-inch power shutdown inhibit jumper and insertion tool. Make jumper connections carefully and exactly as specified.

WARNING

To avoid shock hazard, do not touch the chassis. ground bar. or another receptacle while performing these procedures.

(1) Place wire barrel of taper pin terminal in slot in insertion tool tip (A) with wire slanting out through side of tip.

(2) Using finger to hold wire in place, insert taper pin terminal connected to 12-inch jumper into a vacant receptacle of 1VW on terminal board 21A1TB7. Push insertion tool toward receptacle with a straight steady motion until tool trips.

CAUTION

When using the insertion tool, use only one stroke for each insertion. Extra strokes may damage receptacle.

CAUTION

Do not bend or twist terminal during tool removal. If bent or twisted, remove and reinsert terminal.

(3) Carefully remove insertion tool from terminal.

(4) Repeat procedure by inserting other end of 12-inch jumper into a vacant receptacle of 1AB on terminal board 21A1TB9.

c. Inhibiting PA2 *Power Shutdown* (fig. 3-4). Perform the following jumpering procedures using the 6-inch power shutdown inhibit jumper and insertion tool (fig. 3-4). Observe same warning and cautions as in preceding steps 3-10b(1) through b(4).

(1) Insert taper pin terminal connected to 6-inch jumper into a vacant receptacle of 1NP on terminal board 21A1TB7.

(2) Insert other end of 6-inch jumper into a vacant receptacle of 1RS on terminal board 21A1TB7.

NOTE

The connector plug that mates with transmitter power monitor panel 14A27 connector receptacle J4 can now be disconnected without shutting down the uplink power.

d. *Restoring* PA1 and PA2 Power Shutdown Circuits (fig. 3-5). After completing repair and test of transmitter power monitor panel 14A27, PA1 and PA2 shutdown circuits must be restored to an operative condition. To restore the shutdown circuits to operation, use extraction tool (fig. 3-5) and proceed as follows:

WARNING

To avoid shock hazard, do not touch the chassis. ground bar, or another receptacle while performing these procedures.

(1) Reconnect the mating connector plug to transmitter power monitor panel 14A27 receptacle J4.

(2) Place tip of extraction tool between the two shoulders on taper pin terminal (A).

(3) Pull trigger and carefully remove taper pin terminal and 6-inch inhibit jumper from receptacle in receptacle housing.

(4) Repeat steps 2 and 3 for removal of the 12-inch inhibit jumper.

e. *Initial Test Setup.* Prepare transmitter power monitor panel 14A27 for troubleshooting as follows:

(1) Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.

(2) Loosen eight twist lock fastener studs that hold the top cover to chassis and remove cover.

(3) Connect test equipment as shown in figure 3-6.

3-11. Initial Control Settings.

a. On precision power supply, set controls as follows:

Control	Position
POWER	ON
POLARITY	PLUS
VOLTAGE UNIT/STEP	ZERO
ZERO/USE	ZERO
ZERO ADJ	Adjust for 0 V dc indication on galvanometer meter.
ZERO/USE	USE

b. On multifunction meter, set controls as follows:

Control	Position
LINE SWITCH	on (up) position
FUNCTION	OHMS
RANGE.	AUTO
CONTROL	LOCAL
TRIGGER	INT

c. On transmitter power monitor panel 14A27, set the power switch to the ON position.

3-21. Troubleshooting Procedure (fig. 3-3, 3-7, 3-8, FO-6).

a. Perform the necessary troubleshooting procedures in table 3-3 as specified by sympton/probable cause chart (subparagraph b below). Use the transmitter power monitor panel schematic (fig. FO-6) as an aid in performing the troubleshooting procedures. Perform wiring continuity checks, if required, using the multifunction meter. For test point and part locations refer to figures 3-3, 3-7, and 3-8.

b. Perform the necessary troubleshooting procedures in table 3-3 as specified by the symptom/probable cause listing below.

Symptom	Probable cause
Power ON-OFF switch ON. FEED POWER meter indicates abnormal	FEED POWER meter M2 out of calibration. A1R1, A1R2, or R23 out of tolerance.

Symptom	Probable cause
reading	Perfo ... steps 1 and 2.
EED POWER METER RANGE 1W-10W indicator does not light and meter	Indicator DS6 lamp defective. Relay K7 or diode A2CR7 defective. Perform step 6.
EED POWER METER RANGE 10W-100W indicator does not light and meter indication is normal.	Indicator DS8 lamp defective. Relay K5 or diode A2CR5 defective. Perform step 8.
EED POWER METER RANGE 100W-1KW indicator does not light and meter indication is normal.	Indicator DS5 lamp defective. Relay K8 or diodes A2CR8 defective. Perform step 10.
EED POWER METER RANGE 1KW-10KW indicator does not light and meter indication is normal.	Indicator DS7 lamp defective. Relay K6 or diode A2CR6 defective. Perform step 12.
ed power METER ZERO indication.	Feed power METER ZERO switch S4 defective. Perform step 14.
ed power meter SHUTDOWN indication abnormal.	Feed power meter SHUTDOWN switch S3 defective. Perform steps 15 and 16.
A1 power meter indicates abnormal reading.	2A1 POWER meter M2 out of calibration. A1R9 A1R10. or R22 out of tolerance. Perform steps 17 and 18.
A1 POWER METER RANGE 1W-10W indicator does not light and meter indication is normal.	Indicator DS2 lamp defective. Relay K3 or diode A2CR3 defective. Perform steps 19 and 20.
A1 POWER METER RANGE 10W-100W indicator does not light and meter indication is normal.	Indicator DS4 lamp defective. Relay K1 or diode A2CR1 defective. Perform steps 21 and 22.
PA1 POWER METER RANGE 100W-1KW indicator does not light and meter indication is normal.	Indicator DS9 lamp defective. Relay K4 or diode A2CR4 defective. Perform steps 23 and 24.
PA1 POWER METER RANGE 1KW-10W indicator does not light and meter indication is normal.	Indicator DS3 lamp defective. Relay K2 or diode A2CR2. defective. Perform steps 25 and 26.
PA2 POWER meter indicates abnormal reading.	PA2 POWER meter M3 out of calibration. A1R5. A1R6 or R21 out of tolerance. Perform steps 27 and 28.
PA2 POWER METER RANGE 1W-10W indicator does not light and meter indication is normal.	Indicator DS10 lamp defective. Relay K15 or diode ,A2CR15 defective. Perform steps 29 and 30.
PA2 POWER METER RANGE 10W- 1OOW indicator does not light and meter indication is normal.	Indicator DS12 lamp defective. Relay K13 or diode A2CR13 defective. Perform steps 31 and 32.
PA2 POWER METER RANGE 100W-1KW indicator does not light and meter indication is normal.	Indicator DS9 lamp defective. Relay K16 or diode A2CR16 defective. Perform steps 33 and 34.
PA2 POWER METER RANGE 1KW- 10KW indicator does not light and meter indication is normal.	Indicator DS11 lamp defective. Relay K14 or diode A2CR14 defective. Perform steps 35 and 36.
PA1 POWER SHUTD0WN indication abnormal.	PA1 POWER SHUTDOWN witch S1 defective. Perform step 37.
PA2 POWER SHUTDOWN indication abnormal.	PA2 POWER SHUTDOWN switch S2 defective. Perform step 38.

Table 3-3. Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	FEED POWER meter adjustment	a. Establish initial control settings (para 3-11).	Disconnect connector plugs from connector receptacles J2 and J3 (fig. 3-3).		
		b. On FEED POWER meter, set upper limit pointer above 5 and lower limit pointer below 0.			
		c. On precision power supply, set RANGE switch to 10 V. Set VOLTAGE UNIT/STEP switch sequentially to 2.50000 and 5.00000.		FEED POWER meter reading is twice that of the precision power supply as output is varied from 0 to +5.	A minor alarm indication will appear on fault and system status panel 14A16 when plug for J2 is disconnected. If indication is normal, proceed to step 3. If abnormal, attempt adjustment procedures (para. 3-28). If indication is still abnormal, proceed to step 2.
		d. After check, return limit pointers to original settings.	Connect precision power supply test leads to test points M2-B (-blk) and A1-6 (+red).		
2	FEED POWER meter circuit	a. On transmitter power monitor panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y.	Measure resistance of A1R1, A1R2 and R23.	A1R1-1235 to 1365 A1R2-5890 to 6510 R23-2450 to 2625	If indication is normal and adjustment procedures are unsuccessful, replace FEED POWER meter M2 as directed in section III of this chapter. If indication is abnormal, replace faulty A1R1, A1R2 or R3 as directed in section I of this chapter.
		c. After resistance measurements are com pleted, set transmitter power monitor panel power circuit breakers to ON.	Reconnect connector plugs to J2 and J3.		
3	FEED POWER meter limit alarm relay circuit	a. On precision power supply, set RANGE switch to 10V, VOLTAGE UNIT/STEP switches to a point just below meter lower limit pointer setting, then adjust progressively to a point just above upper	Disconnect connector plugs from connector receptacles J2 and J3 (fig. 3-3). Connect precision power supply test/leads to test points M2-B (-blk) and A1-6 (+red).		

Table 3-3. Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure-Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
		limit pointer setting. b. On multifunction meter, set FUNCTION switch to OHMS and connect two B-12 leads across X and Y terminals of multifunction meter.	Using 1166-36 test leads, connect multifunction meter test leads to M2-25 and M2-13 (fig. 3-6).	Multifunction meter indicates 0 ohms when precision power supply output is below lower limit setting or above upper limit setting and infinity when output is between limit settings.	If indication is normal proceed to step 6. If indication is abnormal, proceed to step 4.
4	FEED POWER meter limit alarm relay circuit	a. On transmitter power monitor panel, set power circuit breaker to OFF. b. On multifunction meter, set FUNCTION switch to AC. c. On transmitter power monitor panel, set power circuit breaker to ON.	Connect multifunction meter test leads to CB1-1 (-blk) and CB1-3 (+red).	120 ± 12 V ac	If indication is normal, proceed to step 5. If indication is abnormal, replace power ON-OFF circuit breaker CB1 as directed in section III of this chapter.
5	FEED POWER meter filters FL1 and FL2	a. On transmitter power monitor panel, set power circuit breaker to OFF. b. On transmitter power monitor panel, set power circuit breaker to ON. c. Test complete.	Connect multifunction meter test leads to M2-8 (-blk) and M2-9 (+red). Reconnect connector plugs to J2 and J3.	120 ± 12 V ac	If indication is normal, replace FEED POWER meter M2 as directed in section III of this chapter. If indication is abnormal, replace filter FL1 and/or FL2 as directed in section III of this chapter.
6	FEED POWER METER RANGE 1W-10W inditor DS6	a. Make test connections. b. On precision power supply, set RANGE switch to 100 V. Set	Disconnect connector plugs from connector recep tacles J2 and J3 (fig. 3-3). Connect precision power supply leads to test points A2-10 (-blk) and	1W-10W indicator DS6 lights.	If indication is normal, proceed to step 8.

Table 3-3 Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
		VOLTAGE UNIT/ STEPswitch to 26.0000.	A2-13 (+red).		If indication is abnormal, remove DS6 and check for continuity. Replace defective indicator light and proceed to step 7.
7	FEED POWER METER RANGE 1W-10W relay K7	a. On transmitter power monitor panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across X and Y terminals of multifunction meter.	Remove relay K7 before making diode checks. Connect multifunction meter to diode A2CR7 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 meg ohms or greater	If diode indication is abnormal, replace faulty diode A2CR7. If diode indication is normal, replace relay K7.
			Reconnect connector plugs to J2 and J3.		
8	FEED POWER METER RANGE 10W-100W indicator DS8	a. Make test connections	Disconnect connector plugs from connector receptacles J2 and J3. (fig. 3-3).		
		b. On precision power supply, set RANGE switch to 100 V. Set VOLTAGE UNIT/ STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-10 (-blk) and A2-9 (+red).	10W-100W indicator DS8 lights.	If indication is normal, proceed to step 10. If indication is abnormal, remove DS8 and check for continuity Replace defective indicator light and proceed to step 9.
9	FEED POWER METER RANGE 10W-100W relay K5	a. On transmitter power monitor panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads to X and Y terminals of multifunction meter.	Remove relay K5 (para 3-21) before making diode checks. Connect multifunction meter to diode A2CR5 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 megohms or greater	If diode indication is abnormal, replace faulty diode A2CR5. If diode indication is normal, replace relay K5.
		c. Test complete.	Reconnect connector plugs to connector receptacles J2 and J3.		
10	FEED POWER METER RANGE 100W-1KW indica-	a. Make test connections.	Disconnect connector plugs from connector receptacles J2 and J3 (fig. 3-3).		

Table 3-3 Transmitter Power Monitor Panel 14A27 troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	tor DS5	b. On precision power supply, set RANGE switch to 100 V. Set VOLTAGE UNIT/ STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-10 (-blk) and A2-15 (+red)	100W-1KW indicator DS5 lights.	If indication is normal, proceed to step 12. If indication is abnormal. remove DS5 and check for continuity. Replace defective indicator light and proceed to step 11.
11	FEED POWER 100W-1KW relay K8	a. On transmitter panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads to X and Y terminals of multifunction meter.	Remove relay K8 before making diode checks. Connect multifunction meter to diode A2CR8 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 megohms or greater	If diode indication is abnormal, replace faulty diode A2CR8. If diode indication is normal, replace relay K8.
		c. Test complete.	Reconnect connector plugs to connector recep tacles J2 and J3.		
12	FEED POWER METER RANGE 1KW-10KW indicator DS7	a. Make test connections.	Disconnect connector plugs from connector receptacles J2 and J3 (fig. 3-3).		
		b. On precision power supply, set RANGE switch to 100 V. Set VOLTAGE UNIT/ STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-10 (-blk) and A2-11 (+red)	1KW-10KW indicator DS7 lights.	If indication is normal, proceed to step 14. If indication is abnormal, remove DS7 and check for continuity. Replace defective indicator light and proceed to step 13.
13	FEED POWER METER RANGE 1KW-10KW relay K6	a. On transmitter power monitor panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads to X and Y terminals of multifunction meter.	Remove relay K6 (para 3-21) before making diode checks. Connect multifunction meter to diode A2CR6 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 megohms or greater	If diode indication is abnormal, replace faulty diode A2CR6. If diode indication is normal, replace replay K6.
		c. Test complete.	Reconnect connector plugs J2 and J3 (fig. 3-3).		
4	FEED POWER METER ZERO switch	a. On transmitter power monitor panel, set pow-			

Table 3-3 Transmitter power monitor Panel 14A27 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	S4	er circuit breaker to OFF. b. Set multifunction meter to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Connect multifunction meter leads to J2-K and J2-U.	Multifunction meter indicates zero ohms when S4 is pressed and infinity when S4 released.	If indication is normal, proceed to step 15. If indication is abnormal, replace switch S4 as directed in section III of this chapter.
		CAUTION **Before proceeding with steps 15 through 38, inhibit uplink power shutdown by performing jumpering procedures as directed in paragraph 3-10b and 3-10c.**			
15	FEED SHUTDOWN switch S3	a. Make test connections.	Disconnect connector plug from connector receptacle J4.		
		b. Set multifunction meter to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Connect multifunction meter test leads to J4-s and J4-u	Multifunction meter indicates infinity when S3 is pressed and zero ohms when S3 is released.	If indication is normal, proceed to step 16. If indication is abnormal, replace switch S3 as directed in section III of this chapter.
16	FEED POWER METER SHUTDOWN switch S3	a. Make test connections	Connect multifunction meter test leads to J4-p and J4-r.	Multifunction meter indicates infinity when S3 is pressed as zero ohms when S3 is released.	If indication is normal, proceed to step 17. If indication is abnormal, replace switch S3 as directed in section III of this chapter.
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
17	PA1 POWER meter M1 adjustment	a. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
		b. On precision power supply, set RANGE switch to 10V. Set VOLTAGE UNIT/STEP switch sequentially to 2.50000 and 5.00000.	Connect precision power supply test leads to test points A1-22 (+red) and negative terminal of M1.	PA1 POWER meter scale reading is twice that of the precision power supply setting as the supply output is varied from +2.5 to +5 V dc.	If indication is normal, proceed to step 19. If indication is abnormal, attempt adjustment procedures (para 3-28). If indication cannot be corrected, proceed to step 18.
18	PA1 POWER meter	a. On transmitter power			

table 3-3 Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	M1 circuit	monitor panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Measure resisuance of A1R9, A1R10, and R22.	A1R9-1235 to 1365 ohms A1R10-5890 to 6510 ohms R22-2540 to 2625 ohms	If indication is normal and adjustment procedures are unsuccessful, replace PA1 POWER meter M1 as directed in section III of this chapter. If indication is abnormal, replace faulty resistor A1R9, A1R10, or R22 as directed in section III of this chapter.
		c. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
19	PA1 POWER METER RANGE 1W-10W indicator DS2	a. On transmitter power monitor panel, set power circuit breaker to ON.			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
		c. On precision power supply, set RANGE VOLTAGE UNIT/STEP switch to 100 V. Set VOLTAGE UNIT/STEP switch to 26.0000.	Connect precision power supply test (-blk) and A2-5 (+red). leads to test points A2-8	Indicator DS2 lights.	If indication is normal, proceed to step 21. and check for continuity. Replace If indication is abnormal, remove DS2 defective indicator light and proceed to step 20.
20	PA1 POWER METER RANGE 1W-10W relay K3	a. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Remove relay K3 (para 3-21) before making diode checks. Connect multifunction meter to diode A2CR3 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 megohms or greater	If diode indication is abnormal, replace faulty diode A2CR3. If diode indication is normal, replace relay K3.
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
21	PA1 POWER METER RANGE 10W-100W indicator DS4	a. On transmitter power monitor, set power circuit breaker to OFF.			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		

Table 3-3 Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	METER RANGE 10W-100W relay K1	c. On precision power supply, set RANGE switch to 100 V. Set VOLTAGE/UNIT STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-8 (-blk) and A2-1 (+red).	10W-100W indicator DS4 lights.	If indication is normal, proceed to step 23. If indication is abnormal, remove DS4 and check for continuity. Replace defective indicator light and proceed to step 22.
22	PA1 POWER METER RANGE 10W-100W relay K1.	a. On multifunction meter set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Remove relay K1 before making diode checks. Connect multifunction meter to diode A2CR1 (Fig. 3-8).	Forward resistance 400 ohms or less. Reverse resistance 30 megohms or greater.	If diode indication is abnormal, replace faulty diode A2CR1. If diode indication is normal, replace relay K1.
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
23	PA1 POWER METER RANGE 100W-1KW indicator DS9	a. On transmitter power monitor HTA-3A9, set power circuit breaker to OFF.			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
		c. On precision power supply, set RANGE switch to 100V. Set VOLTAGE/UNIT STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-8 (-blk) and A2-7 (+red) (fig. 3-8).	100W-1KW indicator DS9 lights.	If indication is normal, proceed to step 25. If indication is abnormal, remove DS9 and check for continuity. Replace defective indicator light and proceed to step 24.
24	PA1 POWER METER RANGE 100W-1KW relay K4	a. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Remove relay K4 (para 3-21) before making diode checks. Connect multifunction meter to diode A2CR4 (fig. 3-8).	Forward resistance 400 ohms or less. Reverse resistance 30 megohms or greater	If diode indication is abnormal, replace faulty diode A2CR4. If diode indication is normal, replace relay K4.
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
25	PA1 POWER METER RANGE 1KW-100KW indicator DS3	a. On transmitter power monitor panel, set power circuit breaker to OFF.			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle.		
		c. On precision power	Connect precision power	1KW-10KW in-	If indication is normal,

Table 3-3 Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
		supply, set range switch to 100 V. Set VOLTAGE/UNIT STEP switch to 26.0000.	supply test leads to test points A2-3 (-blk) and A2-3 (+red).	indicator DS3 lights.	proceed to step 27. If indicator is abnormal, remove DS3 and check for continuity. Replace faulty indicator light and proceed to step 26.
26	PA1 POWER METER RANGE 1KW-10KW relay K2	a. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Remove relay K2 (para 3-21) before making diode check. Connect multifunction meter to diode A2CR2 (fig. 3-8)	Forward resistance 400 ohms or less Reverse resistance 30 megohms or greater	If diode indication is abnormal, replace faulty diode A2CR2. If diode indication is normal, replace relay K2.
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
27	PA2 POWER METER M3 adjustment	a. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
		b. On precision power supply, set RANGE switch to 10V. Set VOLTAGE UNIT/STEP switch sequentially to 2.50000 and 5.00000.	Connect precision power supply test leads to test points A1-14 (+red) and negative terminal of M3 (fig. 3-3 and 3-7).	PA2 POWER meter scale reading is twice that of the precision power supply setting as the supply output is varied from +2.5 to +5 V dc.	If indication is normal, proceed to step 30. Attempt adjustment procedures (para 3-28). If indication is abnormal, proceed to step 29.
28	PA2 POWER METER M3 circuit	a. On transmitter power monitor panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Measure resistance of A1R5, A1R6, and R21.	A1R5-1235 to 1365 ohms A1R6-5890 to 6510 ohms R21-2450 to 2625 ohms	If indication is normal and adjustment procedures are unsuccessful, replace PA2 POWER meter M3 as directed in section III of this chapter. If indication is abnormal, replace faulty resistor as directed in section III of this chapter.
		c. Restore power shutdown as rected in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
29	PA2 POWER ME-	a. On transmitter power			

Table 3-3 Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure - Continued

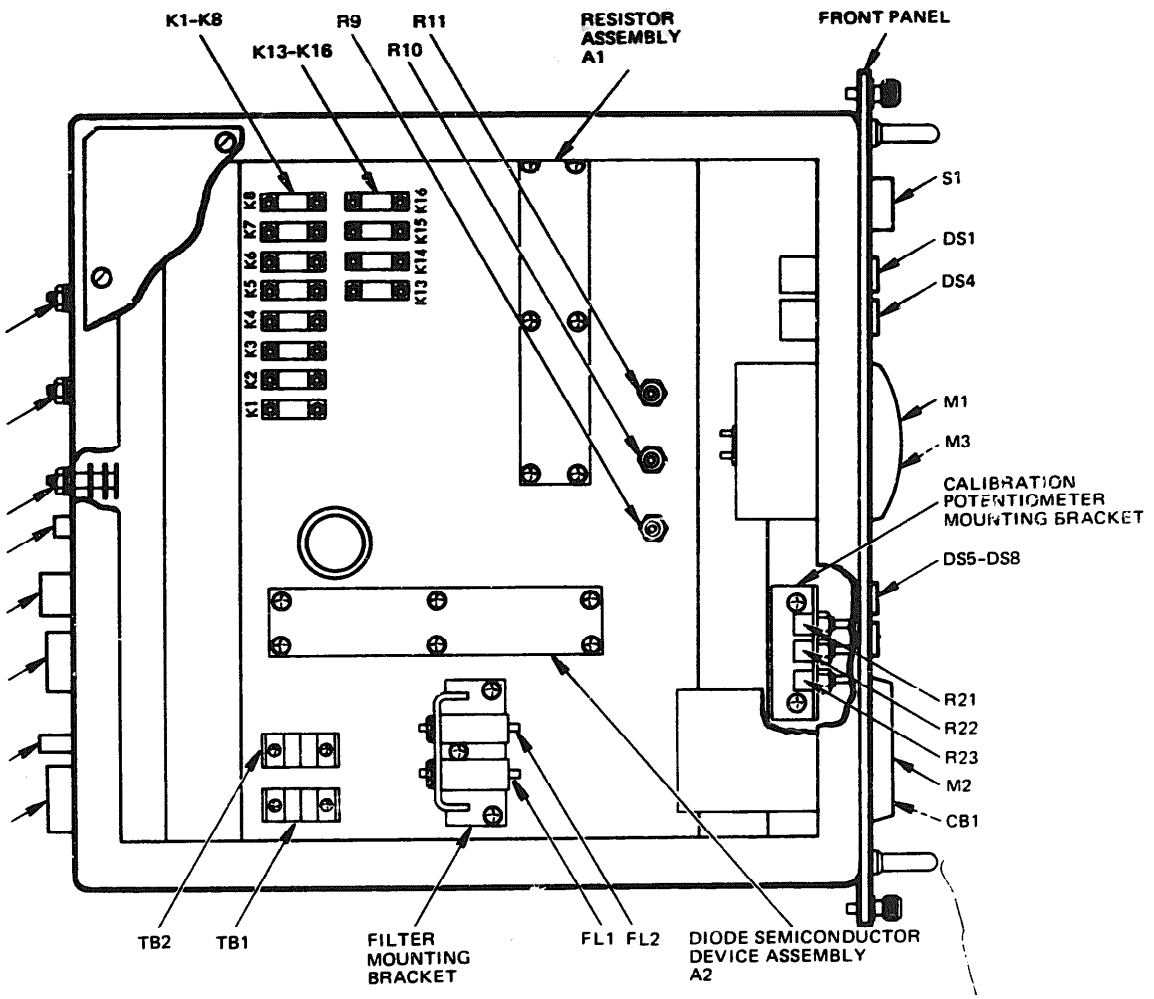
Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	TER RANGE 1W-10W indicator DS10	monitor panel, set power circuit power circuit breaker to OFF.			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
		c. On precision power supply, set RANGE switch to 100V. Set VOLTAGE UNIT/STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-32 (-blk) and A2-29 (+red) (fig. 3-8).	Indicator DS10 lights.	If indication is normal, proceed to step 31. If indication is abnormal, remove DS10 and check for continuity. Replace defective indicator light and proceed to step 30.
30	PA2 POWER METER RANGE 1W-10W relay K15	a. On transmitter power monitor panel, set power circuit breaker to OFF.			
		b. On multifunction meter, set FUNCTION switch connect B-12 test leads across terminals X and Y of multifunction meter.	Remove relay K15 before making diode checks. Connect multifunction meter to diode A2CR15 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 megohms or greater	If diode indication is abnormal, replace faulty diode A2CR15 If diode indication is normal, replace relay K15.
		c. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
31	PA2 POWER METER RANGE 10W-100W indicator DS12	a. On transmitter power monitor, set power circuit breaker to OFF.			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
		c. On precision power supply, set RANGE switch to 100 V. Set VOLTAGE/UNIT STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-32 (-blk) and A2-25 (+red) (fig. 3-8).	10W-100W indicator DS12 lights	If indication is normal, proceed to step 33. If indication is abnormal, remove DS12 and check for continuity. Replace faulty indicator light and proceed to step 32.
32	PA2 POWER METER RANGE 10W-100W relay K13	a. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction me-	Remove relay K13 (para 3-21) before making diode checks. Connect multifunction meter to diode A2CR13 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 meg	If diode indication is abnormal, replace faulty diode A2CR13. If diode indication is normal, replace relay K13.

Table 3-3 Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
		ter.		ohms or greater	
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
	PA2 POWER METER RANGE 100W-1KW indicator DS9	a. On transmitter power monitor, set power circuit breaker to			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptcle J4.		
		c. On precision power supply, set RANGE switch to 100 V. Set VOLTAGE/UNIT STEP switch to 26.0000.	Connect precision power supply test leads to test points A2-32 (-blk) and A2-31 (+red).	100W-1KW indicator DS9 lights.	If indication is normal, proceed to step 35. If indication is abnormal, remove DS9 and check for continuity. Replace faulty indicator light and proceed to step 34.
	PA2 POWER METER RANGE 100W-1KW relay K16	a. On multifunction meter, set FUNCTION switch to OHMS and connect B-12 test leads across terminals X and Y of multifunction meter.	Remove relay K16 (para 3-21) before making diode checks. Connect multifunction meter to diode A2CR16 (fig. 3-8).	Forward resistance 400 ohms or less Reverse resistance 30 meg ohms or greater.	If diode indication is abnormal, replace faulty diode A2CR16. If diode indication is normal, replace relay K16.
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
	PA2 POWER METER RANGE 1KW-10KW indicator DS11	a. On transmitter power monitor, set power circuit breaker to OFF.	Connect precision power suply test leads to test points A2-32 (-blk) and A2-27 (+red) (fig. 3-8).		
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b 3-10c.			
		c. On precision power suppiy, set RANGE switch to 100 V. Set VOLTAGE/UNIT STEP switch to 26.0000.	Disconnect connect plug from connector receptacle J4.	1KW-10KW indicator DS11 lights.	If indication is normal, proceed to step 37. If indication is abnormal, remove DS11 and check for continuity. Replace faulty indicator light and proceed to step 36.
	PA2 POWER METER RANGE 1KW-10KW relay	a. On multifunction meter, set FUNCTION switch to OHMS and	Remove relay K14 before making diode checks. Connect multifunction	Forward resistance 400 ohms or less	If diode indication is abnormal, replace faulty diode A2CR14.

Table 3-3 Transmitter Power Monitor Panel 14A27 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	K14	connect B-12 test leads across terminals X and Y multifunction meter.	meter to diode A2CR14 (fig. 3-8).	Reverse resistance 30 megohms or greater.	If diode indication is normal, replace relay K14.
		b. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		
37	PA1 POWER SHUTDOWN switch S1	a. On transmitter power monitor, set power circuit breaker to OFF.			
		b. Inhibit power shutdown with jumpers as directed in paragraphs 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
			Connect multifunction meter test leads to J4-s and J4-u.	Multifunction meter indicates infinity when S1 is pressed and zero ohms when S2 is released.	If indication is abnormal, replace S1 as directed in section III of this chapter.
38	PA2 POWER SHUTDOWN switch S2	a. On transmitter power monitor, set power circuit breaker to OFF.			
		b. Inhibit power shutdown switch with jumpers as directed in paragraph 3-10b and 3-10c.	Disconnect connector plug from connector receptacle J4.		
			Connect multifunction meter leads to J4-r and J4-p.	Multifunction meter indicates infinity when S2 is pressed, and 0 ohms when S2 is released.	If indication is abnormal, replace S2 as directed in section III of this chapter.
		c. Restore power shutdown as directed in paragraph 3-10d.	Reconnect connector plug to connector receptacle J4.		



EL5895-912-34-TM-39

Figure 3-3 Transmitter power monitor panel 14A27 assembly diagram.

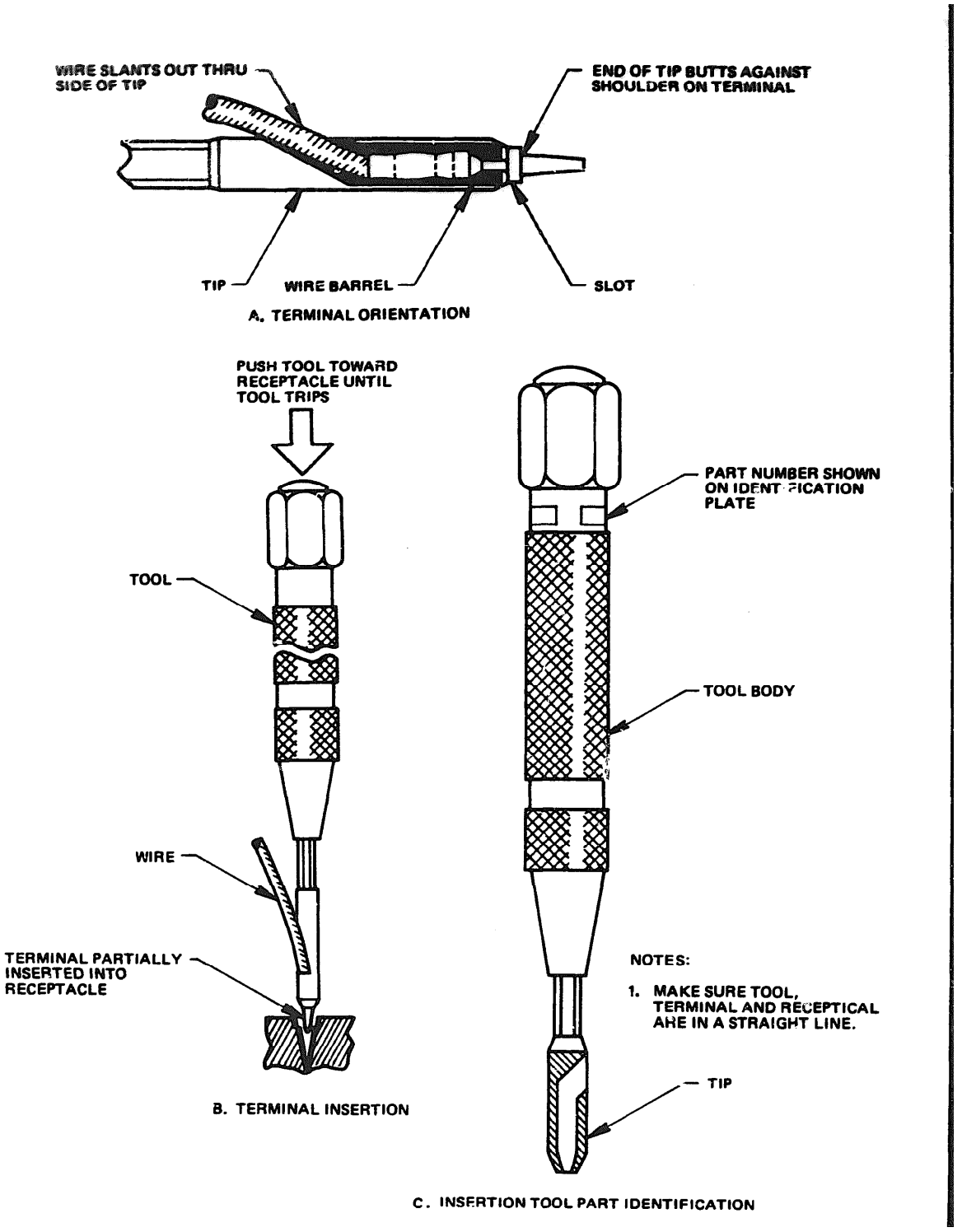


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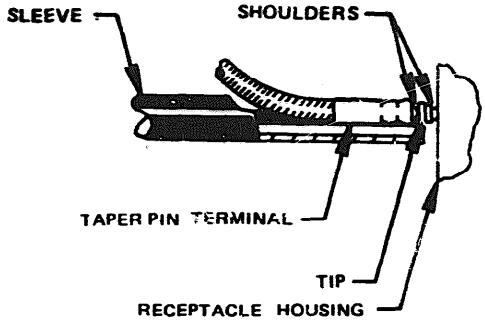
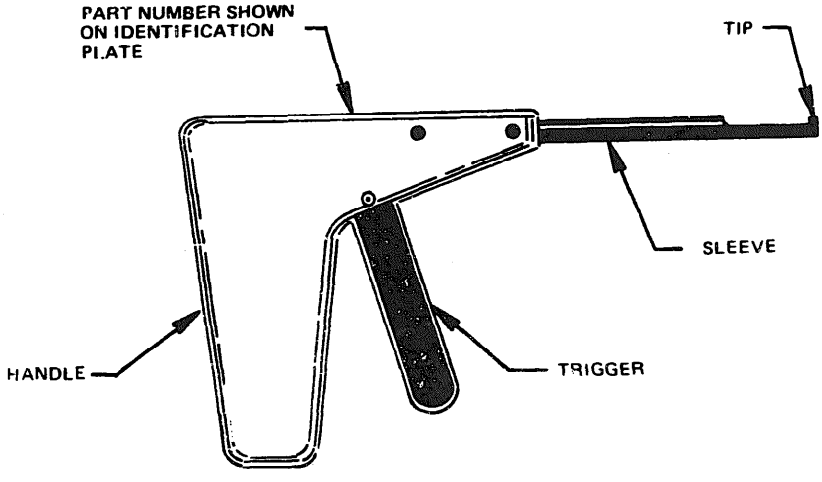
Figure 3-4. Insertion tool.



A. TERMINAL ORIENTATION



B. EXTRACTION TOOL PART IDENTIFICATION

EL5895-912-34-TM-9

Figure 3-5. Extraction tool 91012-1.

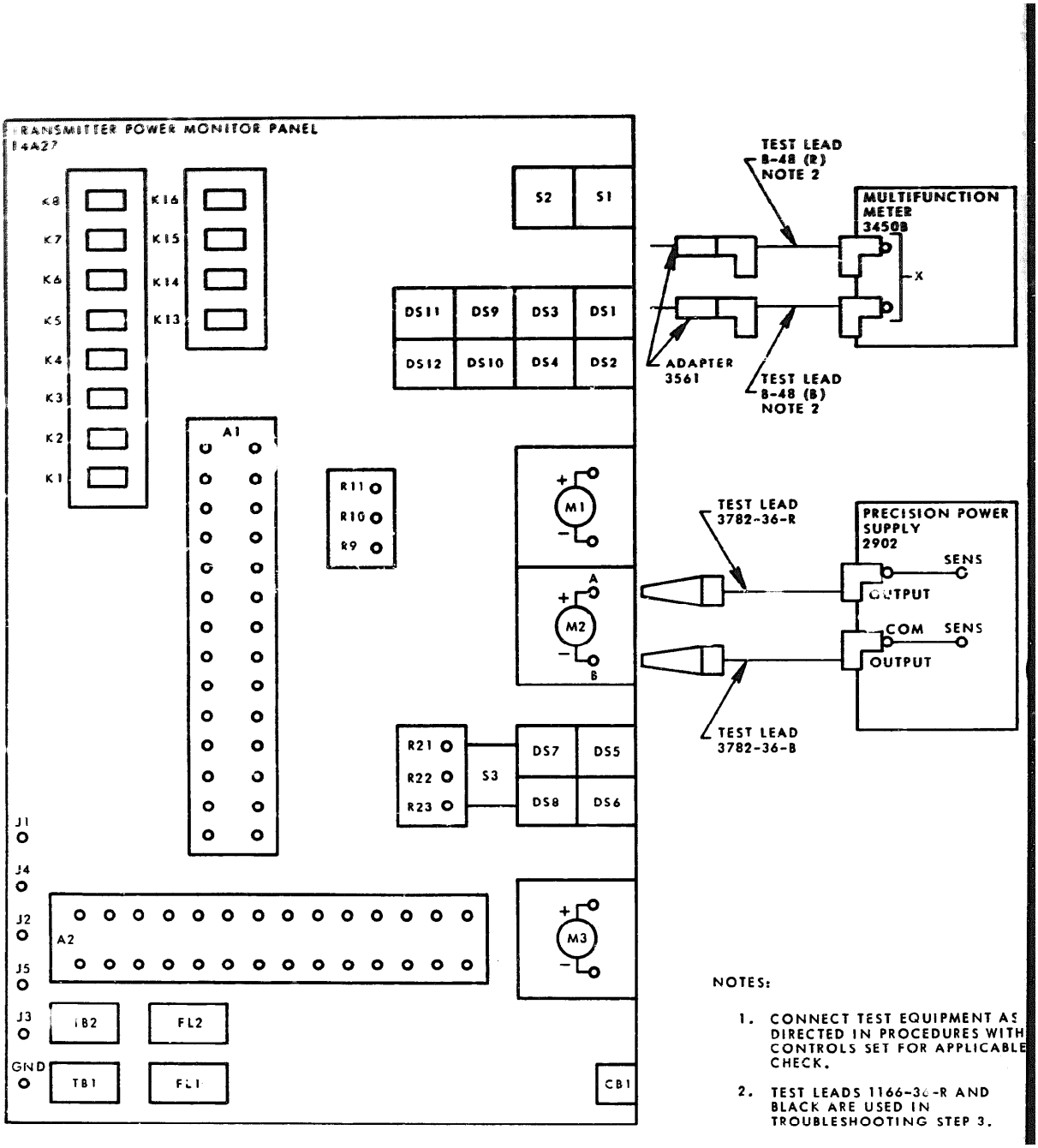


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Figure 3-6. Transmitter power monitor panel 14A27, troubleshooting, test setup diagram.

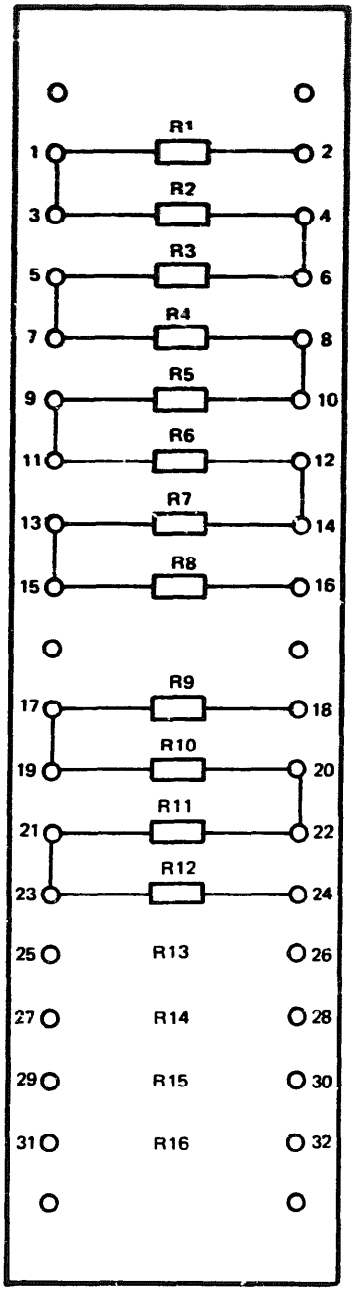

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Figure 3-7. Resistor assembly 14A27A1, parts location.

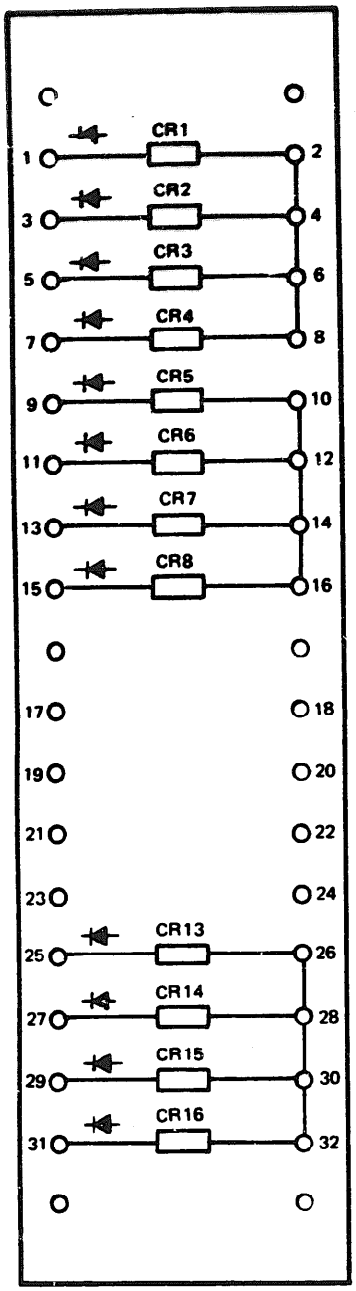

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Figure 3-6. Diode semi-conductor device assembly 14A27a2, parts location.

SECTION III. MAINTENANCE OF TRANSMITTER POWER MONITOR PANEL 14A27

3-13. General. This section provides instructions for removal and replacement of items such as subassemblies and modules during offline maintenance. Adjustment procedures are provided, when required, after replacement of a faulty item. Refer to figure 3-9 for removal and replacement of subassemblies on transmitter power monitor panel 14A27.

3-14. FEED POWER Meter M2 Removal and Replacement (fig. 3-3). To remove and replace FEED POWER meter M2. perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.

b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.

c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.

d. Tag for identification and unsolder electrical wires from rear of FEED POWER meter M2.

e. Remove four nuts and washers which secure FEED POWER meter M2 to chassis.

f. Remove FEED POWER meter M2 from the front of the panel.

g. Install replacement FEED POWER meter in front panel of the chassis so that meter mounting studs pass through the two mounting holes.

h. Secure FEED POWER meter to chassis with four nuts and washers.

i. Identify and solder tagged electrical wires to terminals on rear of FEED POWER meter M2.

j. Adjust FEED POWER meter M2 as directed in paragraph 3-28.

k. Perform testing procedures described in section

3-15. PA1 or PA2 POWER Meter M1 or M3 Removal and Replacement (fig. 3-3). To remove and replace PA1 or PA2 POWER meter M1 or M3, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.

b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.

c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.

d. Tag for identification and unsolder two electrical wires from rear of PA1 or PA2 POWER meter M1 or M2.

e. Remove four countersunk screws which secure PA1 or PA2 POWER meter M1 or M3 to chassis.

f. Lift PA1 or PA2 POWER meter M1 or M3 out of chassis and replace.

g. Position replacement meter on rear of front panel and install mounting screws which secure meter to chassis.

h. Identify and solder tagged electrical wires to terminals on rear of PA1 or PA2 POWER meter Ml or M3.

i. Adjust PA! or PA2 POWER meter M1 or M3 as directed in paragraph 3-28.

j. Perform testing procedures described in section IV of this chapter.

3-16. Front Panel Calibration Potentiometers R21, R22, or R23 Removal and Replacement (fig. 3-3). To remove and replace FEED, PA1 or PA2 CALIB ADJ potentiometers R21, R22, or R23, perform the following steps:

a. On front panel of transmitter power monitor pane! 14A27, set power ON-OFF circuit breaker to OFF.

b. Loosen four screws on transmitter power monitor front pane! and pull chassis outward until slides lock.

c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.

d. Tag for identification and unsolder electrical wires from defective potentiometer.

e. On bottom of chassis, loosen two countersunk screws, washers and nuts which secure the calibration potentiometer mounting bracket to the chassis.

f. Remove nut and washer which secures defective calibration potentiometer to the mounting bracket.

g. Remove defective calibration potentiometer and discard.

h. Install replacement potentiometer and secure to mounting bracket with nut and washer.

i. Secure mounting bracket to chassis with two countersunk screws, washers and nuts.

j. Identify and solder tagged electrical wires on rear of replacement potentiometer.

k. Perform testing procedures described in section IV of this chapter.

3-17. Chassis Mounted Potentiometers R9, R10 or R11 Removal and Replacement (fig. 3-3). To remove and replace potentiometer R9, R10 or R11, perform the following steps:

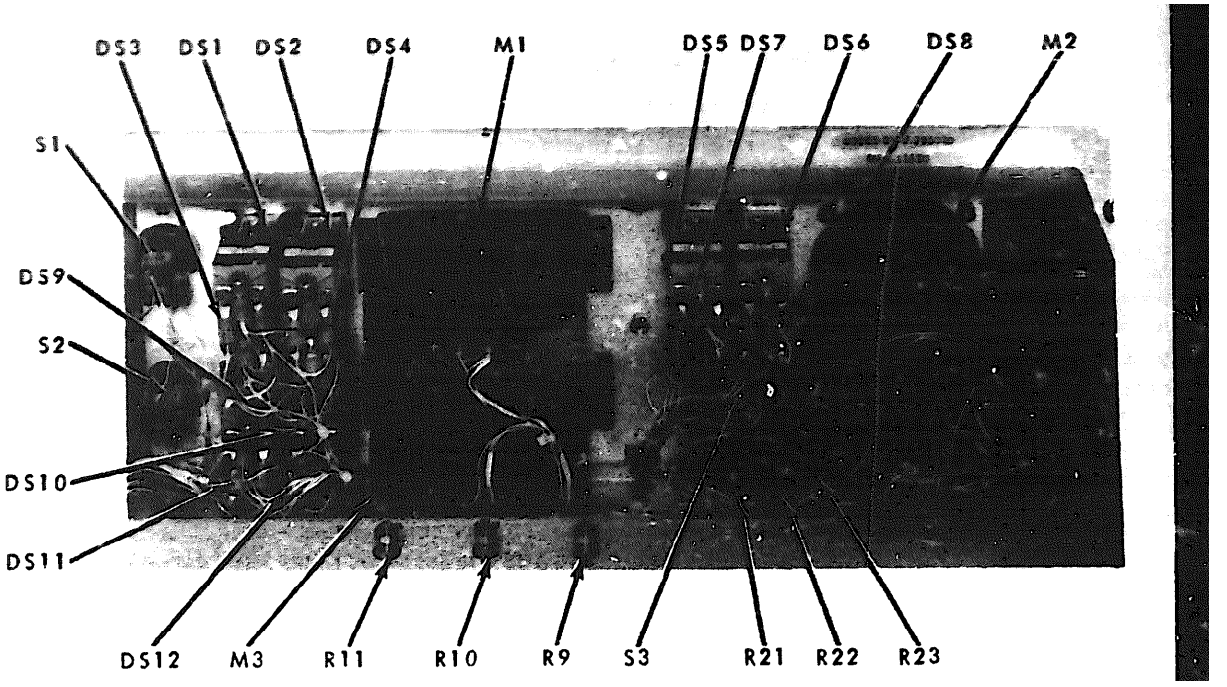

Figure 3-9. Transmitter power monitor panel 14A27, front panel, rear view.

a. On front panel of transmitter power monitor panel 14A27. set power ON-OFF circuit breaker to OFF.
b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
C. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.
d. Tag and disconnect electrical wires from terminals on defective potentiometer.
e. Remove locknut, nut and washer from defective potentiometer.
f. Remove defective potentiometer from bottom of chassis and discard.
g. Install replacement potentiometer through mounting hole in bottom of chassis.
h. Secure potentiometer with washer, nut, and locknut.
i. Identify and connect tagged electrical wires to terminals of replacement potentiometer.
j. Perform testing procedures described in section IV of this chapter.

3-18. Indicator Assemblies DS1 through DS12 Removal and replacement (fig. 3-3). Procedures to remove and replace indicator assemblies DS1 through DS12 are as follows:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.
b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.
d. Tag and remove electrical wires from terminals A, B, and C on rear of indicator assembly.
e. On front panel, pull indicator assembly lens forward and remove from housing.
f. Rotate mounting screw inside housing.
g. Remove indicator assembly from front of front panel.
h. Insert replacement indicator assembly into front of front panel.
i. Rotate mounting screw securing indicator assembly to front panel.
j. Insert indicator assembly lens into housing.
k. Identify and replace tagged electrical wires on rear of indicator assembly.

l. Perform testing procedures described in section IV of this chapter.

3-19. Switches S1 through S4 Removal and Replacement (fig. 3-3). To remove and replace switch S1 through S4, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.

b. Loosen four screws on transmitter Rower monitor front panel and pull chassis outward until slides lock.

c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.

d. Tag and disconnect wires from terminals on defective switch.

e. Remove nut and washers from defective switch.

f. Slide defective switch from rear of panel and discard.

g. Insert replacement switch into rear of front panel.

h. Replace nut and washers making sure that protective shield is in place on switch S1, S2, or S3.

i. Identify and connect tagged wires to replacement switch.

j. Perform testing procedures described in section IV of this chapter.

3-20. Filters FL1 and FL2 Removal and Replacement (fig. 3-3). To remove and replace filter FL1 or FL2, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.

b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.

c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.

d. Tag and disconnect electrical wires from terminal at each end of filter.

e. Remove nut and lockwasher which secures filter to filter mounting bracket.

f. Remove filter from mounting bracket and discard.

g. Insert replacement filter in mounting bracket and secure with nut and lockwasher.

h. Identify and connect electrical wires to terminal at each end of filter.

i. Perform testing procedures described in section IV of this chapter.

3-21. Relays K1 through K8 and K13 through K16 Removal and Replacement (fig. 3-3). To remove and replace a defective relay K1 through K8 or K13 through K16, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.

b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.

c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.

d. Remove two nuts and washers that secure the relay in its socket.

NOTE

Do not remove threaded spacer, washers or machine screw that secure the relay socket to the chassis.

e. Remove relay from socket and discard.

f. Insert replacement relay into socket and secure with two nuts and washers.

g. Perform testing procedures described in section IV of this chapter.

3-22 Relay Sockets K1 through K8 and K13 through K16 Removal and Replacement (fig. 3-3). To remove and replace a defective relay socket K1 through K8 or K13 through K16, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.

b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.

c. Remove eight twist lock fastener studs that secure the top cover to chassis and remove cover.

d. Remove relay from sockets K1 through K8 or from sockets K13 through K16 as described in paragraph 3-21.

e. Tag and unsolder electrical wires from bottom of socket.

f. Remove two screws, washers and nuts from socket and remove socket.

g. Secure replacement socket with two screws, washers and nuts.

i. Identify and solder tagged electrical wires to terminals on socket.

i. Replace relay in socket, secure with two nuts and washers, and perform testing procedures described in section IV of this chapter.

3-23. Multipin Connectors J3 or J4 Removal and Replacement (fig. 3-3). To remove and replace multipin connector J3 or J4, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27. set power ON-OFF circuit breaker to OFF.
b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.
d. Remove four screws, washers and nuts securing connector to rear panel.
e. Tag wires for identification. Remove pins from connector J3 or J4 with extraction tool MS24256R20.
f. Remove connector and discard.
g. Identify wires with connector pins by tag and insert into connector J3 or J4 using insertion tool MS24256A20.
h. Insert connector into mounting hole securing to rear panel with four screws, washers and nuts.
i. Perform testing procedures described in section IV of this chapter.

3-24. solder Contact Connectors J1, J2, and J5 Removal and Replacement (fig. 3-3). To remove and replace a solder contact connector J1, J2, or J5 perform the following steps:

a. On front panel of transmitter power monitor panel 14A27. set power ON-OFF circuit breaker to OFF.
b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.
d. Remove the four screws, washers and nuts securing connector to rear panel and pull connector from mounting hole.
e. Tag for identification and unsolder electrical wires.
f. Remove and replace connector J1, J2, or J5.
g. Identify and solder tagged electrical wires.
h. Install connector into rear panel mounting hole securing with four screws, washers, and nuts.
i. Perform testing procedures described in section IV of this chapter.

3-25. TB1 and TB2 Removal and Replacement (fig. 3-3). To remove and replace TB1 or TB2, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.
b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
c. Remove eight twistlock fastener studs that secure top cover to chassis and remove cover.
d. Tag and extract two wires, using extraction tool, from TB1 or eight wires from TB2.
e. Loosen screw and nut from one end of TB1 or TB2 and slide block holder out of bracket.
f. Slide terminal board TB1 or TB2 from bracket.
g. Insert TB1 or TB2 replacement into bracket and slide block holder into bracket and tighten screw and nut.
h. Using insertion tool insert tagged electrical wires into TB1 or TB2.
i. Perform testing procedures described in section IV of this chapter.

3-26. CB1 Removal and Replacement (fig. 3-3). To remove and replace CB1, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.
b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.
d. Tag and unsolder four wires from rear of CB1.
e. On front panel, loosen CB1 nut and washer.
f. Remove CB1 from rear of front panel.
g. Insert replacement from rear of front panel and tighten washer and nut.
h. Identify and solder tagged electrical wires.
i. Perform testing procedures described in section IV of this chapter.

3-27. A1 or A2 terminal Boards Removal and Replacement (fig. 3-3). To remove and replace terminal board A1 or A2, perform the following steps:

a. On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.
b. Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
c. Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.
d. Tag and unsolder wires from terminal boards Al or A2.
e. Remove six screws, washers and nuts from terminal board A1 or A2.
f. Replace terminal board Al or A2 and secure with six screws, washers and nuts.
g. Identify and solder tagged electrical wires to the terminals.

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

3-28. FEED PA1 and PA2 POWER Meters Adjustment. The following subparagraphs describe the test equipment, connections and conditions, initial control settings, and procedures for adjustment of the POWER meters.

NOTE

Adjustment procedures for the FEED, PA1, and PA2 POWER meters are identical.

a. Test Equipment. Test equipment required for the adjustment is as follows:

Common name	Mfr. Part No.
Power Supply, Precision	Electronic Development 2902
Test Lead, Banana Plug to Mini Test Clip	Pomona 3782-36-R
Test Lead, Banana Plug to Mini Test Clip	Pomona 3782-36-R

b. Connections and *Conditions* Meter adjustments are accomplished with the transmitter power monitor panel in the rack. Prepare the equipment for adjustment as follows:

(1) On front panel of transmitter power monitor panel 14A27, set power ON-OFF circuit breaker to OFF.
(2) Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.
(3) Remove eight twistlock fastener studs that secure the top cover to chassis and remove cover.

CAUTION

Disconnecting the plug from J4 can cause a system shutdown. Before disconnecting the plug, jumper the signal at interconnecting box 21A1 as described in paragraphs 3-10b and 3-10c.

(4) Disconnect connector plugs from receptacle connectors J2 and J3 when adjusting FEED POWER meter. Disconnect connector plug from connector receptacle J4 when adjusting PA! or PA2 POWER meters.
(5) Connect black mini-test clip to negative (-) SENSE OUTPUT terminal on precision power supply.
(6) Connect red mini-test clip to positive (+) SENSE OUTPUT terminal on precision power supply.

c. Initial Control Settings. Set controls as follows:

(1) *Precision power supply.*

Control	Position
POWER	ON
POLARITY	+
RANGE	10 V
VOLTAGE UNIT/STEP	2.50000 to 5.00000

d. Adjustment Procedure (figs. 3-6, *FO-6).* Prepare test connections for the adjustment procedures as follows: (Refer to figures 3-6 and FO-6, sheet 1 for test connections.)

(1) Connect black mini-test clip lead (neg) from precision power supply to test points as follows:

Test point	Location
M2-B	FEED POWER meter M2
M1 negative terminal	PA1 POWER meter M1
M3 negative terminal	PA2 POWER meter M3

(2) Connect red mini-test clip lead (pos) from precision power supply to test points:

Test point	Location
A1-6	FEED POWER meter M2
A1-22	PA1 POWER meter M1
A1-14	PA2 POWER meter M3

NOTE

Prior to performing the following adjustment on the FEED POWER meter, adjust the meter zero controls for an indication of zero on the upper scale with the precision power supply set for zero output.

(3) Set precision power supply for 2.5 V dc.
(4) On front panel adjust meter calibration potentiometer R23 (FEED CALIB ADJ), R22 (PA1 CALIB ADJ), or R21 (PA2 CALIB ADJ) for a pointer reading of 5 on the upper scale of the associated panel meter.
(5) Set precision power supply to 5 V dc.
(6) The meter pointer should indicate 10 on the meter scale. If it does not, readjust meter calibration potentiometer for a meter pointer

reading half way between the actual meter indication and 10 on the upper scale on the associated panel meter.

(7) Set precision power supply for 2.5 V dc.

(8) Readjust meter calibration potentiometer for a meter pointer reading half way between the actual meter reading and 5 on the upper scale on the associated panel meter.

(9) Repeat steps (4) through (8) until the smallest actual error is obtained between the 5 (mid scale) and 10 (full scale) meter indications.

(10) Restore equipment to operating configuration.

SECTION IV. TESTING OF TRANSMITTER POWER MONITOR PANEL 14A27

3-29. General. This section contains the procedures necessary for performance testing of transmitter power monitor panel 14A27 after replacement of parts following the troubleshooting procedures. Each of the preliminary procedures and the 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 equipmcnt 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 transmitter power monitor panel meeting all performance standards specified in the performance test, the equipment can be returned to service.

3-30. Test Equipment. Table 3-4 lists the test equipment required for performance testing of the transmitter power monitor panel.

Table 3-4 lest Equipment Required for Testing of Transmitter Power Monitor Panel 14A27

Common name	Part/model no.	Qty	Manufacturer
Adapter, Banana Jack to Size 16 Male Connector	3563	2	Pomona
Adapter, Banana Jack to Size 20 Male Connector	3561	2	Pomona
Meter, Multifunction	3450B	1	Hewlett-Packard
Power supply, Precision	2902	1	Electronic Development
Test Lead, Banana Plug to Banana Plug	B-48(B)	1	Pomona
Test Lead, 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	1986-36-R	1	Pomona

3-31. Test Connections and Conditions. Testing of the transmitter power monitor panel 14A27 is accomplishcd in the electrical equipment rack. Prior to performing testing procedures. prepare the transmitter power monitor panel and test equipment as follows:

a. Transmitter Power Monitor Panel 14A27 Initial Setup.

(1) Loosen four screws on transmitter power monitor front panel and pull chassis outward until slides lock.

(2) Remove eight twist lock fastener studs that secure the top cover to chassis and remove cover.

b. Test Equipment Initial Setup.

(1) Connect black test probe to black output terminal on precision power supply.

(2) Connect red test probe to red output terminal on precision power supply.

3-32. Initial Control Settings

a. On precision power supply, set controls as follows:

Control	Position
POWER	ON
RANGE	10 V
POLARITY	+
VOLTAGE UNIT/STEP	2.500000
ZERO/USE	ZERO
ZERO ADJ	Adjust for zero on galvanometer meter
ZERO/USE	USE

b. On the multifunction meter, set controls as follows:

Control	Position
LINE switch	On (up) position
FUNCTION	OHMS
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT

3-33. Performance Test Procedure (fig. 3-10).

Table 3-5 contains the test procedure for the transmitter power monitor panel 14A27 and figure 3-10 shows the performance test interconnections. Proceed sequentially through the table in accordance with the numbered steps. Set test equipment controls and equipment under test controls exactly as given in the table and perform the prescribed test procedure. If the result is within the specified performance standard limits, proceed to next step in the table. If result is not as specified, perform troubleshooting procedure in section II or the adjustment procedures in Section III of this chapter. After fault correction, repeat the performance test.

Table 3-5. Transmitter Power Monitor Panel 14A27 Performance Test

Step	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1		Set power circuit breaker to ON.	Disconnect cables to J2 and J3 on rear of transmitter power monitor panel and connect precision power supply between M2-B (black test lead) and A1-6 (red test lead).	FEED POWER meter indicates 5 on top scale.
2			Connect multifunction meter between M2-25 and M2-13.	Open circuit.
3	Set VOLTAGE UNIT/STEP switches to a value lower than lower limit setting on FEED POWER meter.			
4	Set VOLTAGE UNIT/STEP switches to a value higher than the upper limit setting on FEED POWER METER.		Remove test leads at completion of step.	0 ohms
5	Precision Power supply: RANGE to 100 V, VOLTAGE UNIT/STEP to 26.0000		Connect precision power supply between A2-10 (black test lead) and A2-13 (red test lead).	FEED POWER 1W-10W indicator lights.
6			Move red test lead to A2-9.	FEED POWER 10W-100W indicator lights.
7			Move red test lead to A2-15.	FEED POWER 100W-1KW indicator lights.
8			Move red test lead to A2-11. Remove test leads at completion of step.	FEED POWER 1KW-10KW indicator lights.
9		FEED POWER METER ZERO switch pressed	Connect multifunction meter between J2-K and J2-U.	0 ohms
10		FEED POWER METER ZERO switch released.	Remove multifunction meter test leads at completion of step.	Open circuit.
	CAUTION Before proceeding with the following steps, inhibit uplink power shutdown by jumpering as directed in paragraphs 3-10b and 3-10c.			
11	Precision Power Supply: RANGE to 10 V, VOLTAGE UNIT/STEP to 2.50000		Remove cable to J4. Connect precision power supply between A1-22 (red test lead) and negative terminal of M1 (black test lead). Disconnect test leads at completion of step.	PA1 POWER meter indicates 5 on top scale of meter.

Table 3-5 Transmitter Power Monitor Panel 14A27 Performance Test - Continued

Step	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
12	Precision Power Supply: RANGE to 100 V, VOLTAGE UNIT/ STEP to 26.0000		Connect precision power supply between A2-8 (black test lead) and A2-5 (red test lead)	PA1 POWER 1W-10W indicator lights.
13			Move red test lead to A2-1.	PA1 POWER 10W-100W indicator lights.
14			Move red test lead to A2-7.	PA1 POWER 100W-1KW indicator lights.
15			Move red test lead to A2-3.	PA1 POWER 1KW-10KW indicator lights.
16			Connect precision power supply between A2-32 (black test lead) and A2-29 (red test lead).	PA2 POWER 1W-10W indicator lights.
17			Move red test lead to A2-25.	PA2 POWER 10W-100W indicator lights.
18			Move red test lead to A2-31.	PA2 POWER 100W-1KW indicator lights.
19			Move red test lead to A2-27. Disconnect test leads at completion of step.	PA2 POWER 1K-10KW indicator lights.
20	Precision Power Supply: RANGE to 10 V, VOLTAGE UNIT/ STEP to 2.50000		Connect precision power supply between A1-14 (red test lead) and negative terminal of M3 (black test lead). Disconnect test leads at completion of step.	PA2 POWER METER indicates 5 on upper scale of meter.
21		Alternately press and release FEED POWER SHUTDOWN switch then the PA1 POWER SHUTDOWN switch.	Using 3561 adapters, connect multifunction meter between J4-s and J4-m.	Open circuit when either switch is pressed and a closed circuit when both switches are released.
22		Alternately press and release FEED POWER SHUTDOWN switch then the PA2 POWER SHUTDOWN switch.	Using 3561 adapters, connect multifunction meter betwen J4-r and J4-p.	Open circuit when either switch is pressed and a closed circuit when both switches are released.
23			Disconnect test equipment, replace cables to J2, J3, and J4, and remove uplink power shutdown inhibit jumpers as described in paragraph 3-10d.	

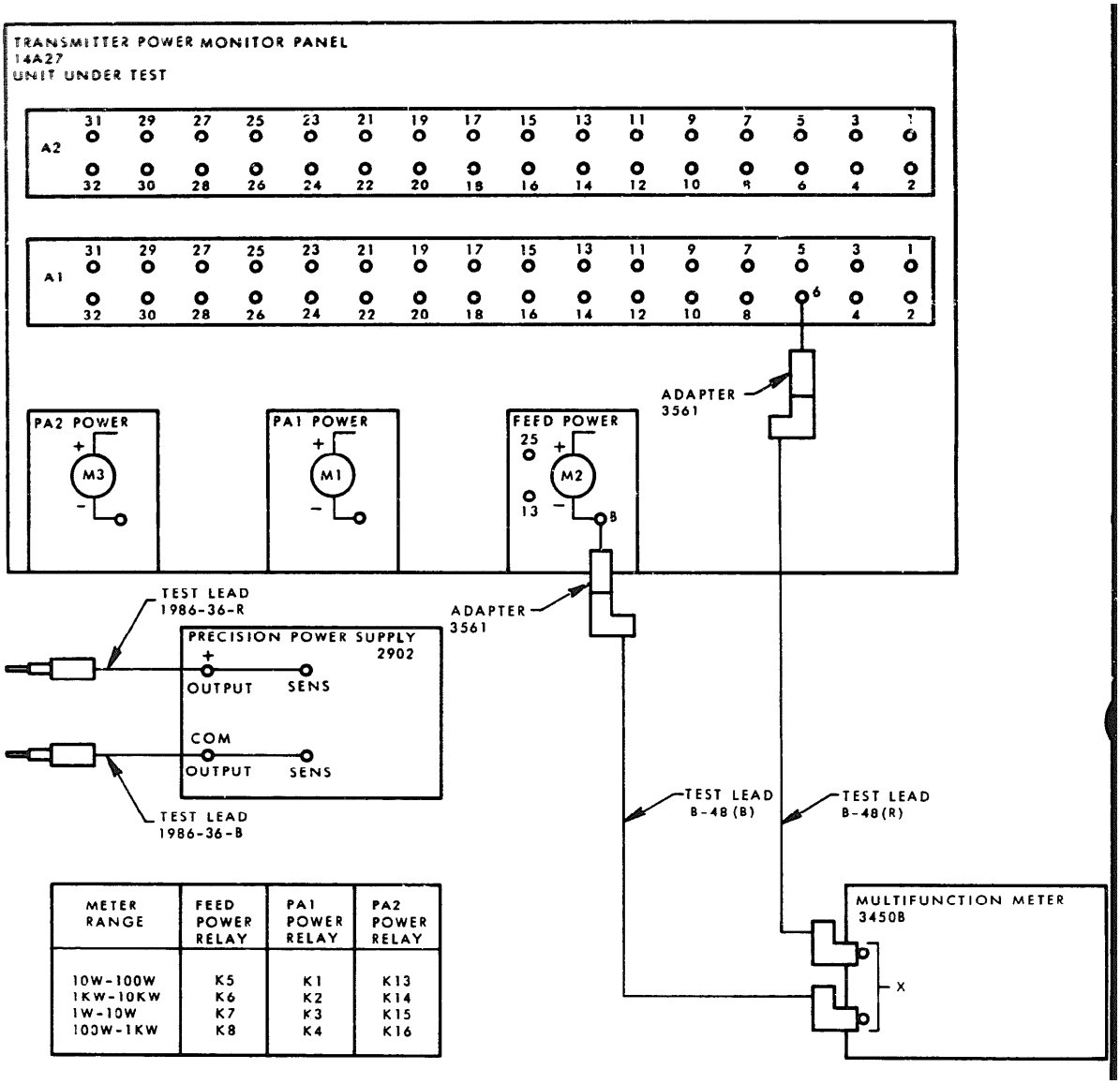

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Figure 3-10. transmitter power monitor panel 14A27 performance test, test setup diagram.

SECTION V. TROUBLESHOOTING OF FEED POWER MONITOR HTA-3A9

3-34. General. This section contains preliminary proccdures and offline troubleshooting procedures for localizing a fault to a component of feed power monitor HTA-3A9 after referral by organizational maintenance. Preliminary procedures consist of obtaining the listed test equipment, making the prescribed test connections. and initially setting equipment controls to specified settings. These settings and all subsequent settings given in the troubleshooting charts must be made carefully to ensure accurate test results. When a troubleshooting procedure specifies replacement of adjustment of a malfunctioning component, refer to section VI in this chapter.

3-35. Test Equipment and materials. Table 3-6 lists the test equipment required for feed power monitor troubleshooting.

Table 3-6 Test Equipment Required for Feed Power Monitor HTA-3A9 Maintenance

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, Banana Jack to Size 16 Male Connector	3563	7	Pomona
Adapter, Elbow, OSM Plug to OSM Jack	219	1	Omni Spectra
Adapter, N Plug to N Plug	3842	1	Pomona
Adapter, OSM Plug to N Jack	21030	1	Omni Spectra
Adapter, Single Banana Plug to Binding Post	2894	3	Pomona
Coupler, Directional, 7 to 12 GHz, 10 dB	30435C-10	1	Narda Microwave
Generator, Signal, SHF	620B	1	Hewlett-Packard
Meter, Multifunction	3450B OPT001, 002	1	Hewlett-Packard
Meter, Power, Microwave	460B	2	General Microwave
Milliammeter, Volt-Ohm-	3-6	1	Simpson
Mount, Thermoelectric	422C	2	General Microwave
Test Lead, Banana Plug to Banana Plug	B-12	1	Pomona
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, Banana Plug to Mini Test Clip	3782-36-B	1	Pomona
Test Lead, Banana Plug to Mini Test Clip	3782-36-R	1	Pomona
Test Lead, N Plug to N Plug	1658-T-36	1	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

3-36. Test Connections and Conditions (fig. 3-11)

Feed power monitor troubleshooting is accomplished in a bench test setup. Prior to performing the troubleshooting procedure, prepare the test equipment for the bench test setup as follows:

a. Connect shf signal generator, adapter, thermoelectric mount No. 1, and microwave power meter No. 1 to directional coupler.

b. Connect adapter on directional coupler to J1 on feed power monitor.

c. On shf signal generator, adjust OUTPUT ATTEN for -10 dBm as indicated on microwave power meter No. 1.

d. Connect fabricated ac line cord to connector J3 **and to bench power plugmold.**

3-37. Initial Control Settings. Prepare feed power monitor HTA-3A9 and test equipment for troubleshooting as follows:

a. Fed Power ***Monitor HTA***-3A9 Initial Setup.

(1) On front panel of feed power monitor HTA-3A9. set POWER ON switch to off (down) position.

(2) Loosen and remove nine screws and washers from bottom and seven screws and washers from the front panel of the Feed power monitor.

(3) Remove cover and arrange feed power monitor and test equipment for convenient access to test connections.

(4) Remove three screws on power head mounting bracket.

(5) Disassemble connection between switch S402 and power sensor A401.

(6) Remove two screws with washers from top of switch S402.

(7) Disassemble connection between switch S402 and .pin attenuator AT401.

b. Shf Signal Generator Initial Setup (fig. 3-11).

(1) On shf signal generator, set operating controls to the following positions:

Control	Position
OUTPUT ATTEN	FULL CW
LINE	ON
MODSELECTOR	CW
FREQUENCY CONTROL	8.2 GHz
POWER SET METER	ZERO
OUTPUT ATTEN	0 dBm

(2) Set microwave power meter No. 1 POWER LINE pushbutton to OFF.

(3) Connect thermoelectric mount No. 1 to microwave power meter No. I (fig. 3-l1).

(4) Set microwave power meter **No. 1 POWER** LINE pushbutton to ON.

(5) Press lowest RANGE button on microwave power meter No. 1.

(6) Determine effective efficiency at 8.2 GHz from graph on thermoelectric mount No. 1 and set EFF control to the value obtained.

(7) Zero microwave power meter No. 1 using METER ZERO control.

(8) Press microwave power meter No. 1 RANGE button to select 1 rnW 0 dBm scale.

(9) Set microwave power meter No. 2 POWER LINE pushbutton to OFF.

(10) Connect thermoelectric mount No. 2 to microwave power meter No. 2 (fig. 3-11).

(11) Set microwave power meter No. 2 POWER LINE pushbutton to ON.

(12) Press lowest RANGE button on microwave power meter No. 2.

(13) Determine effective efficiency from graph on thermoelectric mount No. 2 and set EFF control to the value obtained.

(14) Zero microwave power meter No. 2 using METER ZERO control.

(15) Press microwave power meter No. 2 RANGE to select 1 mW 0 dBm scale.

c. Multifunction Meter. Set LINE switch to on (up) position and press following switches:

Switch	Position
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT

d. Volt-Ohm-Milliammeter. Set controls on volt-ohm-milliammeter (vom) as follows:

Control	Position
FUNCTION	+DC
RANGE	50 V

3-38. Troubleshooting Procedure (figs. FO-4, FO-7). Perform the necessary troubleshooting procedures in table 3-7 as specified by symptom/probable cause listing below. Use the feed power monitor HTA-3A9 schematic (fig. FO-4) and assembly diagram (fig. FO-7) as aids in performing the troubleshooting procedures. After the faulty item has been replaced, perform the testing procedures in section VII of this chapter. Upon satisfactory completion of the performance test, the feed power monitor can be returned to service.

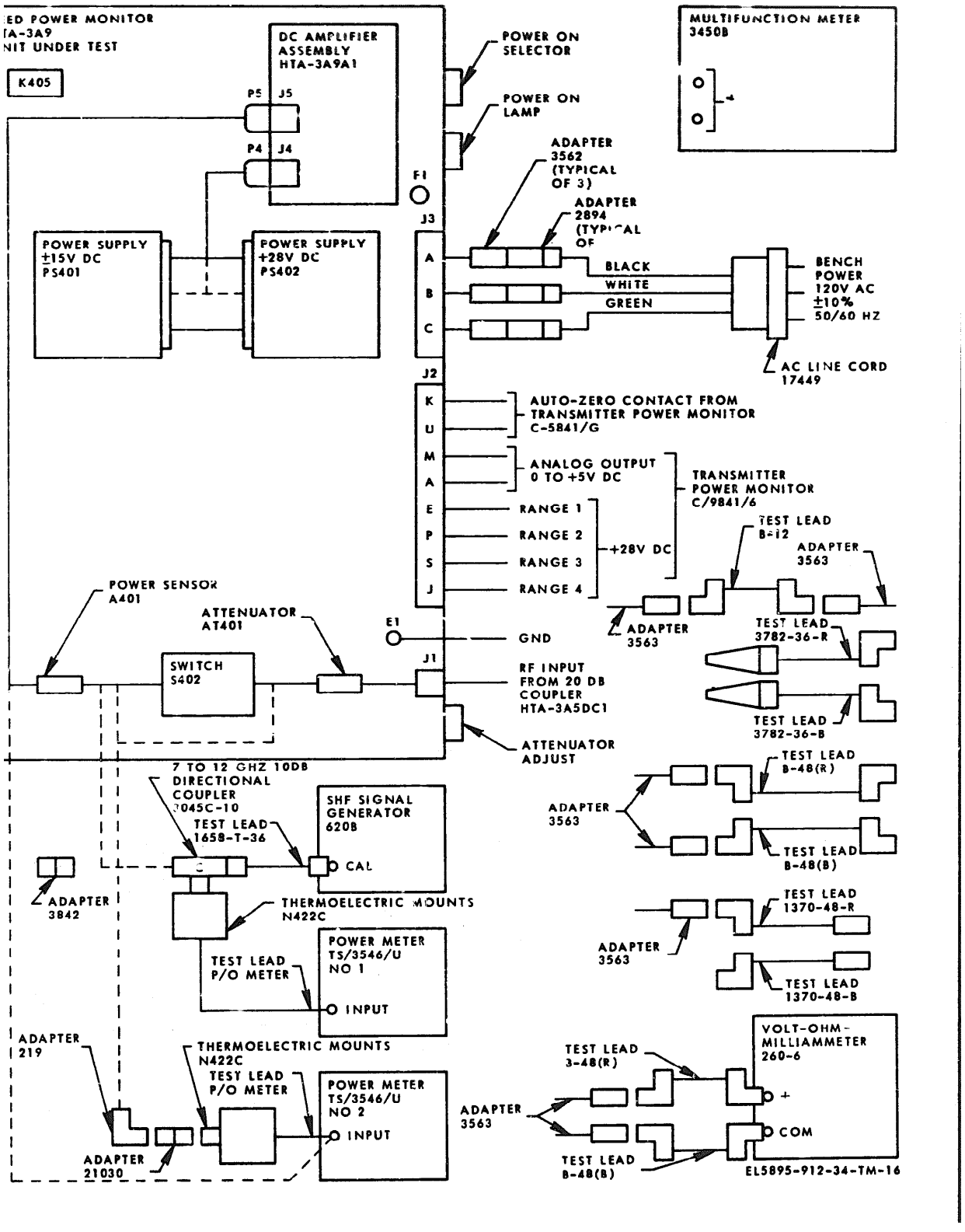

Figure 3-11. Feed power monitor HTA-3A9, troubleshooting test setup diagram.

Symptom	Probable cause
POWER ON switch set to on (up) position and POWER ON indicator lit. multifuntion meter at output of power supply PS401 indication is abnormal.	Power supply PS401 is defective. Perform steps 1 and 2.
POWER ON switch set to on (up) position and POWER ON indicator lit. multifunction meter at output of power supply PS402 indication is abnormal.	Power supply PS402 is defective. Perform step 3.
POWER ON switch to on (up) position. Indication at output of pin attenuator AT401 is abnormal.	Pin attenuator AT401 ATTEN ADJUST potentiometer R403. or resistors defective. Perform steps 4 and 5.
POWER ON switch to on (up) position. Indication at output of switch S402 is abnormal.	Switch S402. relay K405. or resistor R405 defective. Perform step 7.
POWER ON switch to on (up) position. Indication at output of power sensor A401 is abnormal.	Power sensor A401 is defective. Perform step 9.
POWER ON switch to on (up) position. Indication at output of dc amplifier assembly Al is abnormal.	Dc amplifier assembly Al is defective. Perform step 9.

Table 3-7 Feed Power Monitor HTA-3A9 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
1	Power supply PS401 +15 V dc output	a. Establish conditions as specified in paragraph 3-36. Test +(red) pin 5 b. Set POWER ON switch to on position.	Disconnect connector plug P4 from connector receptacle J4. Using 3782 test leads, connect multifunction meter test leads to power supply PS401 as follows: Test leads Terminal -(blk) pin 4 +(red) pin 5	+15 V dc ±75 mV	If indication is normal, proceed to step 2. If indication is abnormal, adjust power supply PS401 as directed in section VI of this chapter. If power supply cannot be adjusted, replace as directed in section VI of this chapter.
2	Power Supply PS401 -15 V dc output	a. Set POWER ON switch to the off position. Test -(blk) pin 4 b. Set POWER ON switch to the on position.	Connect multifunction meter test leads to power supply PS401 as follows: Test leads Terminal +(red) pin 3 -(blk) pin 4	-15 V dc ±75 mV	If indication is normal, proceed to step 3. If indication is abnormal, adjust power supply PS401 as directed in section VI of this chapter. If power supply cannot be adjusted, replace as directed in section VII of

Table 3-7 Feed Power Monitor HTA-3A9 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					this chapter.
		c. Set POWER ON switch to the off position.	Disconnect test leads.		
3	Power supply PS402 +28 V output	a. Make connections as specified in para 3-36. Test +(red) pin 4	Connect multifunction meter test leads to power supply PS402 as follows: Test leads Terminal -(blk) pin 3 +(red) pin 4	+28 ±0.14 V dc	If indication is normal, proceed to step 4.
		b. Set POWER ON selector switch to on position.			If indication is abnormal, adjust power supply PS402 as directed in section VI of this chapter. If power supply PS402 cannot be adjusted, replace as directed in section VI of this chapter.
		c. Set POWER ON selector switch to off position and reconnect J4 to P4.			
4	Pin diode attenuator AT401	a. Rotate front panel ATTEN ADJUST fully CW (minimum attenuation).	Connect thermoelectric mount No. 2 and microwave power meter No. 2 with adapters to the output of pin diode attenuator AT401 (fig. FO-7).		
		b. Set POWER ON selector switch to on position.		Microwave power meter indicates between -1 and -2 dBm.	If indication is normal, proceed to step 4c. If indication is abnormal, proceed to step 5.
		c. Rotate front panel ATTEN ADJUST fully CCW.		-35 ±1.75 dBm	If indication is normal, proceed to step 6. If indication is abnormal, proceed to step 5.
5	Pin diode attenuator AT401 and associated resistors	a. Set POWER ON selector switch to off position.			
		b. Test conditions as specified in para 3-36.	Connect multifunction meter to make checks to the following resistors: R402, R403 and R404.	R402 - 314 to 347 ohms R403 - 9.5 K to 10.5 K ohms R404 - 589 to 651 ohms	If indications are normal, replace pin diode attenuator AT401 as directed in section VI of this chapter. If any indication is abnormal, replace defective resistor.

Table 3-7 Feed Power Monitor HTA-3A9 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
6	Switch S402 (pass test)	Rotate front panel ATTEN ADJUST fully CW. Set POWER ON selector switch to on position.	Restore connection between pin diode attenuator AT401 and switch S402. Connect thermoelectric mount No. 2 and microwave power meter No. 2. with adapters to the output of switch S402 (fig. FO-7).	-4.5 dBm (minimum)	If indication is normal, proceed to step 7. If indication is abnormal, proceed to step 8.
7	Switch S402 (cutoff test)		Connect a jumper between J2-K and J2-U.	Microwave power meter indicates extremely low power level.	K405 energized. If indication is normal, proceed to step 9. If indication is abnormal, proceed to step 8.
8	Relay K405	a. Set POWER ON selector switch to on position.	Disconnect microwave power meter No. 2 and thermo electric mount 2 from output of switch S402.		
		b. On vom, set FUNCTION switch to +DC and RANGE switch to 50 V.	Using vom, connect test leads between pin 1 of K405 and ground, then pin 2 of K405 and ground (fig. FO-7).	Relay K405 pin 1 -0 V dc. Relay K405 pin 2 -28 ±2 V dc	If indication is normal, replace switch S402 as directed in section VI of this chapter. If indication is abnormal, check R405 and replace defective part.
9	Power sensor A401 (output level test 1)	a. Set POWER ON selector switch to off position.			
		b. Restore connection between power sensor A401 and switch S402.	Disconnect jumper from J2-K and J2-U. Disconnect connector plug P5 from connector receptacle J5.		
		c. Set POWER ON selector switch to on position.			
		d. Make test connections as specified in para 3-36.	Connect P5 to microwave power meter No. 2 (fig. FO-7).	-4.5 dBm (minimum)	If indication is normal, replace dc amplifier assembly A1. If indication is abnormal replace power sensor A401.
		e. Restore equipment to operational configuration.			

SECTION VI. MAINTENANCE OF FEED POWER MONITOR HTA-3A9

3-39. General. This section provides instructions for removal and replacement of items such as subassemblies and modules during offline maintenance. Adjustment procedures are provided, when required, after replacement of a faulty item.

3-40. Dual 15 V DC Power Supply PS401 or +28V DC Power Supply PS402 Removal and Replacement (fig. FO-7). To remove and replace power supply PS401 or PS402, perform the following steps. Upon replacement, adjust power supply PS401 or PS402 as directed in paragraph 3-50.

a. Remove power cable from J3.
b. On the top of power supply PS401, cut tie-wrap and remove cable while being careful not to cut into cable insulation.
c. Remove four nuts and lock washers which secure power supply PS401 or PS402 to the mounting bracket.
d. Slide power supply PS401 or PS402 one inch straight out from mounting bracket.
e. On front of power supply PS401 or rear of power supply PS402 (as viewed from front of feed power monitor HTA-3A9), tag for identification and unsolder electrical wires.
f. Remove power supply PS401 or PS402.
g. Install replacement power supply PS401 or PS402 with mounting bolts protruding through the four mounting holes on bracket.
h. Identify tagged wires and solder to applicable terminal on front of power supply PS401 or rear of power supply PS402.
i. Secure power supply PS401 or PS402 to mounting bracket with four nuts and lock washers.
j. Replace power cable on J3.
k. Adjust power supply PS401 output voltage to +- 15 volts +-0.075 volts dc or PS402 output voltage to +28 volts -+0.14 volts dc, as directed in paragraph 3-50.
l. Perform testing procedures described in section VI I of this chapter.

3-41. PIN Diode Attenuator AT401 Removal and Replacement (fig. FO-7). To remove and replace pin diode attenuator AT401, perform the following steps.

a. On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.
b. Remove three screws and washers from power head A401 mounting bracket.
c. Disconnect rf sensor A401 from switch S402.
c. Disconnect rf sensor A401 from switch S402.
d. Remove rf sensor A401 from mounting bracket.
e. From the top of switch S402, remove two screws and washers.
f. Disconnect switch S402 from pin diode attenuator AT401.
g. Tag and disconnect two connectors from rear of pin diode attenuator AT401.
h. From the top of pin diode attenuator AT401, remove two screws and washers.
i. Disconnect pin diode attenuator AT401 from RF INPUT connector J1.
j. Remove pin diode attenuator AT401.
k. Connect replacement pin diode attenuator AT401 to the RF INPUT connector J1.
l. Secure pin diode attenuator AT401 to chassis with two phillips head screws and washers.
m. Identify two electrical wires by tags and connect to rear of pin diode attenuator AT401.
n. Connect switch S402 to pin diode attenuator AT401 and rf sensor A401 to switch S402.
o. Perform testing procedures described in section VII of this chapter.

3-42. PIN Diode Switch S402 Removal and Replacement (fig. FO-7). To remove and replace pin diode switch S402, perform the following steps.

a. On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.
b. Remove three screws and washers from power head A401 mounting bracket.
c. Disconnect rf sensor A401 from switch S402.
d. Remove rf sensor A401 from mounting bracket.
e. On rear of switch S402 disconnect electrical connector.
f. From top of switch S402, remove two screws and washers.
g. Disconnect switch S402 from pin diode attenuator AT401.
h. Remove switch S402.
i. Connect replacement switch S402 to pin diode attenuator AT401.
i. Secure switch S402 to chassis with two screws and washers.
k. Connect electrical connector to rear of switch S402.
l. Connect rf sensor A401 to switch S402.
m. Perform testing procedures described in section VII of this chapter.

3-43. RF Sensor A401 Removal and Replacement (fig. FO-7). To remove and replace rf sensor A401, perform the following steps.

a. On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.

b. On top of power supply PS401 cut tie-wrap and remove cable while being careful not to cut into cable insulation.

c. Loosen and remove connector plug P5 from receptacle connector J5.

d. Remove three screws and washers from rf sensor A401 mounting bracket.

e. Disconnect rf sensor A401 from switch S402.

f. Remove rf sensor A401 from mounting bracket and repair at general support level.

g. Insert replacement rf sensor A401 through mounting bracket and connect to switch S402.

h. Determine effective efficiency from graph on rf sensor A401 and set EFF control on rear of rf sensor A401 to the value obtained.

i. Secure rf sensor A401 to mounting bracket with three screws and washers.

j. Connect and tighten connector plug P5 to receptacle connector J5.

k. Replace tic-wrap around cable on top of power supply PS401.

l. Perform testing procedures described in section VII of this chapter.

3-44. DC Amplifier Assembly HTA-3A9A1 Removal **and Replacement (fig. FO-7).** To remove and replace dc amplifier assembly HTA-3A9A1, perform the following steps:

a). On front panel of feed power monitor HTA-3A9 set POWER ON switch to off (down) position.

b. On rear of amplifier assembly, loosen and remove connector plugs P4 and P5 from connector receptacles J4 and J5.

c. On bottom of feed power monitor. remove two screws and lock washers from rear mounting bracket.

d. Loosen four screws and washers that secure amplifier to the front plate of the feed power monitor.

e. Remove rear mounting bracket from amplifier and repair amplifier at general support level.

f. Connect rear mounting bracket on replacement amplifier.

g. Insert replacement amplifier and secure to front panel with four screws and lock washers

h. Replace two screws and washers through bottom of feed power monitor and secure mounting bracket on amplifier to feed power monitor.

i. Insert and tighten connector plugs P4 and P5.

j. Perform testing procedures described in section VII of this chapter.

3-45. Relay K405 Removal and Replacement (fig. **FO-7). To remove and replace relay K405, perform the following steps:**

a. On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.

b. Remove nine screws and lock washers from bottom and seven screws and lock washers from the front plate of the feed power monitor.

c. Remove cover for access to relay K405.

d. Tag and unsolder SIX wires connected to relay K405.

e. Remove screw and lock washer securing relay K405 to chassis.

f. Remove relay K405 and discard.

g. Secure replacement relay K405 to chassis with one screw and lock washer.

h. Identify wires by tags and solder to applicable terminals on relay K405.

i. Perform troubleshooting procedures described in section VI I of this chapter.

3-46. POWER ON Switch S401 Removal and Replacement (fig. FO-7). To remove and replace switch S401, perform the following steps:

a. On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.

b. Remove nine screws and lock washers from bottom and seven screws and lock washers from the front plate of the feed power monitor.

c. Remove cover for access to switch S401.

d. Tag and unsolder two electrical wires connected to switch S401.

e. Loosen nut on the back side of the front plate first then loosen nut on the front side of the plate.

f. Remove switch and discard.

g. Insert replacement switch through rear of front panel and install nut on front and rear of switch.

h. Identify electrical wires by tags and solder to applicable switch terminals.

i. Perform testing procedures described in section VII of this chapter.

3-47. Indicator assembly DS401 Lamp and As**sembly Removal and Replacement (fig. FO-7).** Procedures to remove and replace the lamp in indicator assembly DS401 and the complete assembly are as follows:

a. Indicator Lamp.

(1) Turn lens cover counterclockwise and remove.

(2) Unscrew lamp counterclockwise and remove.

(3) Screw new lamp into socket and replace lens cover.

b. Indicator Assembly.

(1) On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.
(2) Remove nine screws and lock washers from bottom and seven screws and lock washers from the front plate of the feed power monitor.
(3) Remove cover for access to indicator assembly.
(4) Tag and unsolder two electrical wires from indicator assembly.
(5) Loosen nut on back of front panel.
(6) Push assembly forward from rear until free of chassis panel.
(7) Discard indicator assembly.
(8) Insert replacement indicator assembly through opening in chassis front panel.
(9) Tighten nut to secure indicator assembly to front panel.
(10) Identify electrical wires by tag and solder to indictor assembly.
(11) Perform testing procedures described in section VII of this chapter.

3-48. SIGNAL OUTPUT Connector J2 Removal and **Replacement (fig.** FO-7). To remove and replace SIGNAL OUTPUT connector J2, perform the following steps.

a. On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.
b. Remove nine screws and lock washers from bottom and seven screws and lock washers from the front plate of the feed power monitor.
c. Remove cover for access to connector J2.
d. Remove four screws, lock washers, and nuts securing connector to panel.
e. Pull connector forward through front panel.
f. Tag for identification and unsolder electrical wires.
g. **Remove connector J2 and discard.**
h. Identify electrical wires by tags and solder to replacement connector.
i. **Insert connector through front panel and replace screws, lock washers, and nuts.**
j. **Perform testing procedures described in section VII of this chapter.**

3-49. POWER INPUT Connector J3 Removal and **Replacement (fig. FO-7). To remove and replace POWER INPUT connector J3, perform the following steps.**

a. On front panel of feed power monitor HTA-3A9, set POWER ON switch to off (down) position.
b. Remove nine screws and lock washers from bottom and seven screws and lock washers from the front plate of the feed power monitor.
c. Remove cover for access to connector J3.
d. Remove four screws, lock washers, and nuts securing connector to panel.
e. Tag for identification and unsolder electrical wires.
f. Remove connector J3 and discard.
g. Identify electrical wires by tags and solder to replacement connector.
h. Insert connector through front panel and replace screws, lock washers, and nuts.
i. Perform testing procedures described in section VII of this chapter.

3-50. Dual 15 V DC Power Supply PS401 or +28 V **DC Power Supply PS402 Output Voltage Adjustment.** The following subparagraphs describe the test equipment. connections and conditions, initial control settings, and procedures for adjustment of power supply PS401 or PS402 output voltage.

a. Test Equipment. Test equipment required for the power supply adjustment is given in table 3-8.

Table 3-8 Test Equipment Required for Feed Power Monitor HTA-3A9 Power Supply PS401 and PS402 Adjustment

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, Single Banana Plug to Binding Post	2894	3	Pomona
Meter, Multifunction	3450B OPT001, 002	1	Hewlett-Packard
Test Lead, Banana Plug to Mini Test Clip	3782-36-B	1	Pomona

Table 3-8 Test Equipment Required for Feed Power Monitor HTA-3A9 Power Supply PS401 and PS402 Adjustment - Continued

Common name	Part/model no.	Qty	Manufacturer
Test Lead, Banana Plug to Mini Test Clip	3782-36-R	1	Pomona

b. Connections and Conditions. Power supply adjustment is accomplished with the feed power monitor HTA-3A9 on the bench. Prepare the equipment for adjustment as follows:

(1) On front panel of the feed power monitor, set POWER ON switch to off (down) position.
(2) Remove nine screws and lock washers from the bottom and seven screws and lock washers from the front plate of the feed power monitor.
(3) Remove cover for access to power supplies.
(4) Connect I7449 test lead with 2894 and 3562 adapters to connector J3 and insert other end into bench ac socket.
(5) Connect black test lead to black X terminal on multifunction meter.
(6) Connect red test lead to red X terminal on multifunction meter.

c. Initial Control Settings. Set controls as follows:

(1) Multifunction meter. Set LINE switch to on (up) position and press following switches:

Switch	Position
FUNCTION	DC
RANGE	AUTO

Switch	Position
CONTROL	LOCAL
TRIGGER	INT

(2) Feed power monitor. Set POWER ON switch to on (up) position.

d. Adjustment Procedure (fig. FO-7) Connect black test lead (neg) from multifunction meter to terminal 4 on power supply PS401 or terminal 3 on power supply PS402. Connect red test lead (pos) to terminal 5 on power supply PS401 or terminal 4 on power supply PS402. At rear of PS401 or PS402, insert small screwdriver through voltage adjust access hole (fig. FO-7) and adjust PS401 or PS402 for a multifunction meter display of 15 -+0.075 V dc or 28 -+0.14 V dc. Restore equipment to operating configuration.

3-51. ATTEN ADJUST Control Adjustment. The following subparagraphs describe the test equipment, connections and conditions, initial control settings, and procedures for setting the proper attenuation level for either range of input power (+4 to -36 dBm or +20 to -20 dBm).

a. Test Equipment. Test equipment required for the ATTEN ADJUST adjustment given in table 3-9.

Table 3-9 Test Equipment Required for Feed Power Monitor HTA-3A9 ATTEN ADJUST Adjustment

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 Plug to N Plug	3842	1	Pomona
Adapter, Single Banana Plug to Binding Post	2894	3	Pomona
Coupler, Directional 7 to 12 GHz 10 dB	3045C-10	1	Narda Microwave
Generator, Signal, SHF	620B	1	Hewlett-Packard
Meter, Multifunction	3450B	1	Hewlett-Packard

Table 3-9 Test Equipment Required for Feed Power Monitor HTA-3A9 ATTEN ADJUST Adjustment - Continued

Common name	Part/model no.	Qty	Manufacturer
Meter, Power, Microwave	460B	1	General Microwave
Mount, Thermoelectric	N422C	1	General Microwave
Test Lead, Banana Plug to Banana Plug	B-48(R)	1	Pomona
Test Lead, Banana Plug to Banana Plug	B-48(B)	1	Pomona
Test Lead, N Plug to N Plug	1658-T-36	1	Pomona

b. Connections and Conditions. ATTEN ADJUST control adjustment is accomplished with feed power monitor HTA-3A9 on the bench. Prepare the equipment for adjustment as follows:

(1) On front panel of feed power monitor, set POWER ON switch to off (down) position.
(2) Connect 17449 test lead with 2894 and 3562 connector J3 and insert other end into ac socket.
(3) Connect shf signal generator, thermoelectric mount, and microwave power meter to directional coupler with controls set as prescribed in paragraph 3-37b.
(4) Connect black test lead to black X terminal on multifunction meter.
(5) Connect red test lead to red X terminal on multifunction meter.

c. Initial Control Settings. Set controls as follows:

(1) Multifunction meter. Set LINE switch to on (up) position and press following switches:

Switch	Position
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT

(21 Feed power monitor HTA-3A9. Set POWER ON switch to on (up) position.

d. Adjustment Procedure. Connect black test lead (neg) from multifunction meter to connector J2 pin A and red test lead (pos) from multifunction meter to connector J2 pin M. With 0 dBm input signal to RF INPUT connector J1, adjust the front panel ATTEN ADJUST control fully cw from minimum attenuation. Gradually increase ATTEN ADJUST control for a multifunction meter display of either 2.0 volts, range 4 (+4 dBm full scal) or 5.0 V. range 2 (+20 dBm full scale). Restore equipment to operating configuration.

SECTION VII. TESTING OF FEED POWER MONITOR HTA-3A9

3-52. General. This section contains the procedures necessary for performance testing the feed power monitor HTA-3A9 after replacement of line replaceable units following the troubleshooting procedures. Each of the preliminary procedures and the 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 procedure-s result in the feed power monitor meeting all performance standards specified in the performance test, the equipment can be returned to service.

3-53. Test equipment. Test equipment required for direct support testing of the feed power monitor HTA-3A9 is the same as that required for troubleshooting lined in table 3-6.

3-54. Test Connection and Conditions (fig. 3-11). Testing of feed power monitor HTA-3A9 is accomplished on the bench. Test connections and conditions are the same as those required for troubleshooting and described in paragraph 3-36. The initial test setup is shown in figure 3-11.

3-55. Initial Control Settings. Initial control settings are the same as those required for troubleshooting and described in paragraph 3-37.

3-56. Performance Test Procedure. Table 3-10 contains the test procedure for feed power monitor HTA-3A9. Proceed sequentially through the table in accordance with **the** numbered steps. Set the test equipment controls and equipment under test controls exactly as given in the table and perform the prescribed test procedure. If the result is within the specified performance standard limits, proceed to the next step in the table. If the result is not as specified, perform the troubleshooting procedures in section V. After fault correction, repeat the performance test.

Table 3-10 Feed Power Monitor HTA-3A9 Performance Test

Step	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1		Set POWER ON selector switch to ON position	Observe indicator lamp.	Indicator lamp lights.
2	Set shf signal generator OUTPUT ATTEN to 0 dBm. Set microwave power meter RANGE button to 1 mW, 0 dBm scale. Set multifunction meter FUNCTION switch to DC.	Set POWER ON switch to on position. Insert jumper from J2-K to J2-U. Rotate ATTEN ADJUST fully CW (minimum position).	Connect signal generator, thermoelectric mount and microwave power meter to directional coupler. Connect directional coupler to feed power monitor. Connect multifunction meter test leads as follows: Test lead J2 –(blk) Pin A +(red) Pin S	50 mV dc or less
3			Move multifunction meter read test lead to J2-J.	28 ±2 V dc
4		Disconnect jumper from J2-K and J2-U. Rotate ATTEN ADJUST fully CCW.		28 ±2 V dc
5	Set multifunction meter FUNCTION switch to DC.		Move multifunction meter red test lead to J2-M.	500 mV dc or greater.
6	Rotate shf signal generator OUTPUT ATTEN slowly from 0 dBm to -36 dBm.	Rotate ATTEN ADJUST fully CW.		RANGE switching occurs between 0.4 and 0.475 V dc.
7	Rotate shf signal generator OUTPUT ATTEN slowly from -36 dBm until 28 V dc appears on vom.	Rotate ATTEN ADJUST fully CW.	Connect vom test leads as follows: Test lead J2 –(blk) Pin A +(red) Pin P	28 ±2 V dc at -25 ±2 dBm
8	Rotate shf signal generator OUTPUT ATTEN slowly from -25 ±2 dBm until 28 V dc appears on vom.	Rotate ATTEN ADJUST fully CW.	Connect vom test leads as follows: Test lead J2 –(blk) Pin A +(red) Pin E	28 ±2 V dc at -14 ±2 dBm
9	Rotate shf signal generator OUTPUT ATTEN slowly from -14 ±2 dBm until 28 V dc appears on vom.	Rotate ATTEN ADJUST fully CW.	Connect vom test leads as follows: Test lead J2 –(blk) Pin A +(red) Pin E	28 ±2 V dc at -4 ±2 dBm
10	Rotate shf signal generator OUTPUT ATTEN slowly from 0 dBm until 28 V dc appears on vom.	Rotate ATTEN ADJUST fully CW.	Connect vom test leads as follows: Test lead J2 –(blk) Pin A +(red) Pin E	28 V dc at -25 ±2 dBm

4-1. Scope. This chapter contains troubleshooting maintenance. and testing procedures for feed power monitor HTA-3A9. Section I describes the tools and test equipment required for general support maintenance of the feed power monitor; Section II provides maintenance instructions for dc amplifier assembly HTA-3A9A1; and Section III provides maintenance instructions for rf sensor HTA-3A9A401.

4-2. Test Equipment and Materials. Table 4-1 is an overall list of test equipment and materials required for trouble shooting, maintenance, and testing of rf sensor HTA-3 49A401 and dc amplifier assembly HTA-3A9A1.

Table 4-1 Tools and Test Equipment Required for Maintenance

Common name	Official nomenclature	Part/model no.	Qty	Manufacturer
Ac Line Cord		17449	1	Belden
Adapter, Banana Jack to Minigator Clip		3448	3	Pomona
Adapter, Banana Jack to Size 16 Female Connector		3562	5	Pomona
Adapter, Banana Jack to Size 16 Male Connector		3563	5	Pomona
Adapter, Single Banana Plug to Binding Post		2894	3	Pomona
Calibrator	Calibrator 305B	305B	1	General Microwave
Counter, Digital, Electronic	Electronic Counter CP-772/U	5245L	1	Hewlett-Packard
Generator, Signal, SHF	Signal Generator SG-944/U	620B	1	Hewlett-Packard
Generator, Signal, VHF	Signal Generator SG-1093/U	8640B	1	Hewlett-Packard
Meter, Power, Microwave	Test Set Radio Frequency Power TS-3546/U	460B	1	General Microwave
Meter, Multifunction	Multimeter ME-482(P)/U	3450B OPT001, 002	1	Hewlett-Packard
Milliammeter, Volt-Ohm-	Multimeter ME-450/U	260-6	1	Simpson
Mount, Thermoelectric		N422C	1	General Microwave
Oscilloscope, Dual-Trace	Oscilloscope OS-261/U	475	1	Tektronix
Resistor, 500 Ohm		RCR07G501JS	1	Allen Braddley
Test Lead, Banana Plug to Alligator Clip		3782-12-B	1	Pomona
Test Lead, Banana Plug to Alligator Clip		3782-12-R	1	Pomona
Test Lead, Banana Plug to Banana Plug		B-12	2	Pomona
Test Lead, Banana Plug to Banana Plug		B-48(B)	1	Pomona
Test Lead, Banana to Banana Plug		B-48(R)	1	Pomona

Table 4-1 Tools and Test Equipment Required for Maintenance - Continued

Common name	Official nomenclature	Part/model no.	Qty	Manufacturer
Test Lead, Banana Plug to Mini Test Clip		3782-36-B	1	Pomona
Test Lead, Banana Plug to Mini Test Clip		3782-36-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	1	Pomona
Test Lead, BNC Plug to BNC Plug (48 inches)		10503A	1	Hewlett-Packard
Test Lead, BNC Plug to Double Banana		2BB-BNC-24	1	Pomona
Test Lead, BNC Plug to Stackup Pin Tips		2882-C-36	1	Pomona
Test Lead, Microgator Clip to Microgator Clip		1613-12	1	Pomona
Tool Kit		TK-1	1	General Microwave

4-3. Voltage and Resistance Measurements (fig. 4-2 through 4-6, 4-10). The voltage and resistance measurements required to perform maintenance on dc amplifier assembly HTA-3A9A1 and rf sensor HTA-3A9A401 are given in the following tables. Each point of test can be located by referring to figures 4-2 through 4-8 and 4-10. 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 4-2 DC Amplifier Assembly HTA-3A9A1 Voltage and Resistance Measurements

Point of test	Reference point	Voltage	Resistance	Conditions
TP2	Ground	+10 ±1 V dc		
. 5	R35		0 to 500 ohms	One side disconnected.
Base of Q7	Ground	+10 ±1 V dc		
Cathode of CR6	Anode of CR6	+11.5 ±1 V dc		Range 1
Emitter Q101	Ground	+5 V ±0.3 V dc		Ranges 1, 2, 3 or 4
Base of Q101	Ground	+5.6 ±0.3 V dc		Ranges 1, 2, 3 or 4
Collector of Q108	Ground	+120 mV dc (max)		Range 1
Base of Q108	Ground	+0.5 V dc or greater		Range 1
Pin 13 of A102	Ground	+2.4 to +5.5 V dc		Range 1
R121	R121		2090 to 2310 ohms	Range 1
Pin 11 and 12 of A102	Ground	0 to +0.4 V dc		Range 1
Pin 11 of A104	Ground	0 to +0.4 V dc		Ranges 1, 2, 3 or 4

Table 4-2 DC Amplifier Assembly HTA-3A9A1 Voltage and Resistance Measurements - Continued

Point of test	Reference point	Voltage	Resistance	Conditions
Pin 3 of A104	Ground	0 to +0.4 V dc		Ranges 1, 2, 3 or 4
Pin 6 of A105	Ground	0 to +0.4 V dc		Ranges 1, 2, 3 or 4
Pin 11 of A105	Ground	0 to +0.4 V dc		Ranges 1, 2, 3 or 4
Emitter of Q104	Ground	0 to +0.4 V dc		Ranges 1, 2, 3 or 4
Pin 3 of A103		0 to +0.4 V dc		Ranges 1, 2, 3 or 4
Base of Q103	Ground	+0.3 V dc or greater		Ranges 1, 2, 3 or 4
Pin 12 of A105	Ground	+2.4 to +5.5 V dc		Ranges 1, 2, 3 or 4
Pin 13 of A105	Ground	0 to +0.4 V dc		Ranges 1, 2, 3 or 4
Pin 4 of A101	Ground	+4.5 ±0.5 V dc		Ranges 1, 2, 3 or 4
Between R106 and pin D of J4	Ground	+4.5 ±0.5 V dc		Ranges 1, 2, 3 or 4
Pin 9 of A104	Ground	0 to 3.9 ±0.5 V dc		Ranges 1, 2, 3 or 4
Pin 3 of A104	Ground	0 to +3.9 ±0.5 V dc		Ranges 1, 2, 3 or 4
Pin 5 of A104	Ground	0 to 3.9 ±0.5 V dc		Ranges 1, 2, 3 or 4
Pin 2 of A105	Ground	+3.9 ±0.5 V dc		Ranges 1, 2, 3 or 4
Pin 4 of A105	Ground	+3.9 to 0 ±0.5 V dc		Ranges 1, 2, 3 or 4
Pin 3 of A104	Ground	0 to +3.9 ±0.5 V dc		Ranges 1, 2, 3 or 4
Pin 11 of A105	Ground	0 to +3.9 ±0.5 V dc		Ranges 1, 2, 3 or 4
Cathode of CR7	Anode of CR7	+11.5 ±1 V dc		Range 2
Collector of Q107	Ground	+1.0 ±0.3 V dc		Range 2
Base of Z107	Ground	0.5 V dc or greater		Range 2
Pin 10 of A102	Ground	+2.4 to +5.5 V dc		Range 2
R119	R119		2090 to 2310 ohms	Range 2
Pin 8 and pin 9 of A102	Ground	0 to +0.4 V dc		Range 2
Cathode of CR8	Anode of CR8	+11.5 ±1 V dc		Range 3
Collector of Q106	Ground	+1.0 ±0.3 V dc		Range 3
Base of Q106	Ground	0.5 V dc or greater		Range 3
Pin 4 of A102	Ground	+2.4 to +5.5 V dc		Range 3
R117	R117		2090 to 2310 ohms	
Pin 5 and pin 6 of A102	Ground	0 to +0.4 V dc		Range 3
Cathode of CR9	Anode of CR9	+11.5 ±1 V dc		Range 4
Collector of Q105	Ground	0.5 V dc or greater		Range 4

Table 4-2 DC Amplifier Assembly HTA-3A9A1 Voltage and Resistance Measurements - Continued

Point of test	Reference point	Voltage	Resistance	Conditions
Pin 1 of A102	Ground	+2.4 to +5.5 V dc		
R115	R115		2( ) to 2310 ohms	Range 4
Pin 1 and pin 2 of A102	Ground	0 to +0.4 V dc		Range 4
Pin 6 of AR1	Ground	+5 ±0.03 V dc		Range 4
Pin 3 of AR1	Ground	+1 ±0.1 V dc		Range 4
Pin B of J5	Ground	+1 ±0.1 V dc		Range 4
Pin 1 of AR1	Ground			
R1	R1		0 to 25 Kohms	
Emitter of Q4	Ground	+1 ±0.1 V dc		Range 4
Pin 6 of AR4	Ground	+5.10 ±0.5 V dc		Range 4
TP1	Ground	+1 ±0.1 V dc		Range 4
R39	R39		0 to 500 ohms	
Emitter of Q3	Ground	-15 ±1.5 V dc		Range 4
Emitter of Q2	Ground	+9 ±1.0 V dc		Range 4
Collector of Q1	Ground	-6.5 ±0.7 V dc		Range 4
Between R220 and R222	Ground	0 to +10 V dc		Range 1
Gate of Z201	Ground	0 to +10 V dc		Range 1
Pin 6 of AR201		0 ±0.3 V dc		Range 1

Table 4-3 Power Sensor A401 Voltage and Resistance Measurements

Point of test	Reference point	Voltage (V dc)	Resistance	Conditions
Connector P4 pin 1	Connector P4 pin 3		190 to 210 ohms	

SECTION II. MAINTENANCE OF DC AMPLIFIER ASSEMBLY HTA-3A9A1

4-4. General. This section provides troubleshooting, removal and replacement and testing procedures for maintenance of dc amplifier assembly HTA-3A9A1.

4-5. Troubleshooting. This paragraph contains troubleshooting procedures for isolating a dc amplifier assembly HTA-3A9A1 fault to a malfunctioning assembly or module after referral by direct support maintenance. All preliminary procedures must be performed before the actual troubleshooting procedures are started. Procedural steps must be accomplished in the given sequence. Test and operating equipment control settings given in the following procedures must be made carefully to ensure accurate test conditions.

a. Test Equipment and Materials. Table 4-4 lists the test equipment required for troubleshooting dc amplifier assembly HTA-3A9A1.

Table 4-4 Test Equipment Required for Troubleshooting DC Amplifier Assembly HTA-3A9A1

Common name	Part/model no.	Qty	Manufacturer
AC Line Cord	17449	1	Belden
Adapter, Banana Jack to Minigator Clip	3448	1	Pomona
Adapter, Banana Jack to Size 16 Female Connector	3562	3	Pomona
Adapter, Banana Jack to Size 16 Male Connector	3563	5	Pomona
Adapter, Single Banana to Binding Post	2894	3	Pomona
Calibrator	305B	1	General Microwave
Counter, Digital, Electronic	5245L	1	Hewlett-Packard
Meter, Multifunction	3450B OPT001, 002	1	Hewlett-Packard
Milliammeter, Volt-Ohm-	260-6	1	Simpson
Oscilloscope, Dual-Trace	475	1	Tektronix
Resistor, 500 Ohm	RCR07G 501JS	1	Allen Bradley
Test Lead, Banana Plug to Banana Plug	B-12	1	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
Test Lead, Banana Plug to Mini Test Clip	3782-36-B	1	Pomona
Test Lead, Banana Plug to Mini Test Clip	3782-36-R	1	Pomona
Test Lead, BNC Plug to BNC Plug (48 inches)	10503A	1	Hewlett-Packard
Test Lead, BNC Plug to Double Banana	2BB-BNC-24	1	Pomona
Test Lead, BNC Plug to Stackup Pin Tips	2882-C-36	1	Pomona
Test Lead, Microgator Clip to Microgator Clip	1613-12	1	Pomona

b. Test Connections and Conditions (fig. 4-1). **Troubleshooting of dc amplifier assembly HTA-3A9A1 is accomplished in a bench test setup. Prior to performing the troubleshooting procedure, perform the following steps:**

(1) Install connector P4 in J4 of dc amplifier assembly.

(2) Connect fabricated ac line cord to connector J3 and to ac power plug as shown in figure 4-1.

c. Calibrator 305B Initial Control Settings (fig. 4-1). **Prior to performing the troubleshooting procedure, ensure that the calibrator is outputting the proper levels by performing the following steps after allowing a five minute warmup period:**

(1) Press ZERO.
(2) Press 1 mW HEAD POWER RATING button.
(3) Press POWER RANGE 8 button.
(4) Press ON/OFF pushbutton to ON.
(5) Connect multifunction meter test leads between the test points at the rear of the calibrator 305B.
(6) Observe multifunction meter for an indication of 4.312 mV.
(7) if an indication of 4.312 mV is not obtained, adjust CAL control on rear of the calibrator 305B.
(8) Disconnect multifunction meter test leads and connect calibrator 305B to connector J5 of dc amplifier assembly as shown in figure 4-l.

d. Electronic Digital Counter Initial Control Settings. Set SAMPLE RATE control clockwise from POWER OFF position to turn counter on and set controls as follows:

Control	Position
FUNCTION	FREQUENCY
TIME BASE	1.0
LEVEL	PRESET
SENSITIVITY	1

e. Oscilloscope Initial Control Settings. **Pull POWER switch out to turn on and set controls as follows.**

(1) Set controls as follows:

Control	Position
Channel 1 TRIGGER	
SOURCE	NORMAL
COUPLING	AC
A TRIG HOLDOFF	NORM
TRIG MODE	AUTO
A and B TIME/DIV	5 ms
and B DELAY TIME	5 ms
HORIZ DISPLAY	A
VOLTS/DIV	5
VERTICAL MODE	CH1
AC-GND-DC	DC

(2) Connect test cable with adapters to CH1 input jack as shown in figure 4-1.
(3) Adjust INTENSITY and FOCUS as required for sharp trace on oscilloscope.
(4) Set horizontal FINE POSITION as required; if sweep is not visible, push BEAM FINDER and adjust FINE POSITION as required.

f. Multifunction Meter Initial Control Settings. Set LINE switch to on (up) position and press following switches.

Switch	Position
FUNCTION	DC
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT

g. VOM Initial Control Settings (figs. 4-2 through 4-8, FO-4). Set vom controls as follows:

Control	Position
FUNCTION	+DC
RANGE switch	RX1

h. Troubleshooting Procedures. After completing the preliminary procedures, perform the necessary troubleshooting procedures in table 4-5. Perform the steps in table 4-5 in the sequence given until the malfunctioning item is found. Use the feed power monitor HTA-3A9 schematic (fig. FO-4) and parts location diagram (fig. 4-2 through 4-8) as an aid in performing the troubleshooting procedures. After the faulty item has been replaced, perform the testing procedures described in paragraph 4-7. Upon satisfactory completion of the performance test, the dc amplifier assembly HTA-3A9A1 can be returned to service.

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
1	Chopper drive frequency	On feed power monitor, set POWER ON switch to on position.	Connect electronic digital counter between TP2 and chassis ground (fig. 4-6).	110 Hz ±1 Hz	If indication is normal, proceed to step 5. If indication is abnormal, proceed to step 2.
2	Chopper drive frequency	Adjust R35 pcb A1A5.		110 Hz ±1 Hz	If indication is normal, proceed to step 5. If indication is abnormal, proceed to step 3.
3	Chopper drive and relay pcb A1A5 R35	a. On feed power monitor, set POWER ON switch to off position. b. On vom, set FUNCTION switch to +DC and range switch at RX100	Connect ohmmeter leads across R35 (fig. 4-6).	0 to 500 ohms	If indication is normal, proceed to step 4. If indication is abnormal, replace faulty potentiometer and repeat step 1.
4	Chopper drive and relay pcb A1A5 R64	a. Set osciiloscope controls as prescribed in paragraph 4-5e. b. On feed power monitor, set POWER ON	Connect oscilloscope test lead and adapter to base of Q7 (fig. 4-6).	+10 ±1 V square wave	If indication is normal, replace R64. If indication is abnormal, check Q5, Q6, Q7, Q8, CR1, CR2, CR3, CR4, and associated parts. Replace defective part and repeat step 1.
5	Chopper drive and relay pcb A1A5 relay K1 (range 1)	On 305B calibrator, press POWER RANGE 2 button and release ZERO button.	Connect multifunction meter across K1 winding (+ test lead to cathode and - test lead to anode of CR6) (fig. 4-6).	11.5 ±1 V K1 energized	If indication is normal, proceed to step 24. If voltage is present but relay is not energized, replace relay K1. If voltage is not present, proceed to step 6.
6	Power supply/counter decoder pcb A1A3 Q101		Connect multifunction meter to emitter of Q101 and ground (fig. 4-8).	+5 ±0.3 V dc	If indication is normal, proceed to step 8. If indication is abnormal, proceed to step 7.
7	Power supply/counter decoder pcb A1A3 CR101		Connect multifunction meter to base of Q101 and ground (fig. 4-8).	5.6 ±0.3 V	If indication is normal, replace Q101 and repeat step 5. If indication is abnormal, replace CR101 and repeat step 5.
8	Power supply/counter		Connect multifunction me-	120 mV (max-	If indication is normal, check

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
	decoder pcb A1A3 R122-Q108		ter to collector of Q108 and ground (fig. 4-8).	imum)	CR6 and K1. Replace defective part and repeat step 5. If indication is 0 V, check R122. Replace defective part and repeat step 5. If indication is +15 V, proceed to step 9.
9	Power supply/counter decoder pcb A1A3 R121 Q108		Connect multifunction meter to base of Q108 and ground (fig. 4-8).	0.5 V or greater	If indication is normal, replace Q108 and repeat step 5. If indication is abnormal, proceed to step 10.
10	Power supply/counter decoder pcb A1A3 A102		Connect multifunction meter to pin 13 of A102 and ground (fig. 4-8).	+2.4 to +5.5 V dc	If indication is normal, proceed to step 11. If indication is abnormal, proceed to step 12.
11	Power supply/counter decoder pcb A1A3 R121-Q108	a. On feed power monitor, set POWER ON switch to off position. b. Disconnect one end of R121 from circuit.	Connect vom test leads to R121 (fig. 4-8).	2090 to 2310 ohms	If indication is normal, replace Q108 and repeat step 5. If indication is abnormal, replace R121 and repeat step 5.
12	Power supply/counter decoder pcb A1A3 A102		Connect multifunction meter to pin 11 of A102 and ground (fig. 4-8).	0 to +0.4 V dc	If indication is normal, replace A102 and repeat step 5. If indication is abnormal, proceed to step 13.
13	Power supply/counter decoder pcb A1A3 A104 test 1		Connect multifunction meter to pin 11 of A104 and ground (fig. 4-8).	0 to 0.4 V dc	If indication is normal, proceed to step 14. If indication is abnormal, proceed to step 15.
14	Power supply/and counter decoder pcb A1A3 A104 test 2		Connect multifunction meter to pin 3 of A104 and ground (fig. 4-8).	0 to 0.4 V dc	If indication is normal, replace A104 and repeat step 5. If indication is abnormal, proceed to step 16.
15	Autorange logic pcb A4 A105 test 1		Connect multifunction meter to pin 6 of A105 and ground (fig. 4-7).	0 to 0.4 V dc	If indication is normal, replace CR103 and repeat step 5. If indication is abnormal, proceed to step 16.
16	Autorange logic pcb A4 A105 test 2		Connect multifunction meter to pin 11 of A105 and ground (fig 4-7).	0 to +0.4 V dc	If indication is normal, replace A105 and repeat step 5. If indication is abnormal,

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					proceed to step 17.
17	Autorange logic pcb A4 Q104		Connect multifunction meter to emitter of Q104 and ground (fig. 4-7).	0 to 0.4 V dc	If indication is normal, replace Q104 and repeat step 5. If indication is abnormal, proceed to step 18.
18	Autorange logic pcb A4 A103		Connect multifunction meter to pin 3 of A103 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, check R113 and Q104. Replace defective part and repeat step 5. If indication is abnormal, proceed to step 19.
19	Autorange logic pcb A4 Q103		Connect multifunction meter to base of Q103 and ground (fig. 4-7).	+0.3 V or greater	If indication is normal, replace Q103 and repeat step 5. If indication is abnormal, proceed to step 20.
20	Autorange logic A4 R112		Connect multifunction meter to pin 12 of A105 and ground (fig. 4-7).	+2.4 to +5.5 V dc	If indication is normal, replace R112 and repeat step 5. If indication is abnormal, proceed to step 21.
21	Autorange logic pcb A4 A105		Connect multifunction meter to pin 13 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace A105 and repeat step 5. If indication is abnormal, proceed to step 22.
22	Autorange logic pcb A4 A101		Connect multifunction meter to pin 4 of A101 and ground (fig. 4-7).	4.5 ±0.5 V dc	If indication is normal, replace A101 and repeat step 5. If indication is abnormal, proceed to step 23.
23	Autorange logic pcb A4 R106		Connect multifunction meter between junction of R106 and pin D of J4 and ground (figs. 4-7 and FO-7).	4.5 ±0.5 V dc	If indication is normal, check R106 and A101. Replace defective part and repeat step 5. If indication is abnormal, check 305B calibrator and repeat step 5.
24	Autorange logic pcb A4 A105		Connect multifunction meter to pin 1 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, proceed to step 25. If indication is abnormal, check Q102 and associated resistors. Replace defective part.
25	Autorange logic pcb A4 Q102		Connect multifunction meter to base of Q102 and ground (fig. 4-7).	0.3 ±0.1 V dc	If indication is normal, proceed to step 26. If indication is abnormal

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					check Q102 for correct biasing. Replace defective part and repeat step 5.
26	Autorange logic pcb A4 A105		Connect multifunction meter to pin 2 of A105 and ground (fig. 4-7).	+2.4 to +5.5 V dc	If indication is normal, proceed to step 27. If indication is abnormal, replace A105 and repeat this step.
27	Power supply/counter decoder pcb A1A3 A104 test 1	a. On feed power monitor, set POWER ON switch to off position. b. Using 3 mini test clip leads 3782-36 and 3448 adapter, jumper following pins to ground: A102 pin 1 and A102 pin 13 on 6126-1 pc board on A105 pin 12 on A4 pc board. Refer to paragraph 4-6a for removal and replacement of pcb A4. c. On feed power monitor, set POWER ON switch to on position.	Connect oscilloscope to pin 9 of A104 and ground (fig. 4-8).	Squarewave, 0 to +3.9 ±0.5 V, 1.2 second period.	If indication is normal, remove mini-test clips from A102 pin 1, A102 pin 13 and A105 pin 12 and proceed to step 34. If indication is abnormal, proceed to step 28.
28	Power supply/counter decoder pcb A1A3 A104 test 2		Connect oscilloscope to pin 3 of A104 and ground (fig. 4-8).	Positive-going pulse, 0 to +3.9 ±0.5 V, 0.6 second period.	If indication is normal, replace A104, and repeat step 27. If indication is abnormal, proceed to step 29.
29	Power supply/counter decoder pcb A1A3 A104 test 3		Connect oscilloscope to pin 5 of A104 and ground (fig. 4-8).	Squarewave 0 to +3.9 ±0.5 V, 0.6 second period.	If indication is normal, proceed to step 30. If indication is abnormal, proceed to step 32.
30	Autorange logic pcb A4 A105		Connect oscilloscope to pin 2 of A105 and ground (fig. 4-7).	+3.9 ±0.5 V	If indication is normal, proceed to step 31. If indication is abnormal, replace A105 and repeat step 27.
31	Autorange logic pcb A4 A105		Connect oscilloscope to pin 4 of A105 and ground (fig. 4-7).	Negative-going pulse, +3.9	If indication is normal, replace A103 and repeat step 27.

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
				±0.5 V to 0 V, 0.6 second period.	If indication is abnormal, replace A105 and repeat step 27.
32	Power supply/counter decoder pcb A1A3 A104		Connect oscilloscope to pin 3 of A104 and ground (fig. 4-8).	Positive-going pulse, 0 to +3.9 ±0.5 V, 0.6 second period.	If indication is normal, replace A104 and repeat step 27. If indication is abnormal, proceed to step 33.
33	Autorange logic pcb A4 Q104		Connect oscilloscope to pin 11 of A105 and ground (fig. 4-7).	Positive-going pulse, 0 to +3.9 ±0.5 V, 0.6 second period.	If indication is normal, replace A105 and repeat step 27. If indication is abnormal, check Q104, L101, R113 and Q106, replace defective part and repeat step 27.
34	Chopper drive and relay pcb A1A5 Relay K2 (Range 2)	On 305B calibrator, press power range 4 button.	Connect multifunction meter across K2 winding (+ test lead to cathode and - test lead to anode of CR7) (fig. 4-6).	11.5 ±1 V, K2 energized.	If indication is normal, proceed to step 53. If voltage present but relay not energized, replace K2. If voltage not present, proceed to step 35.
35	Power supply/counter decoder pcb A1A3 Q101		Connect multifunction meter to emitter of Q101 and ground (fig. 4-8).	+5 ±0.3 V dc	If indication is normal, proceed to step 37. If indication is abnormal, proceed to step 36.
36	Power supply/counter decoder pcb A1A3 CR101		Connect multifunction meter to base of Q101 and ground (fig. 4-8).	5.6 ±0.3 V dc	If indication is normal, replace Q101 and repeat step 34. If indication is abnormal, replace CR101 and repeat step 35.
37	Power supply/counter decoder pcb A1A3 R120-Q107		Connect multifunction meter to collector of Q107 and ground (fig. 4-8).	+120 mV (max)	If indication is normal, check CR7 and K2. Replace defective part and repeat step 34. If indication is 0 V, check K2 and R119. Replace defective part and repeat step 34. If indication is +15 V, proceed to step 38.
38	Power supply/counter decoder pcb A1A3 R119-Q107		Connect multifunction meter to base of Q107 and ground (fig. 4-8).	0.5 V or greater	If indication is normal, replace Q107 and repeat step 34. If indication is abnormal,

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					proceed to step 39.
39	Power supply/counter decoder pcb A1A3 A102		Connect multifunction meter to pin 10 of A102 and ground (fig. 4-8).	+2.4 to +5.5 V dc	If indication is normal, proceed to step 40. If indication is abnormal, proceed to step 41.
40	Power supply/counter decoder pcb A1A3 R119-Q107	a. On feed power monitor, set POWER ON switch to off position. b. Disconnect one end of R119 from circuit.	Connect vom test leads to R119 (fig. 4-8).	2090 to 2310 ohms	If indication is normal, replace Q107 and repeat step 34. If indication is abnormal, replace R119 and repeat step 34.
41	Power supply/counter decoder pcb A1A3 A102		Connect multifunction meter to pin 8 of A102 and ground and to pin 9 of A102 and ground (fig. 4-8).	0 to +0.4 V dc	If indication is normal, replace A102 and repeat step 34. If indication is abnormal, proceed to step 42.
42	Power supply/counter decoder pcb A1A3 A104 test 1		Connect multifunction meter to pin 11 of A104 and ground (fig. 4-8).	0 to 0.4 V dc	If indication is normal, proceed to step 43. If indication is abnormal, proceed to step 44.
43	Power supply/counter decoder pcb A1A3 A104 test 2		Connect multifunction meter to pin 3 of A104 and ground (fig. 4-8).	0 to 0.4 V dc	If indication is normal, replace A104 and repeat step 34. If indication is abnormal, proceed to step 45.
44	Autorange logic pcb A4 A105 test 1		Connect multifunction meter to pin 6 of A105 and ground (fig. 4-7).	0 to 0.4 V dc	If indication is normal, replace CR103 and repeat step 34. If indication is abnormal, proceed to step 45.
45	Autorange logic pcb A4 A105 test 2		Connect multifunction meter to pin 11 of A105 and ground (fig. 4-7).	0 to 0.4 V dc	If indication is normal, replace A105 and repeat step 34. If indication is abnormal, proceed to step 46.
46	Autorange logic pcb A4 Q104		Connect multifunction meter to emitter of Q104 and ground (fig. 4-7)	0 to 0.4 V dc	If indication is normal, replace Q104 and repeat step 34. If indication is abnormal, proceed to step 47.
47	Autorange logic pcb A4 A103		Connect multifunction meter to pin 3 of A103 and ground (fig. 4-7).	0 to 0.4 V dc	If indication is normal, check R113 and Q104. Replace defective part and repeat step 34. If indication is abnormal,

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					proceed to step 48.
48	Autorange logic pcb A4 Q103		Connect multifunction meter to base of Q103 and ground (fig. 4-7).	+0.3 V or greater	If indication is normal, replace Q103 and repeat step 34. If indication is abnormal, proceed to step 49.
49	Autorange logic pcb A4 R112		Connect multifunction meter to pin 12 of A105 and ground (fig. 4-7).	+2.4 to +5.5 V dc	If indication is normal, replace R112 and repeat step 34. If indication is abnormal, proceed to step 50.
50	Autorange logic pcb A4 A105		Connect multifunction meter to pin 13 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace A105 and repeat step 34. If indication is abnormal, proceed to step 51.
51	Autorange logic pcb A4 A101		Connect multifunction meter to pin 4 of A101 and ground (fig. 4-7).	4.5 ±0.5 V dc	If indication is normal, replace A101 and repeat step 34. If indication is abnormal, proceed to step 52.
52	Autorange logic pcb A4 R106		Connect multifunction meter between junction of R106 and pin D of J4 and ground (fig. 4-7).	4.5 ±0.5 V dc	If indication is normal, check R106 and A101. Replace defective part and repeat step 34. If indication is abnormal, check 305B calibrator and repeat step 34.
53	Chopper drive and relay pcb A1A5 Relay K3 (Range 3)	On 305B calibrator, press power range 6 button.	Connect multifunction meter across K3 winding (+ test lead to cathode and - test lead to anode of CR8) (fig. 4-6).	11.5 ±1 V, K3 energized.	If indication is normal, proceed to step 72. If voltage is present but relay is not energized, replace K3. If voltage is not present, proceed to step 54.
54	Power supply/counter decoder pcb A1A3 Q101		Connect multifunction meter to emitter of Q101 and ground (fig. 4-8).	+4.7 to +5.3 V dc	If indication is normal, proceed to step 56. If indication is abnormal, proceed to step 55.
55	Power supply/counter decoder pcb A1A3 CR101		Connect multifunction meter to emitter of Q101 and ground (fig. 4-8).	5.6 ±0.3 V dc	If indication is normal, replace Q101 and repeat step 53. If indication is ab normal, replace CR101 and repeat step 53.
56	Power supply/counter decoder pcb A1A3 R118-Q106		Connect multifunction meter to collector of Q106 and ground (fig. 4-8).	120 mV dc (max)	If indication is normal, check CR8 and K3. Replace defective part and repeat step 53.

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					If indication is 0 V, check K3 and R117. Replace defective part and repeat step 53. If indication is +15 V, proceed to step 57.
57	Power supply/counter decoder pcb A1A3 R117-Q106		Connect multifunction meter to base of Q106 and ground (fig. 4-8).	+0.5 V or greater	If indication is normal, replace Q106 and repeat step 53. If indication is abnormal, proceed to step 58.
58	Power supply/counter decoder pcb A1A3 A102		Connect multifunction meter to pin 4 of A102 and ground (fig. 4-8).	+2.4 to +5.5 V dc	If indication is normal, proceed to step 59. If indication is abnormal, proceed to step 60.
59	Power supply/counter decoder pcb A1A3 R117-Q106	a. On feed power monitor, set POWER ON switch to off position. b. Disconnect one end of R117 from circuit.	Connect vom test leads to R117 (fig. 4-8) R117 (fig. 4-8).	2090 to 2310 ohms	If indication is normal, replace Q106 and repeat step 53. If indication is abnormal, replace R117 and repeat step 53.
60	Power supply/counter decoder pcb A1A3 A102	On feed power monitor, set POWER ON switch to ON position.	Connect multifunction meter to pin 5 of A102 and ground and to pin 6 of A102 and ground (fig. 4-8).	0 to +0.4 V dc	If indication is normal, replace A102 and repeat step 53. If indication is abnormal, proceed to step 61.
61	Power supply/counter decoder pcb A1A3 A104 test 1		Connect multifunction meter to pin 11 of A104 and ground (fig. 4-8).	0 to +0.4 V dc	If indication is normal, proceed to step 62. If indication is abnormal, proceed to step 63.
62	Power supply/counter decoder pcb A1A3 A104 test 2		Connect multifunction meter to pin 3 of A104 and ground (fig. 4-8).	0 to +0.4 V dc	If indication is normal, replace A104 and repeat step 53. If indication is abnormal, proceed to step 64.
63	Autorange logic pcb A4 A105 test 1		Connect multifunction meter to pin 6 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace CR103 and repeat step 53. If indication is abnormal, proceed to step 64.
64	Autorange logic pcb A4 A105 test 2		Connect multifunction meter to pin 11 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace A105 and repeat step 53. If indication is abnormal,

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					proceed to step 65.
65	Autorange logic pcb A4 Q104		Connect multifunction meter to emitter of Q104 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace Q104 and repeat step 53. If indication is abnormal, proceed to step 66.
66	Autorange logic pcb A4 A103		Connect multifunction meter to pin 3 of A103 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, check R113 and Q104. Replace defective part and repeat step 53. If indication is abnormal, proceed to step 67.
67	Autorange logic pcb A4 Q103		Connect multifunction meter to base of Q103 and ground (fig. 4-7).	+0.3 V or greater	If indication is normal, replace Q103 and repeat step 53. If indication is abnormal, proceed to step 68.
68	Autorange logic pcb A4 R112		Connect multifunction meter to pin 12 of A105 and ground (fig. 4-7)	+2.4 to +5.5 V dc	If indication is normal, replace R112 and repeat step 53. If indication is abnormal, proceed to step 69.
69	Autorange logic pcb A4 A105		Connect multifunction meter to pin 13 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace A105 and repeat step 53. If indication is abnormal, proceed to step 70.
70	Autorange logic pcb A4 A101		Connect multifunction meter to pin 4 of A101 and ground (fig. 4-7).	4.5 ±0.5 V dc	If indication is normal, replace A101 and repeat step 53. If indication is abnormal, proceed to step 71.
71	Autorange logic pcb A4 R106		Connect multifunction meter of R106 and pin D of J4 and ground (figs. 4-7 and FO-7).	4.5 ±0.5 V dc	If indication is normal, check place defective part and repeat step 53. If indication is abnormal, check 305B calibrator and repeat step 53.
72	Chopper drive and relay pcb A1A5 Relay K4 (Range 4)	On 305B calibrator, press power range 8 button.	Connect multifunction meter across K4 winding (+ test lead to cathode and - test lead to anode of CR9) (fig. 4-6).	11.5 ±1 V, K4 energized.	If indication is normal, proceed to step 91. If voltage is present but relay is not energized replace K4. If voltage is not present, proceed to step 73.
73	Power supply/counter decoder pcb A1A3 Q101		Connect multifunction meter to emitter of Q101 and ground (fig. 4-8)	+4.7 to +5.3 V dc	If indication is normal, proceed to step 75. If indication is abnormal,

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					proceed to step 74.
74	Power supply/counter decoder pcb A1A3 CR101		Connect multifunction meter base of Q101 and ground (fig. 4-8).	5.6 ±0.3 V dc	If indication is normal, replace Q101 and repeat step 72. If indication is abnormal, replace CR101 and repeat step 72.
75	Power supply/counter decoder pcb A1A3 R116-Q105		Connect multifunction meter to collector of Q105 and ground (fig. 4-8).	120 mV dc (max)	If indication is normal, check CR9 and K4. Replace defective part and repeat step 72. If indication is 0 V, check K4 and R115. Replace defective part and repeat step 72. If indication is +15 V, proceed to step 76.
76	Power supply/counter decoder pcb A1A3 R115-Q105		Connect multifunction meter to base of Q105 and ground (fig. 4-8).	0.5 V or greater	If indication is normal, replace Q105 and repeat step 72. If indication is abnormal, proceed to step 77.
77	Power supply/counter decoder pcb A1A3 A102		Connect multifunction meter to pin 1 of A102 and ground (fig. 4-8).	+2.4 to +5.5 V dc	If indication is normal, proceed to step 78. If indication is abnormal, proceed to step 79.
78	Power supply/counter decoder pcb A1A3 R115-Q105	a. On feed power monitor, set POWER ON switch to off position. b. Disconnect one end of R115 from circuit.	Connect vom test leads to R115 (fig. 4-8).	2090 to 2310 ohms	If indication [illegible]mal, replace Q105 and r[illegible]72. If indication is abnormal, replace R115 and repeat step 72.
79	Power supply/counter decoder pcb A1A3 A102		Connect multifunction meter to pin 2 of A102 and ground and to pin 3 of A102 and ground (fig. 4-8)	0 to +4.4 V dc	If indication is normal, replace A102 and repeat step 72. If indication is abnormal, proceed to step 80.
80	Power supply/counter decoder pcb A1A3 A104 test 1		Connect multifunction meter to pin 11 of A104 and ground (fig. 4-8).	0 to +0.4 V dc	If indication is normal, proceed to step 81. If indication is abnormal, proceed to step 82.
81	Power supply/counter decoder pcb A1A3 A104 test 2		Connect multifunction meter to pin 3 of A104 and ground (fig. 4-8).	0 to +0.4 V dc	If indication is normal, replace A104 and repeat step 72. If indication is abnormal, proceed to step 83.

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
82	Autorange logic pcb A4 A105 test 1		Connect multifunction meter to pin 6 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace CR103 and repeat step 72. If indication is abnormal, proceed to step 83.
83	Autorange logic pcb A4 A105 test 2		Connect multifunction meter to pin 11 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace A105 and repeat step 72. If indication is abnormal, proceed to to step 84.
84	Autorange logic pcb A4 Q104		Connect multifunction meter to emitter to Q104 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace Q104 and repeat step 72. If indication is abnormal, proceed to step 85.
85	Autorange logic pcb A4 A103		Connect multifunction meter to pin 3 of A103 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, check R113 and Q104. Replace defective part and repeat step 72. If indication is abnormal, proceed to step 86.
86	Autorange logic pcb A4 Q103		Connect multifunction meter to base of Q103 and ground. (fig. 4-7).	+0.3 V or greater	If indication is normal, replace Q103 and repeat step 72. If indication is abnormal, proceed to step 87.
87	Autorange logic pcb A4 R112		Connect multifunction meter to pin 12 of A105 and ground (fig. 4-7).	+2.4 to +5.5 V dc If indication is ab	If indication is normal, replace R112 and repeat step 72. normal, proceed to step 88.
88	Autorange logic pcb A4 A105		Connect multifunction meter to pin 13 of A105 and ground (fig. 4-7).	0 to +0.4 V dc	If indication is normal, replace A105 and repeat step 72. If indication is abnormal, proceed to step 89.
89	Autorange logic pcb A4 A101		Connect multifunction meter to pin 4 of A101 and ground (fig. 4-7).	+4.5 ±0.5 V dc	If indication is normal, replace A101 and repeat step 72. If indication is abnormal, proceed to step 90.
90	Autorange logic pcb A4 R106		Connect multifunction meter between junction of R106 and pin D of J4 and ground (figs. 4-7 and FO-7).	+4.5 ±0.5 V dc	If indication is normal, check R106 and A101. Replace defective part and repeat step 72. If indication is abnormal, check 305B calibrator and repeat step 72.
91	Amplifier no. 1 pcb A1A7 AR1	On 305B calibrator, press power range 8 button.	Connect multifunction meter to pin 6 of AR1 and ground (fig. 4-3).	+5 ±0.3	If indication is normal, proceed to step 107

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					If indication is abnormal, proceed to step 92.
92	Amplifier no. 1 pcb A1A7 AR1		Connect multifunction meter to pin 3 of AR1 and ground (fig. 4-3).	120 mV dc (max)	If indication is normal, proceed to step 93. If indication is abnormal, check R3 and wiring between AR1 and J5.
93	Amplifier no. 1 pcb A1A7 AR1		Connect multifunction meter to pin 1 of AR1 and ground (fig. 4-3).	+10 ± V dc	If indication is normal, replace AR1 and repeat step 91. If indication is abnormal, proceed to step 94.
94	Amplifier no. 1 pcb A1A7 R1	a. On feed power monitor, turn POWER ON switch to off. b. Disconnect one side of potentiometer R1 from pcb A1A7. c. On feed power monitor, set POWER ON switch to ON.	Connect vom to R1 (fig. 4-3).	0 to 25 K ohms	If indication is normal, replace AR1 and repeat step 91. If indication is abnormal, replace AR1 potentiometer R1 and repeat step 91.
95	Amplifier no. 1 pcb A1A7 Q4		Connect multifunction meter to the emitter of Q4 and ground (fig. 4-3).	+1 ±0.1 V dc	If indication is normal, check R62 and C33, replace defective part and repeat step 91. If indication is abnormal, proceed to step 96.
96	Amplifier no. 1 pcb A1A7 AR4		Connect multifunction meter to pin 6 of AR4 and ground (fig. 4-3).	5.10 ±0.5 V dc	If indication is normal, proceed to step 98. If indication is abnormal, proceed to step 97.
97	Amplifier no. 1 pcb A1A7 TP1	a. On feed power monitor, set POWER ON switch to off. b. Remove AR4 from pcb A1A7. c. On feed power monitor, set POWER ON switch to on.	Connect oscilloscope with test leads and adapters between TP1 and ground (fig. 4-3).	1 ±0.1 V dc	If indication is normal, set POWER ON switch to off and plug in new AR4. Set POWER ON switch to on and repeat step 91. If indication is abnormal and cannot be adjusted by potentiometer R39, proceed to

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					step 98.
98	Amplifier no. 2 pcb A1A6 R39	a. On feed power monitor, set POWER ON switch to off. b. Disconnect one side of potentiometer R39. c. Replace AR4 on A1A6.	Connect vom to R39 (fig. 4-4).	0 to 500 ohms	If indication is normal, proceed to step 99. If indication is abnormal, replace R39 and repeat step 91.
99	Amplifier no. 1 pcb A1A7 chopper A1G1-B	On feed power monitor, set POWER ON switch to on.	Connect oscilloscope to the emitter of Q3 and ground (fig. 4-3).	15 ±1.5 V dc	If indication is normal, proceed to step 100. If indication is abnormal, check Q2 and Q3. defective part and repeat step 91.
100	Amplifier no. 1 pcb A1A7 chopper A1G1-B		Connect oscilloscope to the emitter of Q2 and ground (fig. 4-3).	+9 ±1.0 V dc	If indication is normal, replace chopper A1G1 as directed in paragraph 4-6g. If indication is abnormal, check biasing of Q2 and replace as needed.
101	Amplifier no. 2 pcb A1A6 AR3		Connect oscilloscope to pin 6 of AR3 and ground (fig. 4-4).	28 V ac	If indication is normal, check R44 and C26. Replace defective part and repeat step 90. If indication is abnormal, proceed to step 102.
102	Amplifier no. 2 pcb A1A6 AR3		Connect oscilloscope to pin 2 of AR3 and ground (fig. 4-4).	41 ±4 mV p-p pulses	If indication is normal, replace AR3 and repeat step 91. If indication is abnormal, proceed to step 103.
103	Amplifier no. 2 pcb A1A6 AR2		Connect oscilloscope to pin 6 of AR2 and ground (fig. 4-4).	0.8 V ac	If indication is normal, check R36, R38, R39, R40, C19 and C21. Replace defective part and repeat step 91. If indication is abnormal, proceed to step 104.
104	Amplifier no. 2 pcb A1A6 AR2		Connect oscilloscope to pin 3 of AR2 and ground (fig. 4-4).	48 mV p-p pulses	If indication is normal, replace AR2 and repeat step 91. If indication is abnormal, proceed to step 105.
105	Amplifier no. 2 pcb A1A6 Q1		Connect oscilloscope to collector of Q1 and ground (fig. 4-4).	-6.5 ±0.7 V dc	If indication is normal, check C11, R31 and AR2. Replace defective part and re-

Table 4-5 DC Amplifier Assembly HTA-3A9A1 Troubleshooting Procedure - Continued

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
					peat step 91. If indication is abnormal, proceed to step 106.
106	Chopper A1G1-A		a. Connect oscilloscope to Q1-B side of C8 and ground (fig. 4-4). b. Connect oscilloscope to opposite side of C8 and ground (fig. 4-4).	70 mV ac	If indication is normal, replace Q1 and repeat step 91. If indication is abnormal, replace chopper A1G1 as directed in paragraph 4-6g.
107	Auto-zero pcb A1A1		a. Connect a jumper from J2-K to J2-U. b. Connect multifunction meter test leads between R219 and R220 and ground (fig. 4-5).	Multifunction meter displays a changing voltage from 0 to 10 V dc.	If indication is normal, troubleshooting procedure is completed. If indication is abnormal, proceed to step 108.
108	Auto-zero pcb A1A1		Connect multifunction meter test leads to the gate of Q201 and ground (fig. 4-5). (Jumper connected from J2-K to J2-U).	Multifunction meter displays a changing voltage from 0 to 10 V dc.	If indication is normal, replace Q201 and repeat step 107. If indication is abnormal, proceed to step 109.
109	Auto-zero pcb A1A1 AR201		Connect multifunction meter test leads to pin 6 of AR201 and ground (fig. 4-5). (Jumper connected from J2-K and J2-U).	0 ±0.3 V dc	If indication is normal, check R212, K205 and Q201. Replace defective part and repeat step 107. If indication is abnormal, adjust R209 for a 0 ±0.3 V dc indication. If R209 cannot be adjusted, check and replace as needed. If R209 is normal, check AR201, CR205, and CR206. Replace defective part and repeat step 107.

4-6. Removal and Replacement. This paragraph provides removal and replacement procedures for the subassemblies mounted on dc amplifier assembly HTA-3A9A1.

a. Autorange Logic Printed Circuit Board HTA-3A9A4 (fig. 4-2).

(1) Remove four spacers from both sides of pcb A4.
(2) Unsolder wires from defective component on pcb A4.
(3) Remove and replace defective component from pcb.

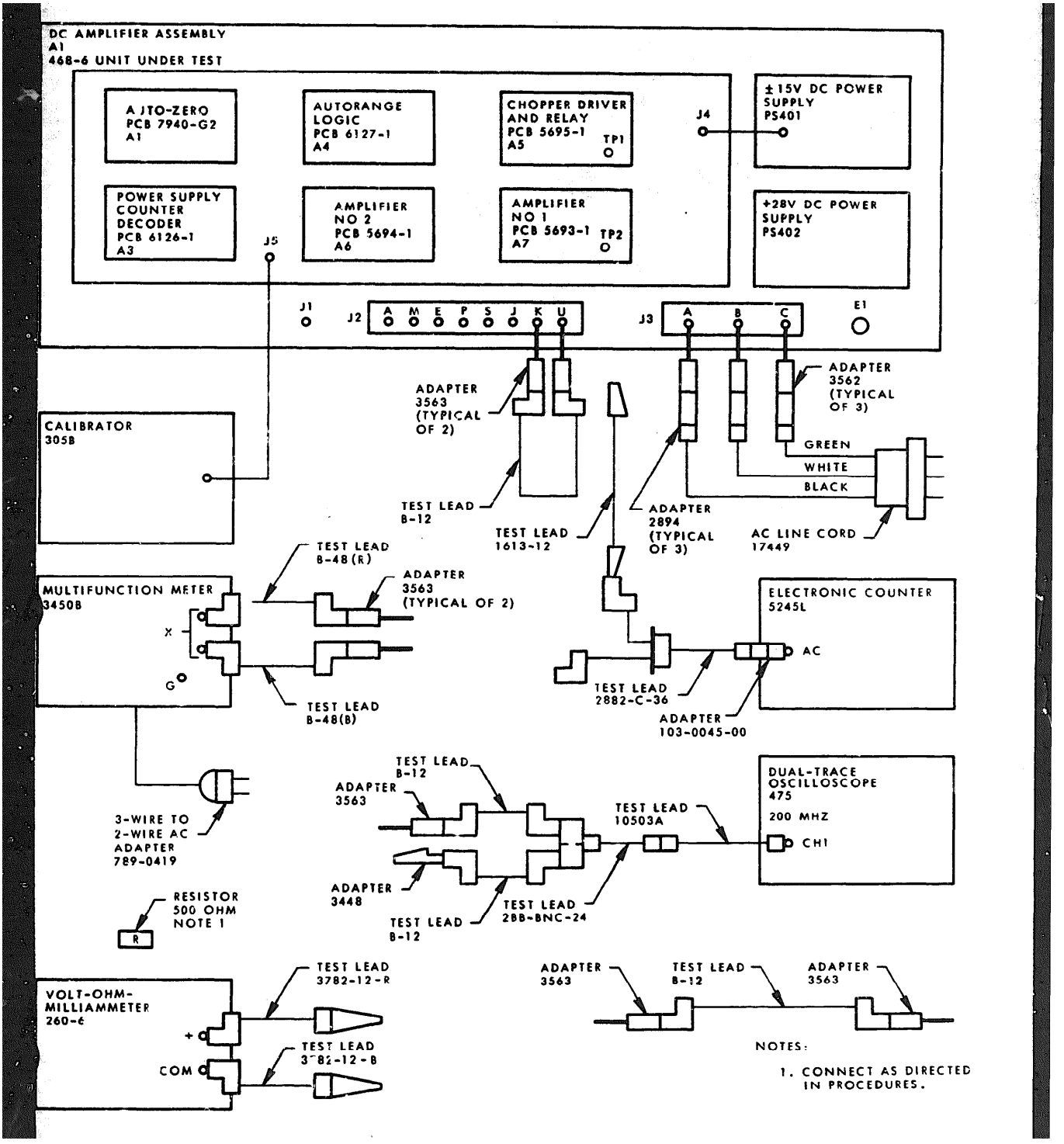

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Figure 4-1. DC amplifier assembly HTA-3A9A1, test setup diagram.

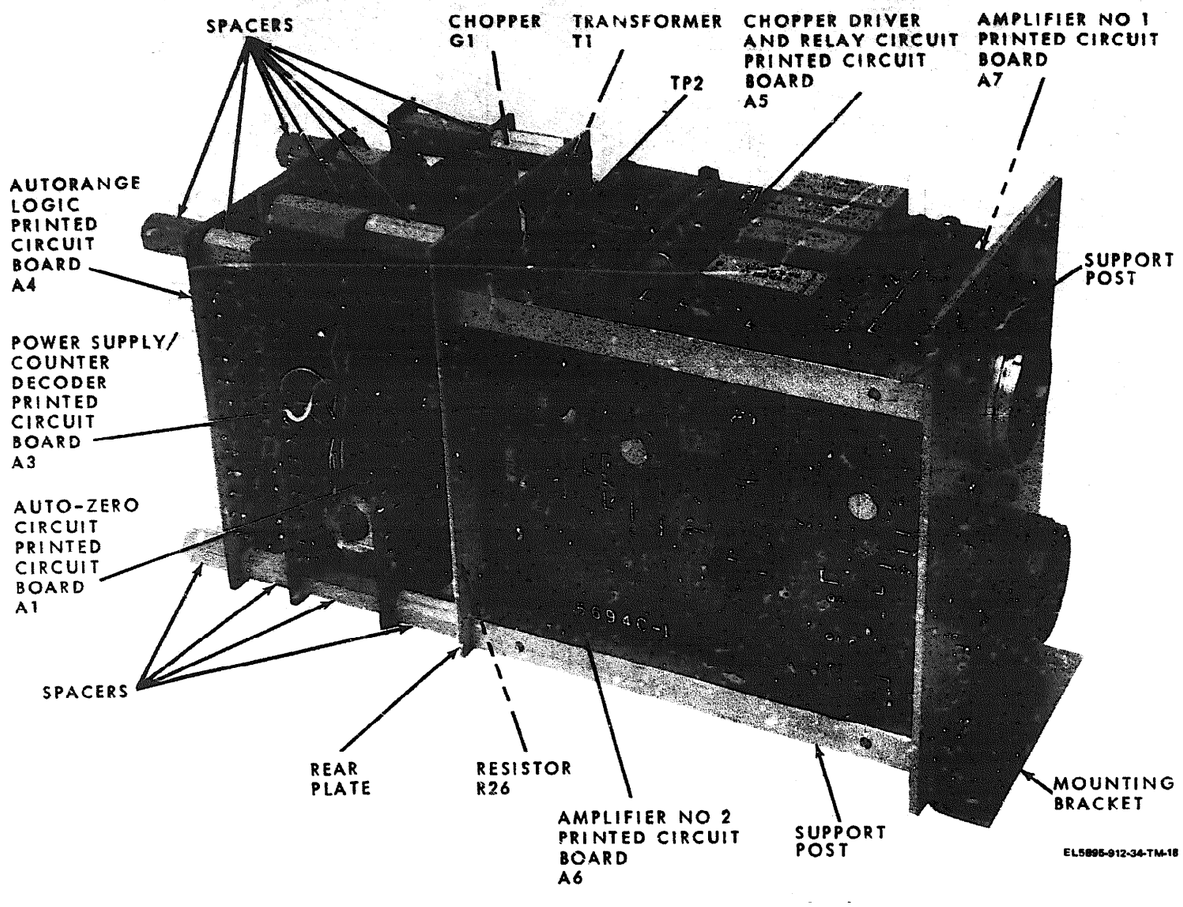

Figure 4-2. DC amplifier assembly HTA-3A9A1, parts location

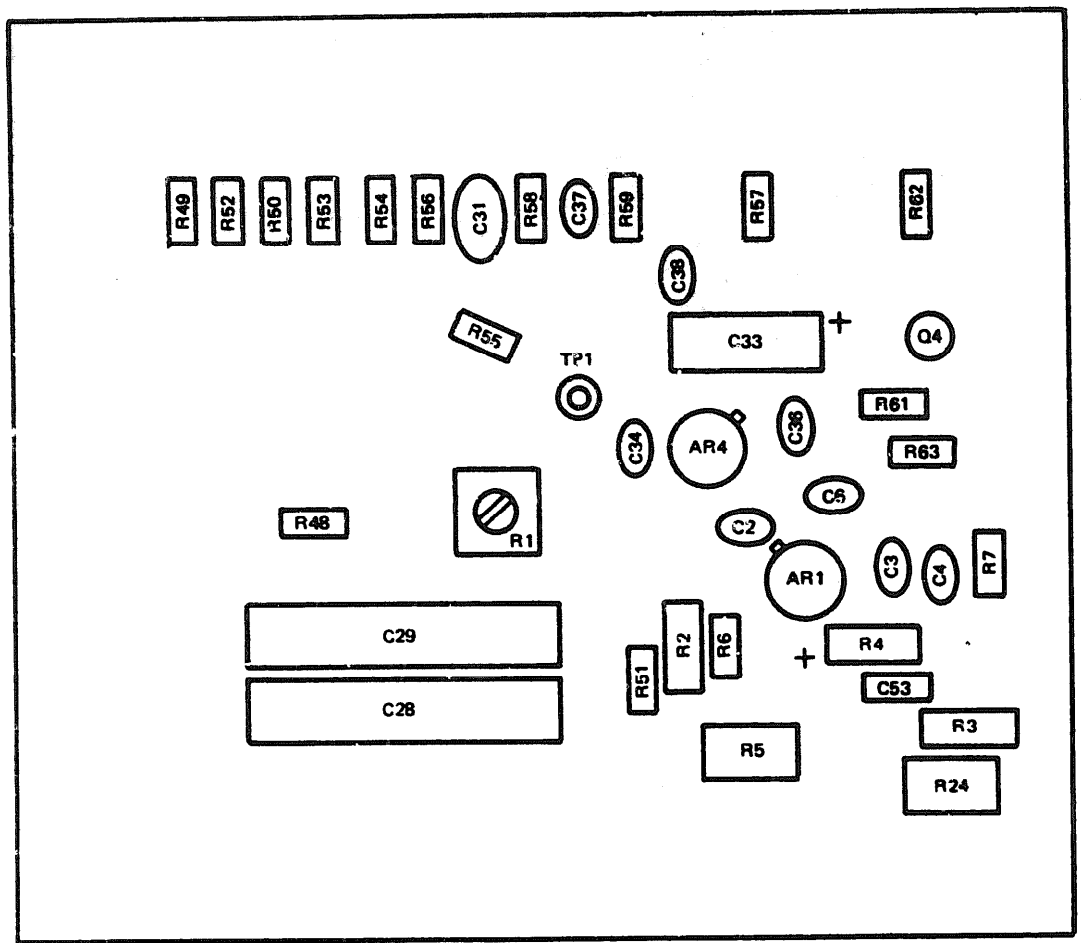

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Figure 4-3. Amplifier no. 1, printed circuit board HTA-3A9A1A7, parts location

(4) Replace four spacers on each side of pcb A4.
(5) Perform test procedure described in paragraph 4-7.

b. Power Supply/Counter Decoder Printed Circuit Board HTA-3A9A1A3 (fig. 4-2).

(1) Remove pcb A4 as described in *a* above.
(2) Remove four screws and washers holding the four spacers betwen pcb A4 and A1A3.
(3) Unsolder wires from defective component on pcb A1A3.
(4) Replace component and solder to pcb A1A3.
(5) Replace the four screws and washers, that hold the spacers between pcb A1A3 and pcb A4.
(6) Replace pcb A4 as described in *a* above.
(7) Perform test procedure described in paragraph 4-7.

c. Auto-Zero Printed Circuit Board HTA-3A9A1A1 (fig. 4-2).

(1) Perform procedures in steps *a* and *b* above.
(2) Remove four spacers between pcb A1A3 and A1A1 for access to pcb A1A1.

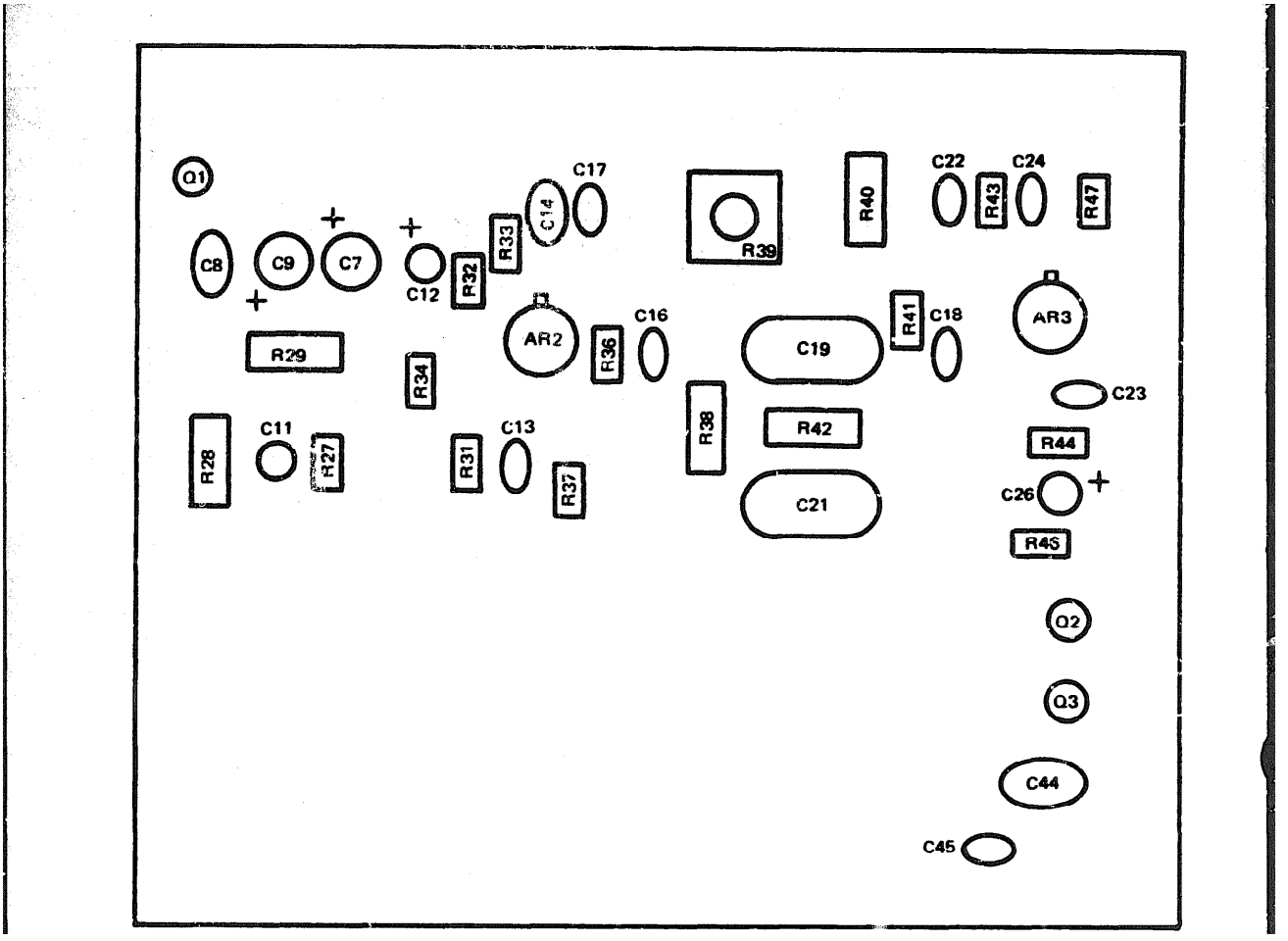

Figure 4-4. Amplifier no. 2, printed circuit board HTA-3A9A1A6, parts location

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(3) Tag and unsolder wires from defective component on pcb A!A1.
(4) Replace component. Identify and solder wires to pcb A1A1.
(5) Replace four spacers between pcb A1A3 and pcb A1A1.
(6) Replace pcb A1A3 and pcb A4 as described in *a* and *b* above.
(7) Perform test procedure described in paragraph 4-7.

d. Chopper Driver and Relay Printed Circuit Board HTA-3A9A1A5 (fig. 4-2).

(1) Remove four screws, washers, and spacers which secure pcb A1A5 to the top of dc amplifier assembly HTA-3A9A1.
(2) Unsolder defective component from pcb A1A5.
(3) Replace and solder component to pcb A1A5.
(4) Align pcb A1A5 four spacers with mounting holes.
(5) Insert four screws with washers and secure pcb to top of dc amplifier assembly.
(6) Perform test procedure described in paragraph 4-7.

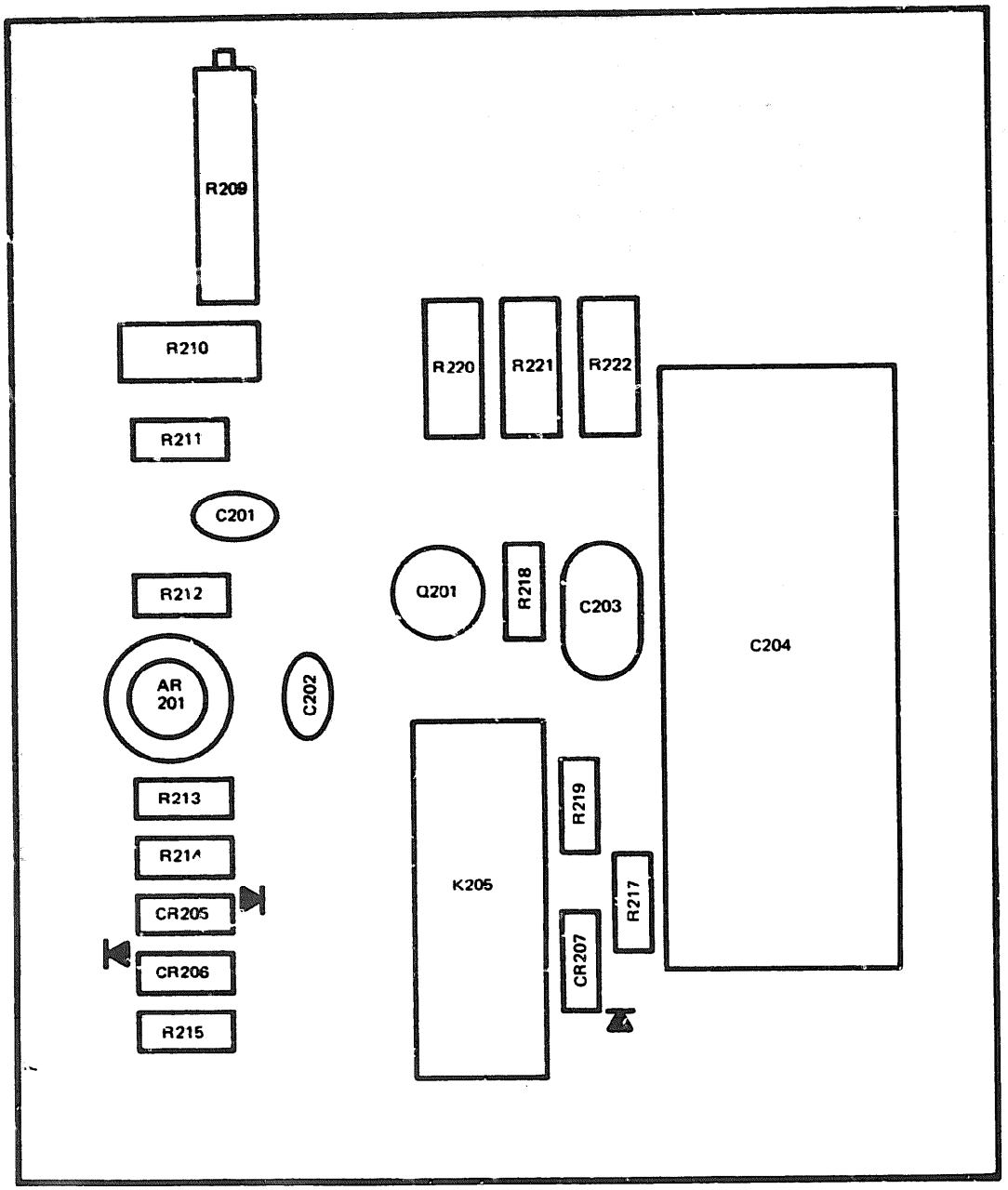

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Figure 4-5. Auto-zero printed circuit board HTA-3A9A1A1, parts location

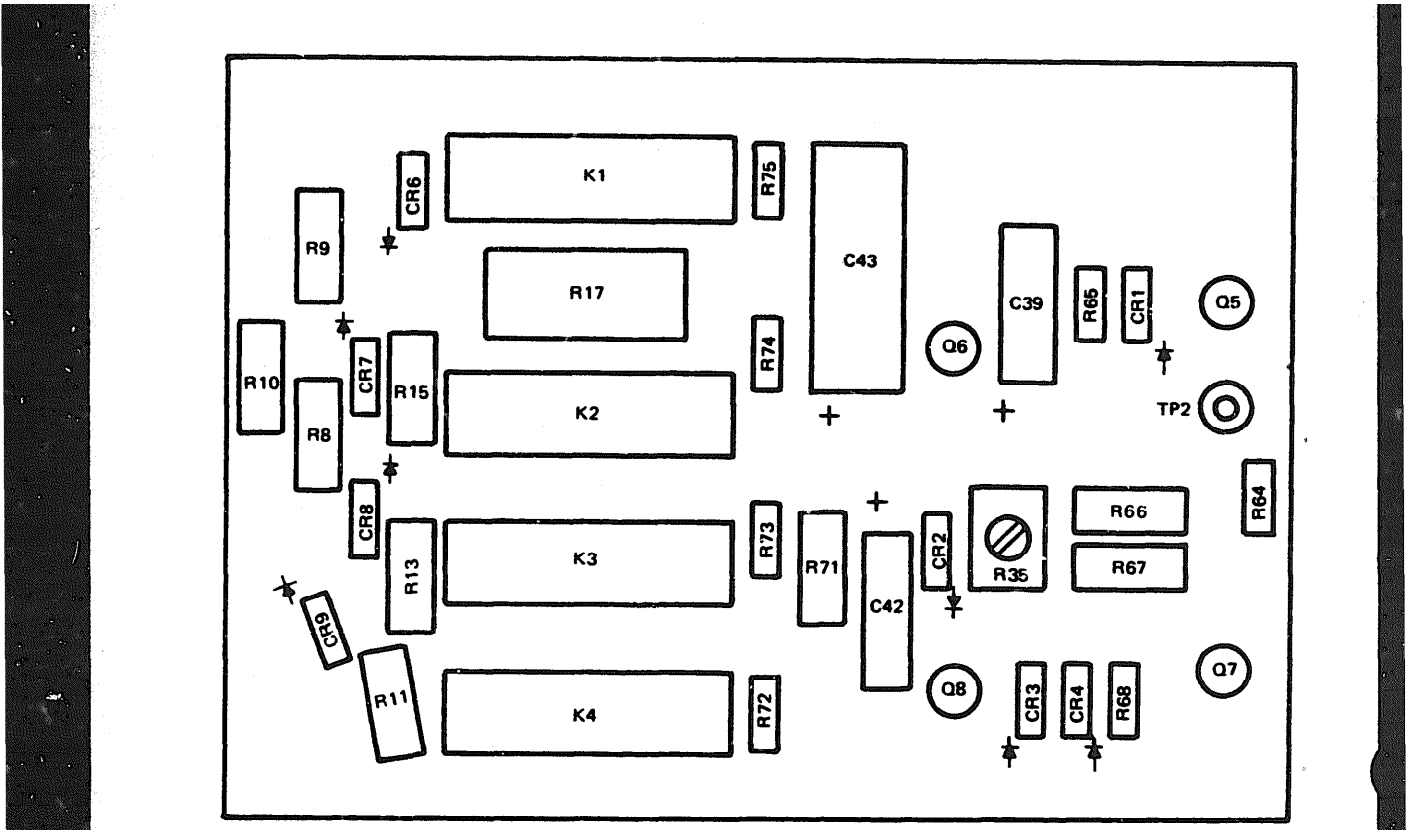

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Figure 4-6. Chopper driver and relay printed circuit board HTA-3A9A1A5, parts locution.

e. Amplifier No. 1 HTA-3A9A1A7 or No. 2 HTA-3A9A1A6 Printed Circuit Boards (fig. 4-2).

(1) Remove 16 spacers between pcb A4, A1A3, A1A1 and rear plate of dc amplifier assembly HTA-3A9A1.

(2) On front plate, remove four screws securing support posts to front plate.

(3) On rear plate. remove two screws and washers securing mounting bracket to front plate.

(4) On top of dc amplifier assembly, remove four screws, washers, and spacers and remove pcb A1A5.

(5) Slide top supporting post outward from dc amplifier assembly for access to pcb A1A6 or A1A7 components.

(6) Tag and unsolder wires from defective components.

(7) Replace component. Identify and solder wires to pcb A1A6 or A1A7.

(8) Align supporting posts with mounting holes and replace two screws and washers on rear plate and four screws on front plate of dc amplifier assembly.

(9) Replace pcb A1A5 on top of dc amplifier assembly with four screws, washers, and spacers.

(10) Replace pcb A1A1, A1A3, and A4 with four spacers between each board.

(11) Perform test procedure described in paragraph 4-7.

f. Resistor HTA-3A9A1R26 (fig. 4-2).

(1) Remove 16 spacers between pcb A4, A1A3, A1A1, and rear plate of dc amplifier assembly HTA-3A9A1.

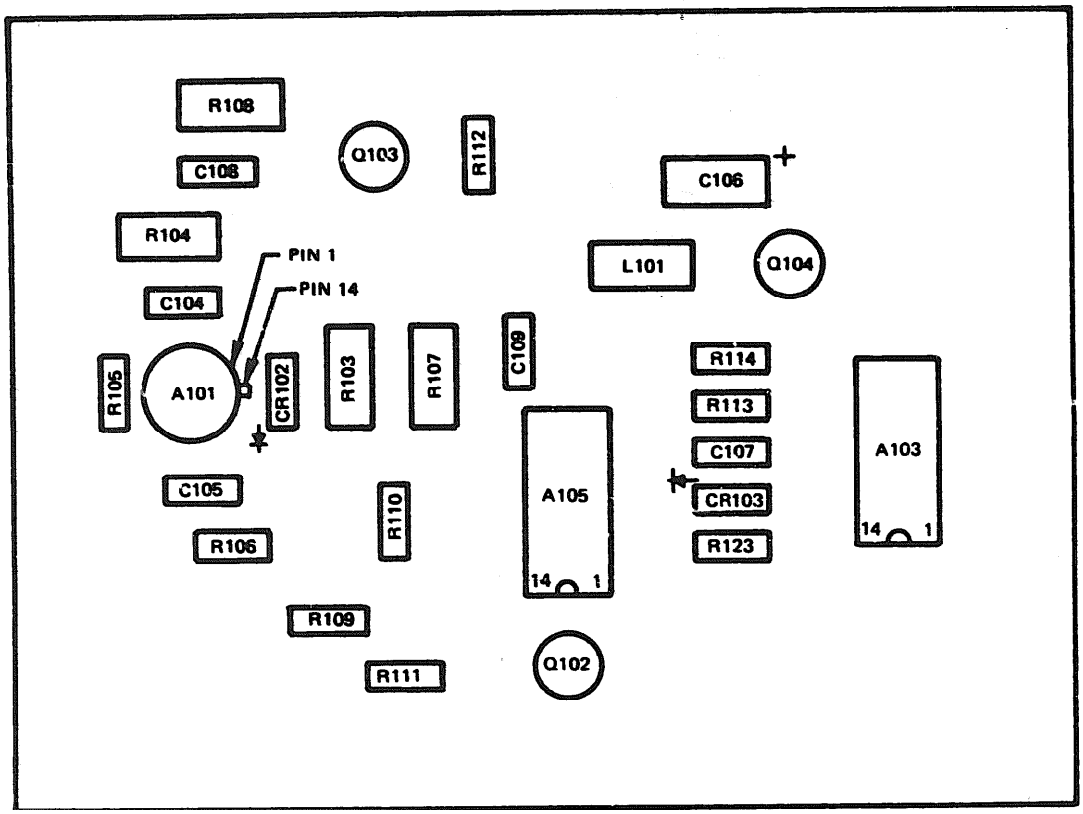

Figure 4-7. Autorange logic printed circuit board HTA-3A9A1A4, parts location EL5895-912-34-TM-23

(2) Tag and unsolder two electrical wires from R26 on rear plate.

(3) Replace R26 on rear plate.

(4) Identify and solder tagged electrical wires.

(5) Replace pcb A1A1, A1A3, and A4 with four spacers between each board.

(6) Perform test procedure described in paragraph 4-7.

Chopper HTA-3A9A1G1 (fig. 4-2).

(1) Remove 16 spacers between pcb A4, A1A3, and A1A1 and rear plate of dc amplifier assembly HTA-3A9A1.

(2) On rear plate, remove four screws and lock washers securing A1G1 to rear plate.

(3) Remove pcb A1A5 (step 4-6*d*, above) for accessibility to solder points.

(4) Remove three screws and lock washers which hold front and back plates to supporting posts of pcb A1A7.

(5) Tag and unsolder three wires at the base of A1G1 and three wires connected to pcb A1A7.

(6) Tag and unsolder three wires on pcb A1A5 from the top of A1G1.

(7) Replace A1G1. Identify and solder tagged electrical wires.

(8) Replace four screws and lock washers securing A1G1 to rear plate.

(9) Align supporting posts with mounting holes and replace three screws and lock washers on front and rear plates.

(10) Replace pcb A1A5 on top of dc amplifier assembly with four screws, washers, and spacers.

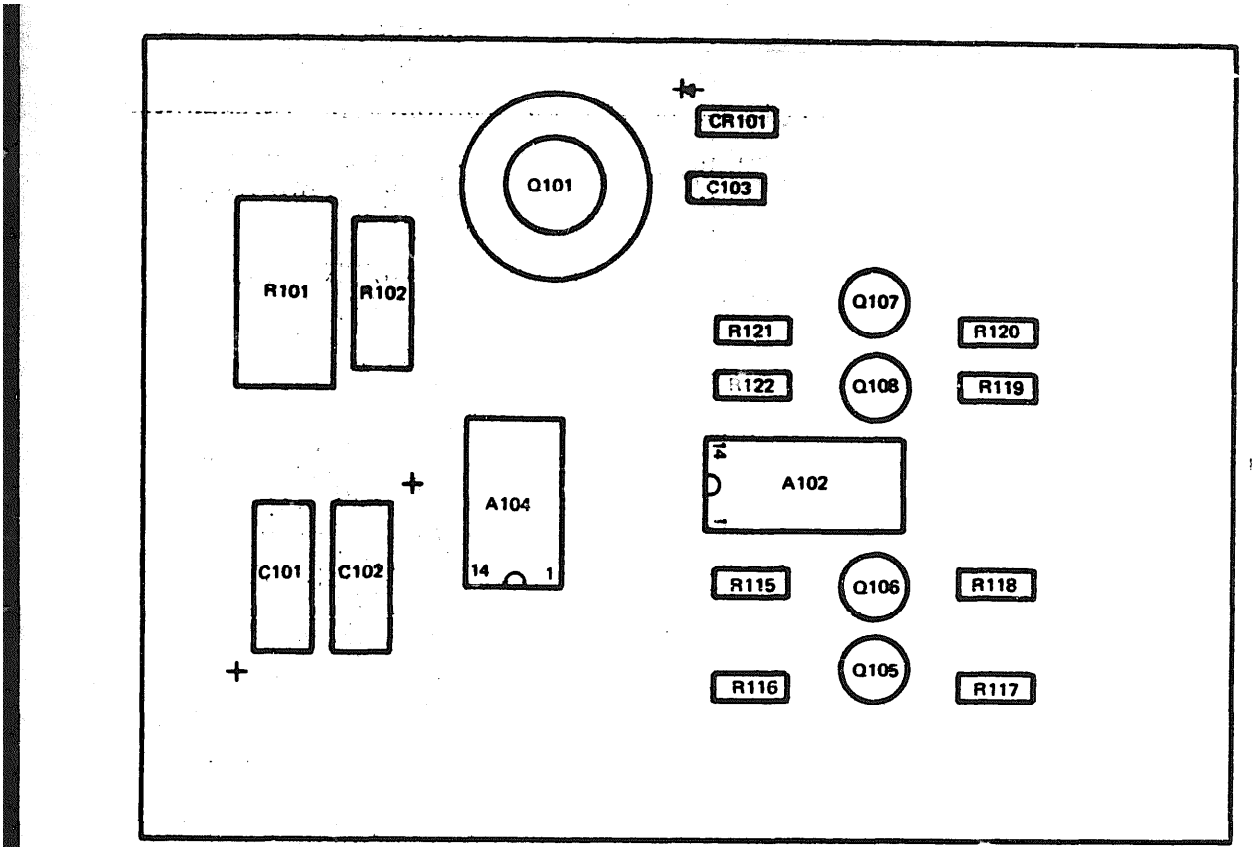

Figure 4-8. Power supply/counter decoder printed circuit board HTA-3A9A1A3, parts location.

(11) Replace pcb A1A1, A1A3, and A4 with four spacers between each board.
(12) Perform test procedure described in paragraph 4-7.

h. Transformer HTA-3A9A1T1 (fig. 4-2).

(1) Remove 16 spacers between pcb A4, A1A3. A1A1, and rear plate of dc amplifier assembly HTA-3A9A1.
(2) Remove pcb A1A5 (step 4-6d above) for access to solder points.
(3) Remove, three screws and lockwashers which hold front and back plates to supporting posts of pcb A1A6.
(4) Tag and unsolder ground lead to rear plate and three wires connected to pcb A1A6 from transformer T1,
(5) Remove two nuts and washers on mounting bolt: which attach T1 to rear plate, and remove T1.
(6) Replace T1 and secure to back plate with nuts and washers.
(7) Identify and solder ground wire to rear plate and three wires to pcb A1A6.
(8) Replace pcb A1A5 on top of dc amplifier assembly with three screws. washers. and spacers.
(9) Replace pcb A1A1, A1A3. and A4 with four spacers between each board.
(10) Perform test procedure described in paragraph 4-7.

4-7. Performance Test. This paragraph contains the procedures necessary for performance testing dc an-

plifier assembly HTA-3A9A1 after replacement of a malfunctioning assembly or module following the troubleshooting procedures. Each of the preliminary procedures and the 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 procedure results in the dc amplifier assembly meeting all performance standards specified in the performance test. the equipment can be returned to service.

a. Test *Equipment* and Materials. Table 4-6 lists the test equipment required for performance testing of dc amplifier assembly HTA-3A9A1.

Table 4-6 Test equipment Required for Perfomance Testing DC Amplifier Assembly HTA-3A9A1

Common name	Part/model no.	Qty	Manufacturer
AC Line Cord	17449	1	Belden
Adapter, Banana Jack to Minigator Clip	3448	3	Pomona
Adapter, Banana Jack to Size 16 Female Connector	3562	5	Pomona
Adapter, Banana Jack to Size 16 Male Connector	3563	4	Pomona
Adapter, Single Banana Plug to Binding Post	2894	3	Pomona
Calibrator	305B	1	General Microwave
Counter, Digital, Electronic	5245L	1	Hewlett-Packard
Meter, Multifunction	3450B	1	Hewlett-Packard
Oscilloscope, Dual-Trace	475	1	Tektronix
Resistor, 500 Ohm	RCR07G051JS	1	Allen Bradley
Test Lead, Banana Plug to Banana Plug	B-12	1	Pomona
Test Lead, Banana Plug to Mini Test	3782-36-B	1	Pomona
Test Lead, BNC Plug to Double Banana	2BB-BNC-24	2	Pomona

b. Test Co*nnections and Conditions (fig. 4-1).* Performance testing of dc amplifier assembly HTA-3A9A1 is accomplished in a bench test setup. Prior to performing the performance test. connect the test equipment as shown in figure 4-1.

c. Initial Control Settings. initial test equipment settings required for the performance test are as follows:

(1) *Calibrator 305B.* Initial control settings for the calibrator are the same as those required for troubleshooting. (Refer to paragraph 4-5c.)

(2) *Electronic digital coun*Per. Initial control settings for the electronic digital counter are the same as those required for troubleshooting. (Refer to paragraph 4-5*d.*)

(3) *Oscilloscope.* Initial control settings for the oscilloscope are the same as those required for troubleshooting. (Refer to paragraph 4-5e.)

(4) Multifunction meter. Initial control settings for the multifunction meter arc the same as those required for troubleshooting. (Refer to paragraph 4-5f.)

(5) Vom. Initial control settings for the vom are the same as those required for troubleshooting. (Refer to paragraph 4-5g.)

d. Perfo*rmance* Test procedure (figs. 4-2 through 4-8). Table 4-7 contains the test procedure for dc amplifier assembly HTA-3A9A1. Proceed sequentially through the table in accordance with the numbered steps. Set test equipment controls and equipment under test controls exactly as given in the table and perform the prescribed test procedure. Location of test points can be found in figures 4-2 through 4-8. If the result is within the specified performance standard limits, proceed to the next step in the table. If the result is not as specified, perform the

troubleshooting procedure in paragraph 4-5. After fault correction, repeat the performance test.

Table 4-7 DC Amplifier Assembly HTA-3A9A1 Performance Test Procedure

Step	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	Test equipment	POWER ON switch to on position.	Connect electronic digital counter between TP2 and ground.	110 Hz ±1 Hz
		Adjust R35 if counter indication is not within limits.		
2		Connect jumper from collector of Q102 to ground.	a. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pins P, S and J	0.4 V dc or less
			b. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin E	+28 ±2 V dc (range 4)
3	On oscilloscope, set VOLTS/DIV to 0.5.	POWER ON switch to off position.	a. Remove AR4 from its socket on pcb A1A7.	
		POWER ON switch to on position.	b. Connect jumper from J2L to ground (black) calibration jack on rear of 305B calibrator. Connect oscilloscope between TP1 and ground. Adjust R39 if observed voltage level is not within limits.	2 V p-p negative going rectified sine wave with notch centered between the negative going pulses. (See fig. FO-4, sh 2).
		POWER ON switch to off position.	c. Disconnect oscilloscope from TP1 and ground. Replace AR4 in socket on pcb A1A7.	
4		POWER ON switch to on position.	Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin M Adjust R1 if meter reading is not within limits.	0 ±0.3 V dc (range 1)
5		Place POWER ON switch to off position. Remove jumper connection between collector of Q102 and ground. Place POWER ON switch to on position.	a. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pins E, P and S	+0.4 V dc or less

Table 4-7 DC Amplifier Assembly HTA-3A9A1 Performance Test Procedure - Continued

Step	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
			b. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin J	+28 ±2 V dc (range 1)
6		Adjust R209 if meter reading is not within limits.	a. On dc amplifier assembly, assembly, connect jumper momentarily between J2-K and J2-U.	Less than +20 mV dc
			b. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin M	
			c. Repeat steps 2a and 3a thru 9 until no further adjustment of R1 and R209 is required to obtain 0 ±0.3 mV dc on ranges 4 and 1.	Less than 0 ±20 mV dc
7	On the 305B calibrator, release ZERO and depress POWER RANGE 6 button (range 4).		a. On dc amplifier assembly, remove jumper between J2-K and J2-U. b. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin M c. Repeat steps 2a and b.	+4.97 to 5.03 V dc (range 4)
8	On the 305B calibrator, depress POWER RANGE 5 then 6 button. (range 3)		a. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin M	+4.97 to 5.03 V dc (range 3)
			b. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pins E, S and J	+0.4 V dc or less
			c. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin P	+26 +2 V dc (range 3)
9	On the 305B calibrator, depress POWER RANGE 3 then 4 button.		a. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin M	+4.97 to 5.03 V dc
			b. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A	+0.4 V dc or less

Table 4-7 DC Amplifier Assembly HTA-3A9A1 Performance Test Procedure - Continued

Step	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
			+(red) pins E, P and J	
			c. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin S	+28 ±2 V dc (range 2)
10	On the 305B calibrator, depress POWER RANGE 1 then 2 button. (range 1)		a. Connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin M	+4.97 to 5.03 V dc
			b. Repeat step 5a and b. On completion of step, disconnect multifunction meter from connector J2.	
11	On the 305B calibrator, depress POWER RANGE 8 button and the ZERO button.		a. Connect oscilloscope between J2-M(+) and J2-A(-).	
			b. Release the 305B calibrator ZERO button while observing the oscilloscope.	Rise and fall times are each 3 seconds or less.
			c. Remove oscilloscope and connect multifunction meter test leads as follows: Test lead J2 -(blk) pin A +(red) pin M	
			d. Press the 305B calibrator ZERO button while observing the multifunction meter.	50 mV dc or less
12			a. Connect 500 ohm resistor across the multifunction meter input.	0.1 V dc or less change in multifunction meter indication.
			b. Release the 305B calibrator ZERO button and observe multifunction meter.	
			c. Disconnect multifunction meter and 305B calibrator.	

SECTION III. MAINTENANCE OF RF SENSOR HTA-3A9A401

4-8. General. This section provides troubleshooting. removal and replacement, and testing procedures for maintenance of rf sensor HTA-3A9A401.

4-9. Troubleshooting. This paragraph contains troubleshooting procedures for isolating an rf sensor HTA-3A9A401 fault to a malfunctioning assembly or module after referral by direct support maintenance. All preliminary procedures must be performed before the actual troubleshooting procedures are started. Procedural steps must be accomplished in the given sequence. Test and operating equipment control settings given in the following procedures must be made carefully to ensure accurate test conditions.

a. Test Equipment and **Materials.** Table 4-8 lists the test equipment required for troubleshooting rf sensor HTA-3A9A401.

Table 4-8 Test Equipment Required for Troubleshooting RF Sensor HTA-3A9A401

Common name	Part/model no.	Qty	Manufacturer
Generator, Signal, SHF	620B	1	Hewlett-Packard
Meter, Multifunction	3450B OPT001, 002	1	Hewlett-Packard
Meter, Power, Microwave	460B	1	General Microwave
Mount, Thermoelectric	N422C	1	General Microwave
Test Leads, Banana Plug to Banana Plug	B-12	2	Pomona
Test Leads, Banana Plug to Test Probe	1986-36-B	1	Pomona
Test Leads, Banana Plug to Test Probe	1986-36-R	1	Pomona
Tool Kit	TK-1	1	General Microwave

b. Test Connections and Conditions. Rf sensor HTA3A9A401 troubleshooting is accomplished in a bench test setup. Prior to performing the troubleshooting procedure. remove rf sensor HTA-3A9A401 from feed power monitor as described in paragraph 3-43.

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

(1) *Shf signal generator.* Set signal generator controls as follows:

Control	Position
OUTPUT ATTEN	FULL CCW
LINE pushbutton	ON
MOD SELECTOR switch	CW
Frequency control	8.2 GHz
POWER SET knob	POWER SET meter reads zero.
OUTPUT ATTEN	-10 dBm

(2) *Microwave power meter.*

(a) Connect thermoelectric mount N422C to microwave power meter with controls set as follows:

Control	Position
POWER LINE	ON
RANGE	Lowest scale
EFF control	Set to value determined from graph on mount N422C for frequency of 8.2 GHz

(b) Zero microwave power meter using METER ZERO control.

(c) Press RANGE button to select 1 mW, 0 dBm scale.

(3) *Multifunction meter.* Set LINE switch to on (up) position and press following switches.

Switch	Position
FUNCTION	O H M S
RANGE	AUTO
CONTROL	LOCAL
TRIGGER	INT

d. *Troubleshooting Procedures* (fig. 4-9). After completing the preliminary procedures, perform the troubleshooting procedures in table 4-9. Perform steps in table 4-9 in the sequence given until the malfunctioning item is found. Use rf sensor HTA-3A9A401 troubleshooting test setup diagram (fig. 4-9) and parts location diagram (fig. 4-10) as an aid in performing troubleshooting procedures. After faulty item has been replaced, perform test procedure described in paragraph 4-12. Upon satisfactory completion of performance test and rf calibration, the rf sensor HTA3A9A401 can be returned to service.

Table 4-9. RF Sensor HTA-3A9A401 Troubleshooting Procedure

Step	Item of check	Test conditions	Test connections	Normal indication	Additional checks and remarks
1	Rf sensor HTA-3A9A401 (resistance check)		Connect multifunction meter test leads between pins 1 and 3 of connector P4 on rf sensor A401.	190 to 210 ohms	If indication is normal, proceed to step 2. If indication is abnormal, replace tft element and thermistor assembly RT1.
2	Rf sensor HTA-3A9A401	a. After thermoelectric mount is connected, adjust OUTPUT ATTN on shf generator for -1 dBm indication on power meter. b. On microwave power meter, set POWER LINE pushbutton to OFF. c. Set EFF control on rf sensor HTA- 3A9A401 according to chart.	Connect thermoelectric mount to CAL jack on shf signal generator. Disconnect thermoelectric mount from shf signal generator and microwave power meter. Connect rf sensor HTA-3A9A401 to shf signal generator and microwave power meter.	Microwave power meter indicates -1 dBm.	Test equipment check.
3		On microwave power meter, set POWER LINE pushbutton to ON.		Microwave power meter indicates -1 dBm.	If indication is normal, rf sensor HTA-3A9A401 can be returned to service. If indication is abnormal, replace tft element (para 4-10a) and thermistor assembly RT1 (para 4-10b).

4-10. Removal and Replacement. This Paragraph provides removal and replacement procedures for subassemblies mounted on rf sensor HTA-3A9A401.

a. Tft element (fig. 4-10).

(1) Insert proper size spline wrench and remove EFF control dial from shaft.
(2) Remove three screws and washers which secure the housing to the front heat sink assembly.
(3) Slide housing off the rf sensor until it is free on the cable assembly.
(4) Remove three screws and washers which secure the rear heat sink assembly to the front heat sink assembly.
(5) Remove rear heat sink assembly.
(6) Remove center screw and washer securing the tft element to the front heat sink assembly.
(7) Remove tft element and cover sheets.

NOTE

Do not reuse old cover sheets.

(8) Install tft element and cover sheets over the front heat sink assembly using the tool kit tweezer.
(9) Slip tool kit assembly jig over the front heat sink assembly pins and insert new washer in center hole of the assembly jig.
(10) Ensure that the countersink in the washer faces away from the tft element.
(11) Using new center screw, apply sufficient torque to firmly sea: the tft element.
(12) Remove the assembly jig.
(13) Reassembly rear heat sink assembly to front heat sink assembly.
(14) Reattach the housing to front heat sink assembly and secure with three screws and washers.
(15) Replace dial. rotate fully clockwise. set to read 100 pct EFF and secure to control shaft.
(16) Perform test procedure described in paragraph 4-12.

b. Thermistor assembly RT1 (fig. 4-10).

(1) Remove dial from control shaft.

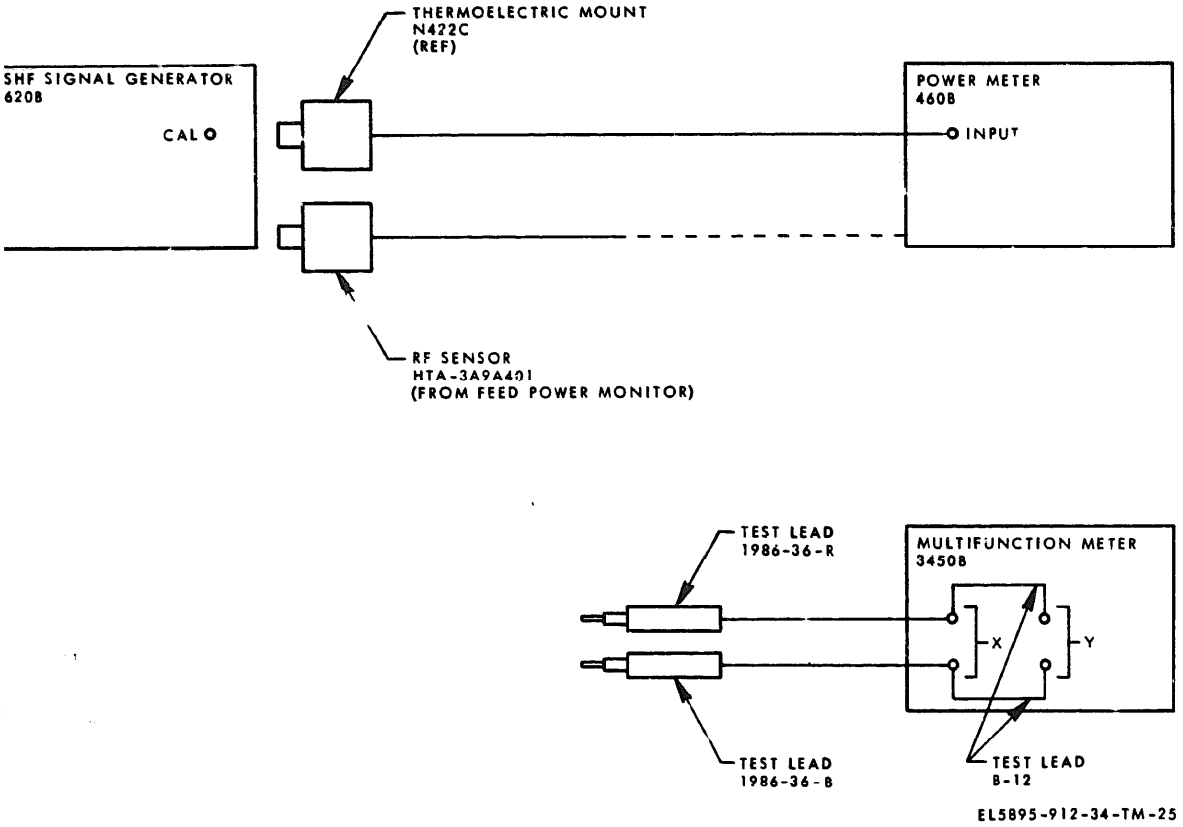

Figure 4-9. Rf sensor HTA-3A9A401 troubleshooting, test setup diagram.

(2) Remove three screws and washers which secure the housing to the front heat sink assembly.
(3) Remove two screws which secure cable mounting bracket to two spacers.
(4) Push cable mounting bracket aside and remove the two spacers.
(5) Push electrical caps back on the electrical contacts until the wires they secure come free.
(6) Remove electrical caps and helical compression springs.
(7) Tag and unsolder thermistor assembly leads from pcb.
(8) Remove screw which secures the pcb and remove the board.
(9) Remove screw which secures the thermistor assembly.
(10) Replace thermistor assembly and secure with screw.
(11) Replace screw securing pcb.
(12) Identify and solder tagged thermistor assembly leads to pcb.
(13) Replace helical compression springs and the electrical caps.
(14) Replace spacers and cable mounting bracket with two screws.
(15) Reattach housing to front heat sink assembly and secure with three screws and washers.
(16) Replace dial, rotate fully clockwise, set to read 100 pct EFF and secure to control shaft.
(17) Perform test procedure described in paragraph 4-12.

4-11. RF Calibration. This paragraph provides rf calibration procedures for rf sensor HTA-3A9A401.

a. Test Equipment and Materials. Table 4-10 lists the test equipment required for rf calibration of rf sensor HTA-3A9A401.

Table 4-10 Test Equipment Required for RF Calibration of RF Sensor HTA-3A9A401

Common name	Part/model no.	Qty	Manufacturer
Generator, Signal, VHF	86408	1	Hewlett-Packard
Meter, Power, Microwave	460B	1	General Microwave

b. Test Connection and Conditions. Rf calibration of rf sensor HTA-3A9A401 is accomplished in a bench test setup. Prior to performing the performance test procedure, perform the following steps.

(1) Connect the rf sensor HTA-3A9A401 to the microwave power meter.

(2) Set EFF control on rf sensor HTA-3A9A401 to 100.

c. Initial Control Settings. Initial test equipment settings required for the rf calibration procedure are as follows:

(1) Microwave power meter. Connect rf sensor to microwave power meter with controls set as follows:

Control	Position
POWER LINE	ON
RANGE	Lowest scale
METER ZERO	Zero power indication
RANGE	1 mW, 0 dBm

(2) VHF signal generator. Connect vhf signal generator to power source and prepare for operation as follows:

(a) Make following initial settings of front panel controls as follows:

control	Position
Meter Function	LEVEL
Counter MODE:	
EXPAND X10	on (in)
EXPAND INT	on (in)
LOCK	off (out)
TIME BASE	CAL
VERNIER	
AM	OFF
FM	OFF
RANGE	256-512 MHz
FREQUENCY TUNE	centered
FINE TUNE	centered
OUTPUT LEVEL	-5 dBm switch scale indication
RF ON/OFF	ON

(b) Push LINE switch to ON, on vhf signal generator.

(c) Adjust FREQUENCY TUNE and FINE TUNE controls for 500 MHz -+5 Hz indication on FREQUENCY display.

(d) To phase-lock the signal generator output, set COUNTER MODE LOCK to OF Observe that the flickering of FREQUENCY display stops (signifies phase lock Use TIME BASE VERNIER control as the fine frequency tune.

(e) Whenever phase- lock is lost, the FREQUENCY display wil flash. To reestablish phase lock, set COUNTER MODE LOCK to OFF; adjust (if necessary) FREQUENCY TUNE and FIN TUNE for a 500 MHz indication, and set COUNTER MODE LOCK to ON.

NOTE

To get an accurate indication of frequency when not phase locked. set TIME BASE VERNIER 1 to CAL.

(f) Adjust OUTPUT LEVEL control for -5 dBm indication on -10 to +3 dB scale of meter.

d. RF Calibration Procedures. After completing the preliminary procedures. perform the calibration procedures as follows:

(1) Connect rf sensor HTA-3A9A401 to the RF OUTPUT on vhf signal generator.

(2) Observe a -5 dBm indication on the microwave power meter.

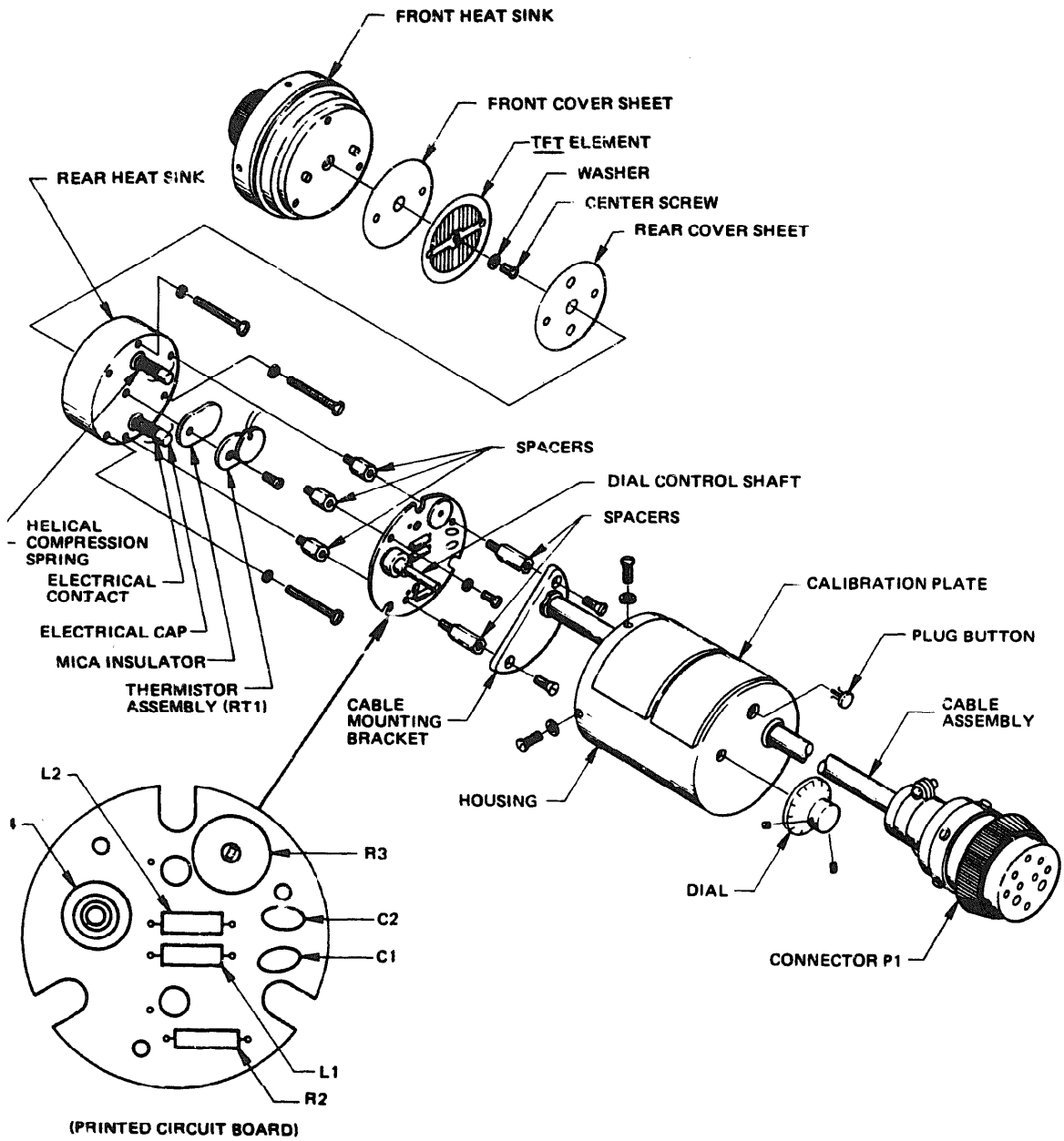

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Figure 4-10. Rf sensor HTA-3A9A401, exploded view.

NOTE

Calibration potentiometer is available at the rear of rf sensor HTA-3A9A401 housing by removing the metal plug under the CAL notation.

(3) If indication is incorrect, adjust the calibration potentiometer R3 to produce a -5 dBm reading.

t. This paragraph contains the procedures necessary for performance testing rf sensor HTA-3A9A401 after replacement of components following the troubleshooting procedures. Each of the preliminary procedures and the performance test must be performed in the given sequence. Preliminary procedure consist of obtaining the listed test equipment, making the prescribed test connections, and initially setting the equipment controls to the specified settings. These set tings, and all subsequent settings given in the perform ance test table, must be made carefully to ensure accurate test conditions. If the test procedures result in the rf sensor meeting all performance standards specified in the performance test, the equipment can be returned to service.

a. Test Equipment and Materials. Table 4-11 lists the test equipment required for performance testing the rf sensor HTA-3A9A401.

Table 4-11 Test Equipment Required for Performance Testing RF Sensor HTA-3A9A401

Common name	Part/model no.	Qty	Manufacturer
Generator, Signal, SHF	620B	1	Hewlett-Packard
Meter, Multifunction	3450B OPT001, 002	1	Hewlett-Packard
Meter, Power, Microwave	460B	1	General Microwave
Mount, Thermoelectric	N422C	1	General Microwave

b. Test Connections and Conditions (fig. 4-9). Performance testing of rf sensor HTA-3A9A401 is accomplished in a bench test setup. Prior to performing the performance test, connect the test equipment as shown in figure 4-9.

c. Initial Control Settings. Initial test equipment settings required for the performance test are as follows.

(1) Shf signal generator. Initial control settings for the signal generator are the same as those required for troubleshooting. (Refer to paragraph 4-9c.)

(2) Microwave power meter. Initial control settings for the microwave power meter are the same as those required for troubleshooting. (Refer to paragraph 4-9c.)

(3) Multifunction meter. Initial control settings for the multifunction meter are the same as those required for troubleshooting. (Refer to paragraph 4-9c.)

d. Performance Test Procedures. Table 4-12 contains the test procedures for rf sensor HTA-3A9A401 Proceed sequentially through the table in accordance with the numbered steps. Set the test equipment control! and the equipment under test controls exactly as given it the table and perform the prescribed test procedure. If the result is within the specified performance standard limits proceed to the next step in the table. If the result is not as specified, perform the troubleshooting procedure in paragraph 4-9. After fault correction, repeat the perform ance test.

Table 4-12 RF Sensor HTA-3A9A401 Performance Test Procedure

Step	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			Connect multifunction meter test leads between pins 1 and 3 of connector P4 on rf sensor HTA-3A9-A401.	190 to 210 ohms
	On microwave power meter, set POWER LINE pushbutton to ON.		a. Connect thermoelectric mount to signal generator and observe microwave power meter.	-1 dBm
	On microwave power meter, set POWER LINE pushbutton to OFF.		b. Disconnect thermoelectric mount from signal generator and microwave power meter.	
		Set efficiency control according to chart on rf sensor HTA-3A9A401.	c. Connect rf sensor HTA-3A9A401 to signal generator and microwave power meter.	
	On microwave power meter set POWER LINE pushbutton to ON.		d. Observe microwave power meter.	-1 dBm

APPENDIX

REFERENCES

The following is a list of applicable references that are available to the repairman of Transmitter Power Monitor 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 11-4-5180-SO5	Tool Equipment TE-50B.
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 31P5-1-1).
TB 43-0118	Field Instructions for: Painting and Preserving Electronics Command Equipment.
TM 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 31R5-2FSC78-1	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN/FSC-78(V).
TM 11-5895-898-20P 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 11-5895-899-12 NAVELEX 0967-LP-546-5010 TO 31RS-2FSC79-1	Operator and Organizational Maintenance Manual for Satellite Communication Terminal AN/FSC-79.
TM 11-5895-899-20P NAVELEX 0967-LP-546-5020 TO 31R5-2FSC79-4	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 . . . . . 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 far Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79.
NAVELEX 0967-LP-546-6040
TO 31R5-2-104

TM I l-5895-901-34 . . . . . Direct and General Support Maintenance Manual 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.
NAVELEX 0967-LP-546-6060
TO 31R5-2G-112

TM 11-5895-901-34P . . . . . 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.
NAVELEX 0967-LP-546-6070
TO 31R5-2G-114

TM 11-5895-902-34 . . . . . Direct and General Support Maintenance Manual for Tracking Receiver Equipment including: Scanner, Signal TD-1104/GSC; Power Supply PP-6976/G; Converter, Frequency, Electronic CV-313l/G; Demodulator MD-922/G; Control Indicator ID-1911/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79.
NAVELEX 0967-LP-546-6090
TO 31R5-2G-122

TM 11-5895-902-34P . . . . . 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-1104/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 AN/FSC-79.
NAVELEX 0967-LP-546-6100
TO 31R5-2G-124

TM I I-5895-903-34 . . . . . Direct and General Support Maintenance Manual for Parametric Amplifier Group OG-133/G for Satellite Communication Terminal AN/FSC-78(V).
NAVELEX 0967-LP-546-6120
TO 31RS-2G-132

TM 11-5895-903-34P . . . . . Direct Support, General Support Maintenance 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).
NAVELEX 0967-LP-546-6130
TO 31R5-2G-134

TM 11-5895-994-34 . . . . . 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 OG-150/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79.
NAVELEX 0967-LP-546-6150
TO 31R5-2G-142

TM 11-5895-904-34P . . . . . 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 AM-6788/FSC-79; Control-Monitor C-9400/G; Amplifier, Monitor Group OG- 150/G for Satellite Communication Terminals AN/FSC78(V) and AN/FSC-79.
NAVELEX 0967-LP-546-6160
TO 31R5-2G-144

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 11-5895-905-34P 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 OG-131A/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 OG-132A/MSC; Cooler, Liquid, Electron Tube HD-955A/GR for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79.
TM 11-5895-907-34 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: Control-Monitor 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 31RS-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 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 I I-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 11-5895-908-34P 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/FSC-78(V) and AN/FSC-79.

TM **11-5895-909-34** ..... NAVELEX 0967-LP-546-6300 TO 31R5-2G-182	Direct and General Support Maintenance Manual 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 11-5895-909-34P ..... NAVELEX 0967-LP-546-6310 TO 31R5-2G-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 I I-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 TS-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-985 l/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 11-5895-911-34P ..... NAVELEX 0967-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-985 l/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 11-5895-912-34P ..... 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 31R5-2G-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 31R5-2G-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 Communicaation Terminal AN/FSC-78(V).

TM 11-5895-914-34 . . . . . NAVELEX 0967-LP-546-6450 TO 31R5-2G-232	**Direct and General Support Maintenance Manual for Ancillary Equipment including: Control-Monitor ID-1914/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79.**
TM 11-5895-914-34P , ... NAVELEX 0967-LP-546-6460 TO 31R5-2G-234	**Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools for Ancillary Equipment including: Control-Monitor ID-1914/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79.**
TM 11-5895-915-34 . . . . . NAVELEX 0967-LP-546-6480 TO 31R5-2-122	**Direct and General Support Maintenance Manual for Servo and Control Equipment including: Control, Antenna C-9402/G; Indicator, Antenna, Position-Status ID-1912/G; Power Supply Assembly PP-6959/G; Control, Direct Current C-9849/FSC; Drive Assembly, Electromechanical, Antenna TG-232-FSC; Synchro, Antenna SN-498/FSC; Synchro, Antenna SN-482/FSC; Control-Indicator ID-1936/G for Satellite Communication Terminals AN/FSC-78(V) and AN/FSC-79.**
TM 11-5895-915-34P . . . . . NAVELEX 0967-LP-546-6490 TO 31R5-2-124	**Direct Support, 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; Indicator, Antenna, Position-Status ID- 1912/G: Power Supply Assembly PP-6959/G; Control, Direct Current C-9849/FSC; Drive Assembly, Electromechanical, Antenna TG-232/FSC; Synchro. Antenna SN-498/FSC; Synchro, Antenna SN-482/FSC; Control-Indicator ID-1936/G for Satellite Communication Terminals AN/FSC-78(v) and AN/FSC-79.**

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.

BITE ..... Built In Test 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

NARROWBAND ..... Any 40 MHz rf segment of the military satellite communication frequency band.

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 7.9 to 8.4 GHz.

X

X-BAND ..... The military SATCOM band of radio frequencies, from 7.25 to 8.4 GHz.

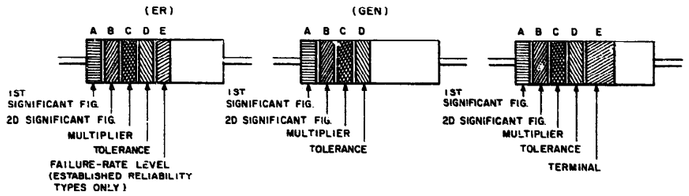
XMTR ..... Transmitter. Equipment used to generate and amplify an rf carrier, modulate the carrier, and radiate the modulated rf carrier from an antenna.

INDEX

C

D

✪ U.S. GOVERNMENT PRINTING OFFICE: 1978-703-128/164



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE I
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

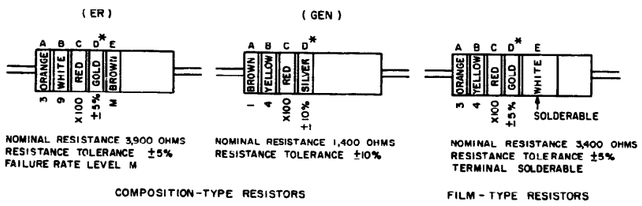
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODED)

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

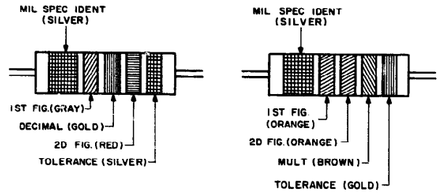


COMPOSITION-TYPE RESISTORS

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. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330UH INDUCTOR ARE ILLUSTRATED.

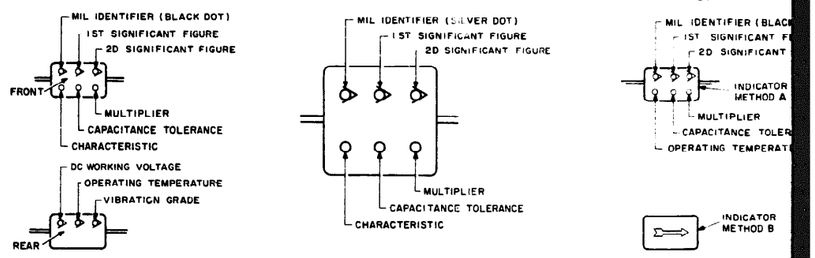
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

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.

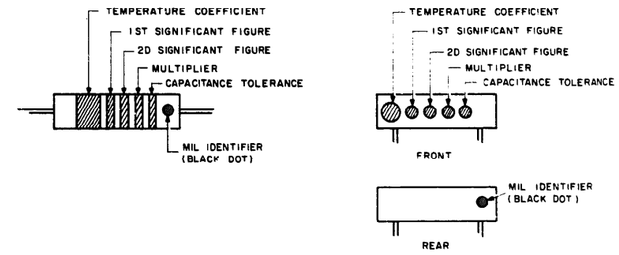
CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB



MICA-DIELECTRIC

PAPER-DIELECTRIC

GLASS-DIELECTRIC, GLASS C

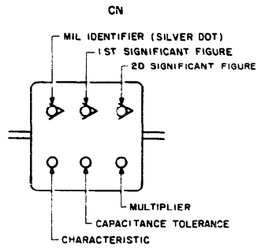


AXIAL LEAD

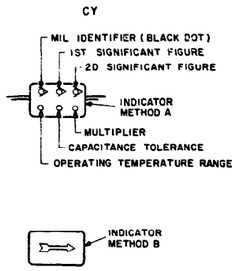
RADIAL LEAD

C. COLO

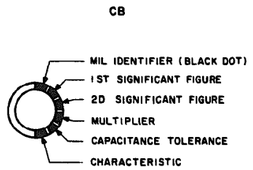
US-DIELECTRICS, STYLES CM, CN, CY, AND CB.



PAPER-DIELECTRIC



GLASS-DIELECTRIC, GLASS CASE



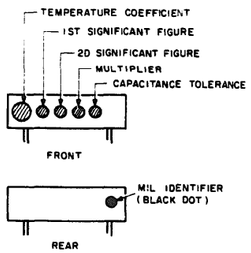
MICA, BUTTON TYPE

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

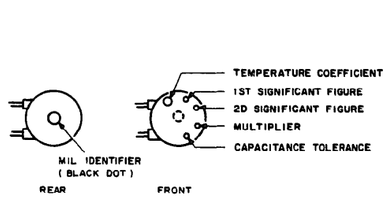
COLOR	MIL ID	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CM
BLACK	CM, CY, CB	0	0	1			±20%	±20%		A			-55°TO+70°C	10-55Hz
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C				-55°TO+85°C	
ORANGE		3	3	1,000		±30%			D		D	300		
YELLOW		4	4	10,000					E				-55°TO+125°C	10-2,000Hz
GREEN		5	5		±5%				F			500		
BLUE		6	6										-55°TO+150°C	
PURPLE (VIOLET)		7	7											
GRAY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN			0.01	±10%	±10%	±10%	±10%						

TEMPERATURE COEFFICIENT
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
MULTIPLIER
CAPACITANCE TOLERANCE
MIL IDENTIFIER (BLACK DOT)

AXIAL LEAD



RADIAL LEAD



DISK-TYPE

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-25D, 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

Figure FO-1. Color code marking for MIL-STD resistors, inductors, and capacitors

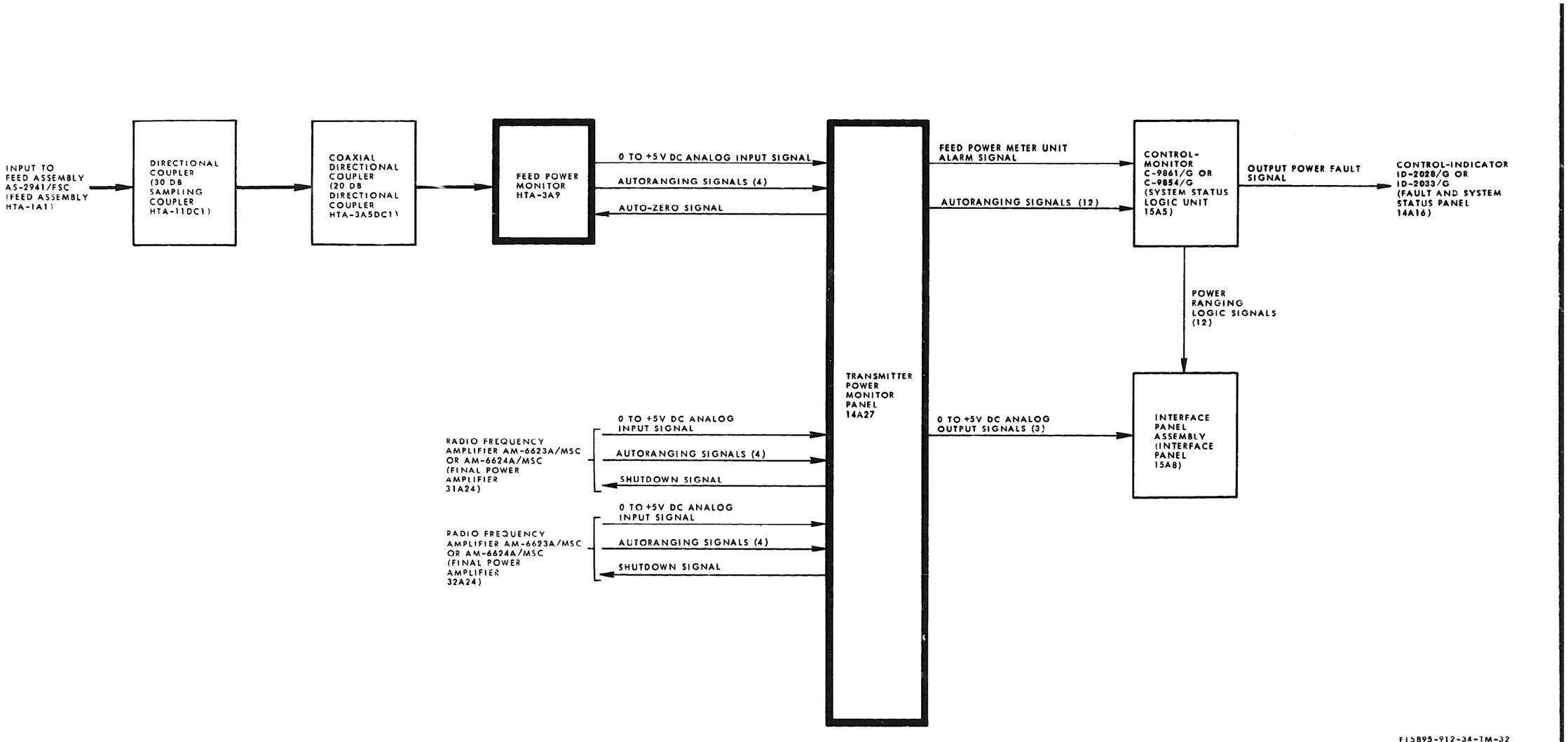
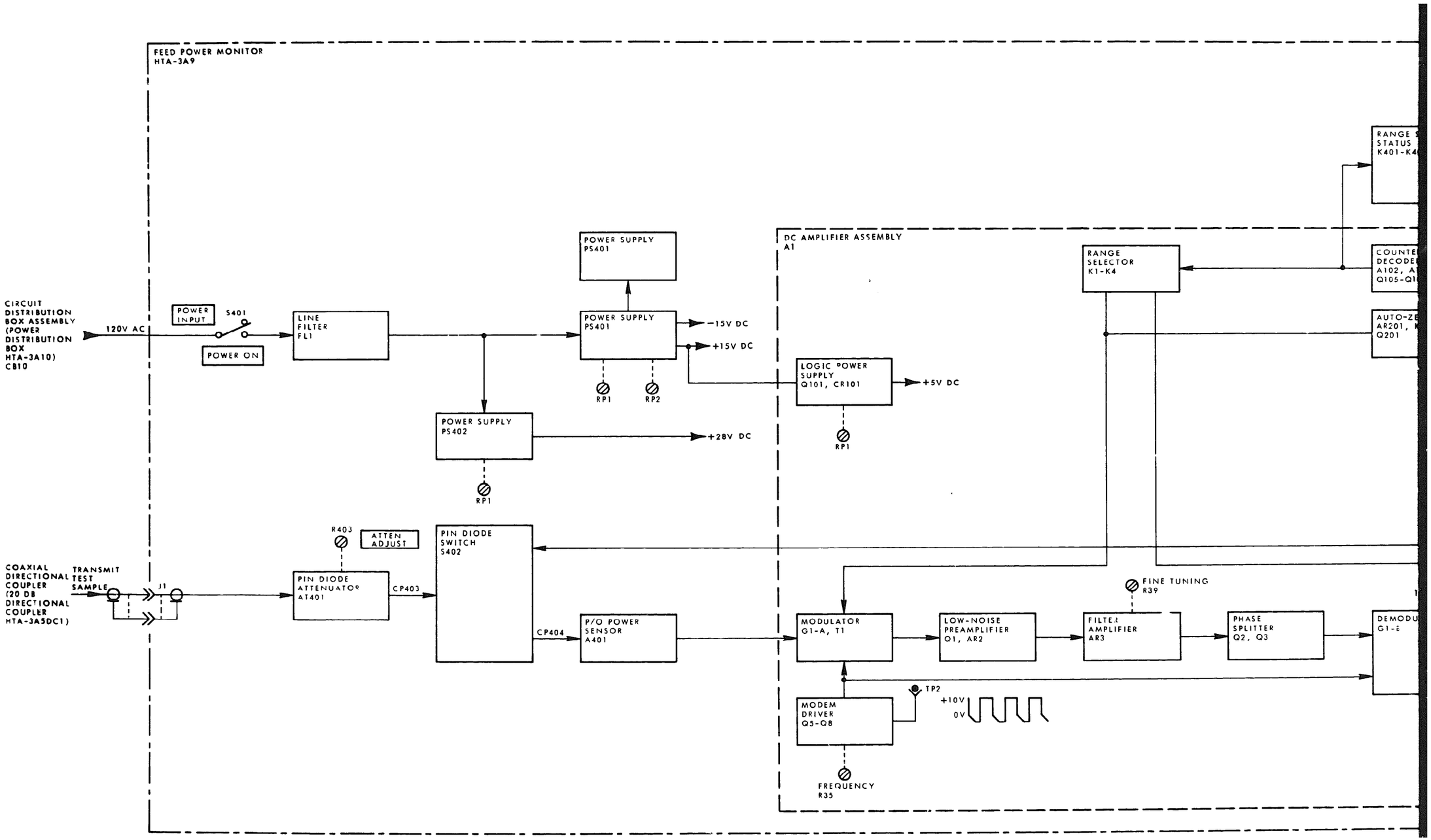
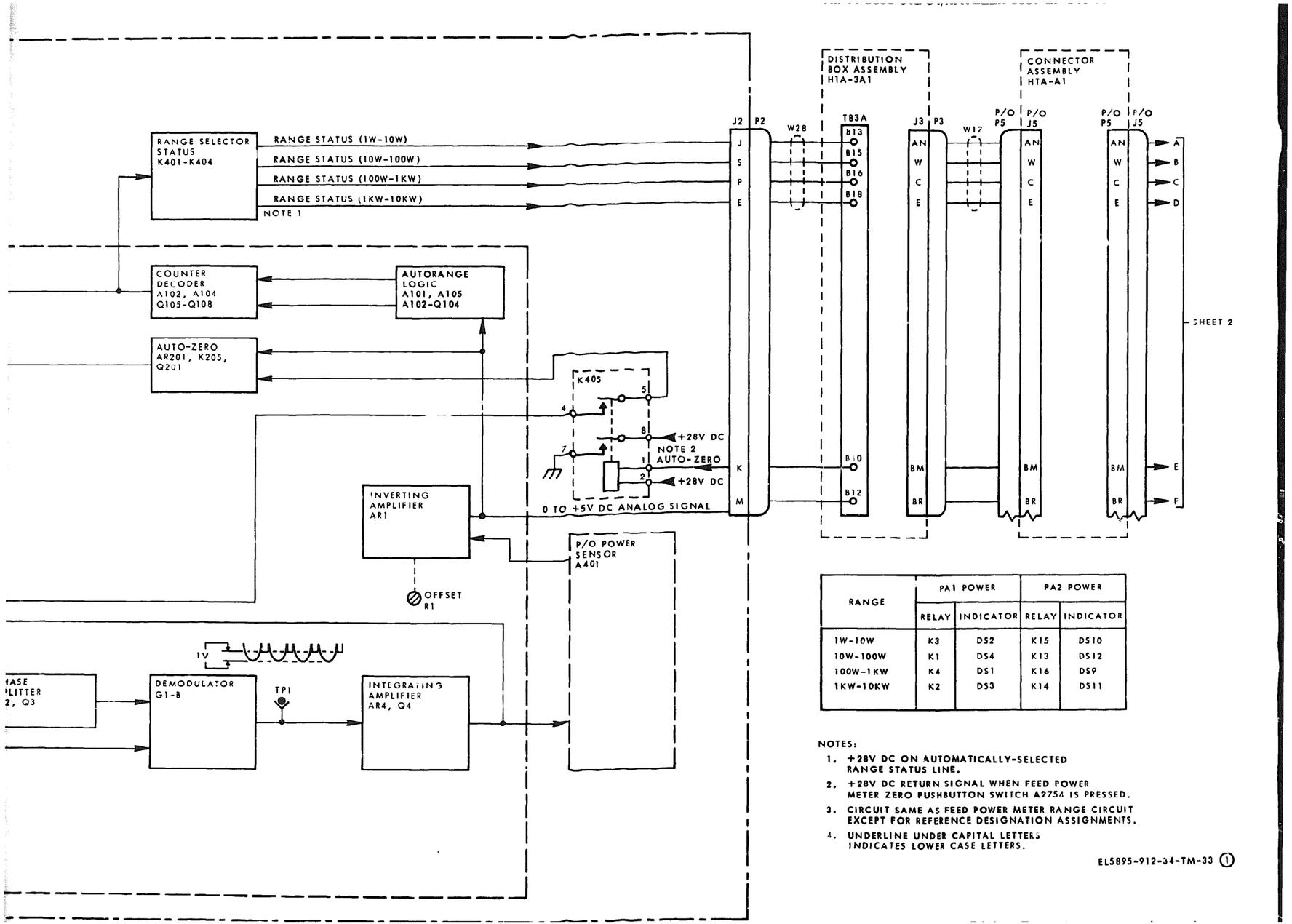


Figure FO-2. Transmitter power monitor equipment, interface block diagram.


FEED POWER MONITOR
HTA-3A9
CIRCUIT DISTRIBUTION BOX ASSEMBLY (POWER DISTRIBUTION BOX HTA-3A10) CB10
120V AC
POWER INPUT
S401
POWER ON
LINE FILTER FL1
POWER SUPPLY PS401
POWER SUPPLY PS401
−15V DC
+15V DC
RP1
RP2
POWER SUPPLY PS402
+28V DC
RP1
DC AMPLIFIER ASSEMBLY A1
LOGIC POWER SUPPLY Q101, CR101
+5V DC
RP1
RANGE SELECTOR K1-K4
RANGE S STATUS K401-K4
COUNTE DECODE A102, A Q105-Q1
AUTO-ZE AR201, K Q201
R403
ATTEN ADJUST
COAXIAL DIRECTIONAL COUPLER (20 DB DIRECTIONAL COUPLER HTA-3A5DC1)
TRANSMIT TEST SAMPLE
J1
PIN DIODE ATTENUATOR AT401
CP403
PIN DIODE SWITCH S402
CP404
P/O POWER SENSOR A401
FINE TUNING R39
MODULATOR G1-A, T1
LOW-NOISE PREAMPLIFIER O1, AR2
FILTER AMPLIFIER AR3
PHASE SPLITTER Q2, Q3
DEMODU G1-B
TP2
+10V
0V
MODEM DRIVER Q5-Q8
FREQUENCY R35



RANGE	PA1 POWER		PA2 POWER	
	RELAY	INDICATOR	RELAY	INDICATOR
1W-10W	K3	DS2	K15	DS10
10W-100W	K1	DS4	K13	DS12
100W-1KW	K4	DS1	K16	DS9
1KW-10KW	K2	DS3	K14	DS11

NOTES:

1. +28V DC ON AUTOMATICALLY-SELECTED RANGE STATUS LINE.
2. +28V DC RETURN SIGNAL WHEN FEED POWER METER ZERO PUSHBUTTON SWITCH A2754 IS PRESSED.
3. CIRCUIT SAME AS FEED POWER METER RANGE CIRCUIT EXCEPT FOR REFERENCE DESIGNATION ASSIGNMENTS.
4. UNDERLINE UNDER CAPITAL LETTERS INDICATES LOWER CASE LETTERS.

EL5895-912-34-TM-33 (1)

Figure FO-3. Transmitter power monitor equipment, functional block diagram (sheet 1 of 3).

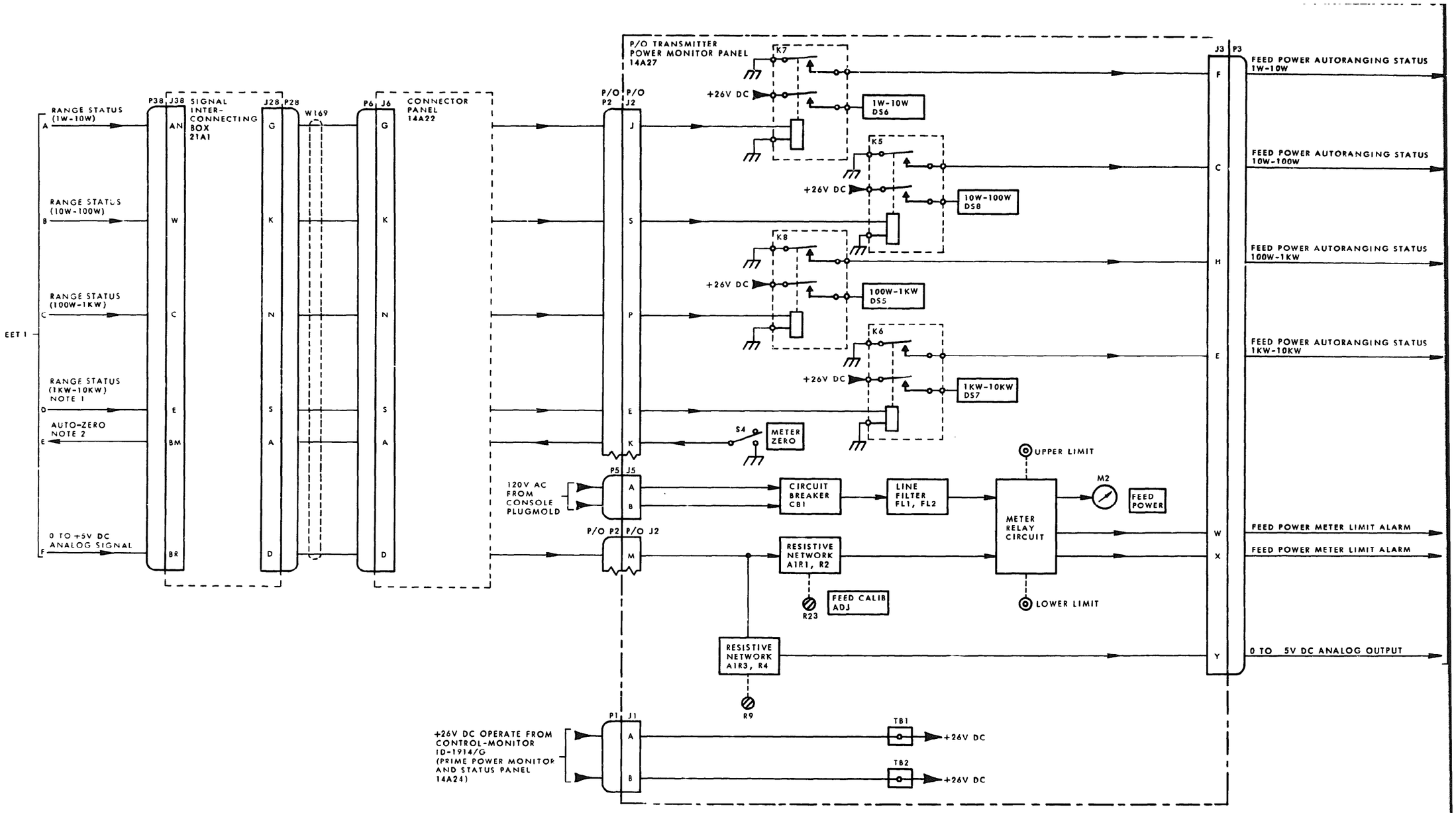


Figure FO-3. Transmitter p
functional block diagr

Transmitter power monitor equipment, functional block diagram. (sheet 2 of 3)

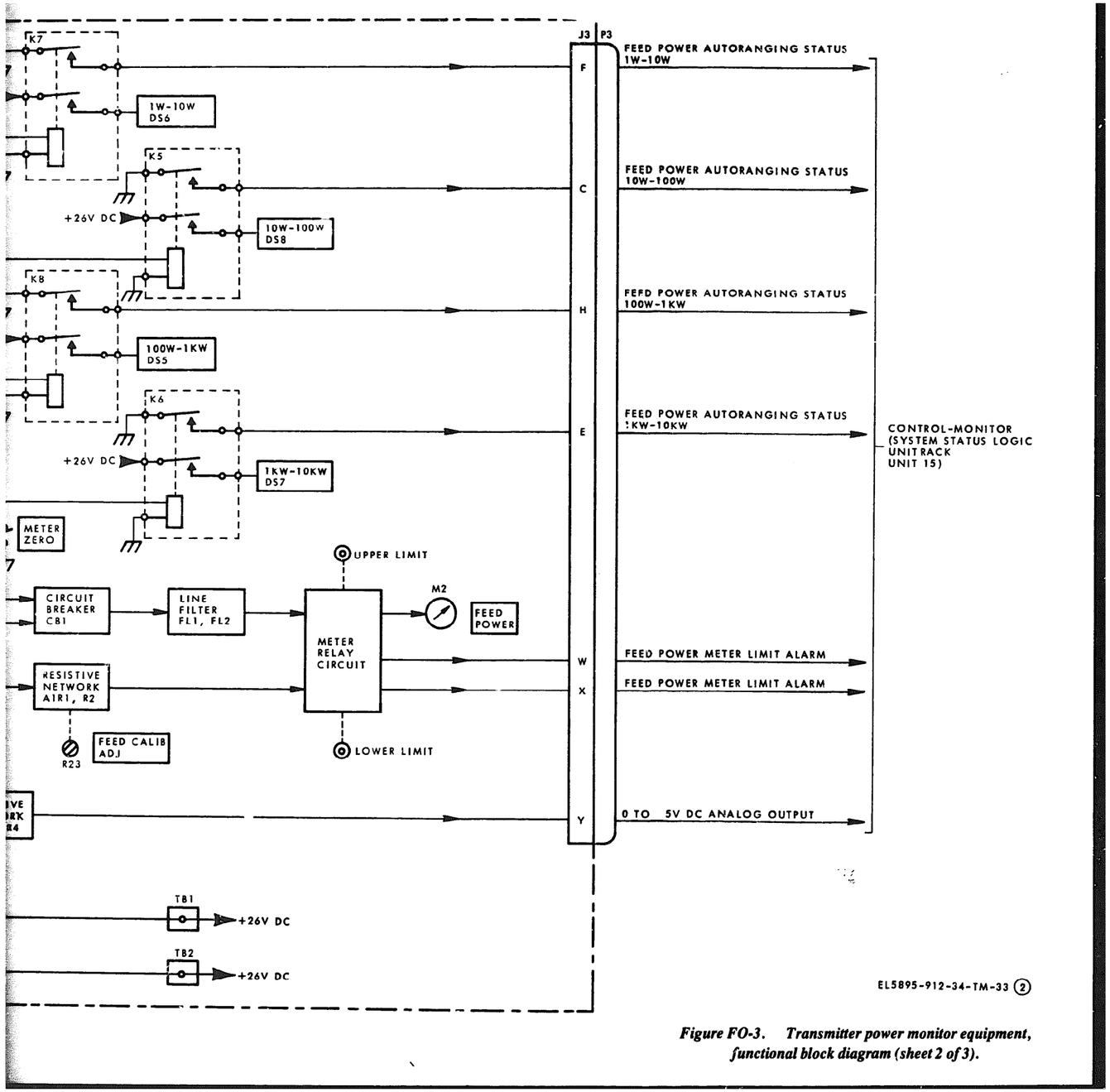


Figure FO-3. Transmitter power monitor equipment, functional block diagram (sheet 2 of 3).

Figure FO-3. Transmitter power monitor equipment, functional block diagram (sheet 2 of 3).

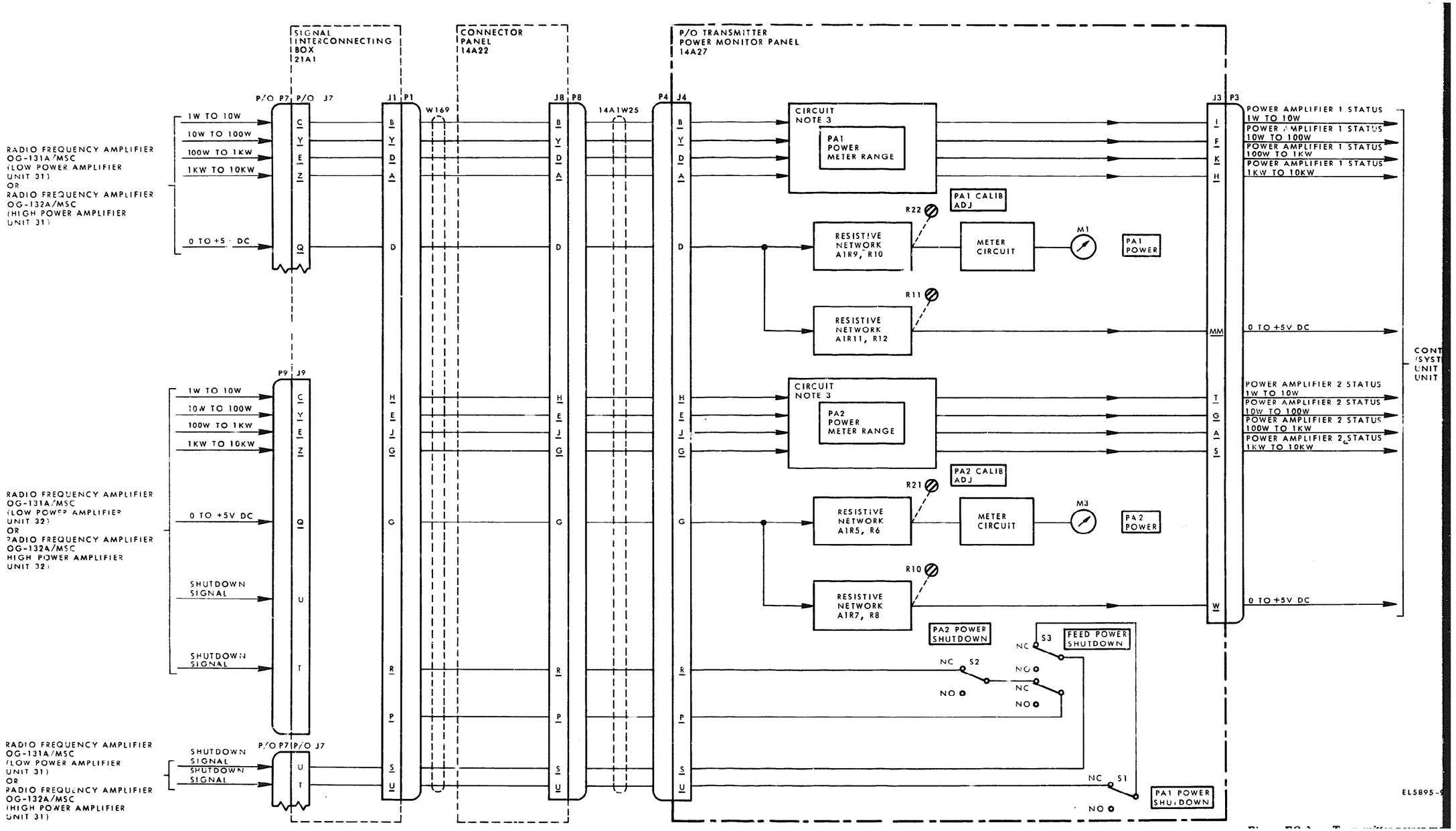


Figure FO-3. Transmitter power monitor equipment. functional block diagram (sheet 3 of 3).

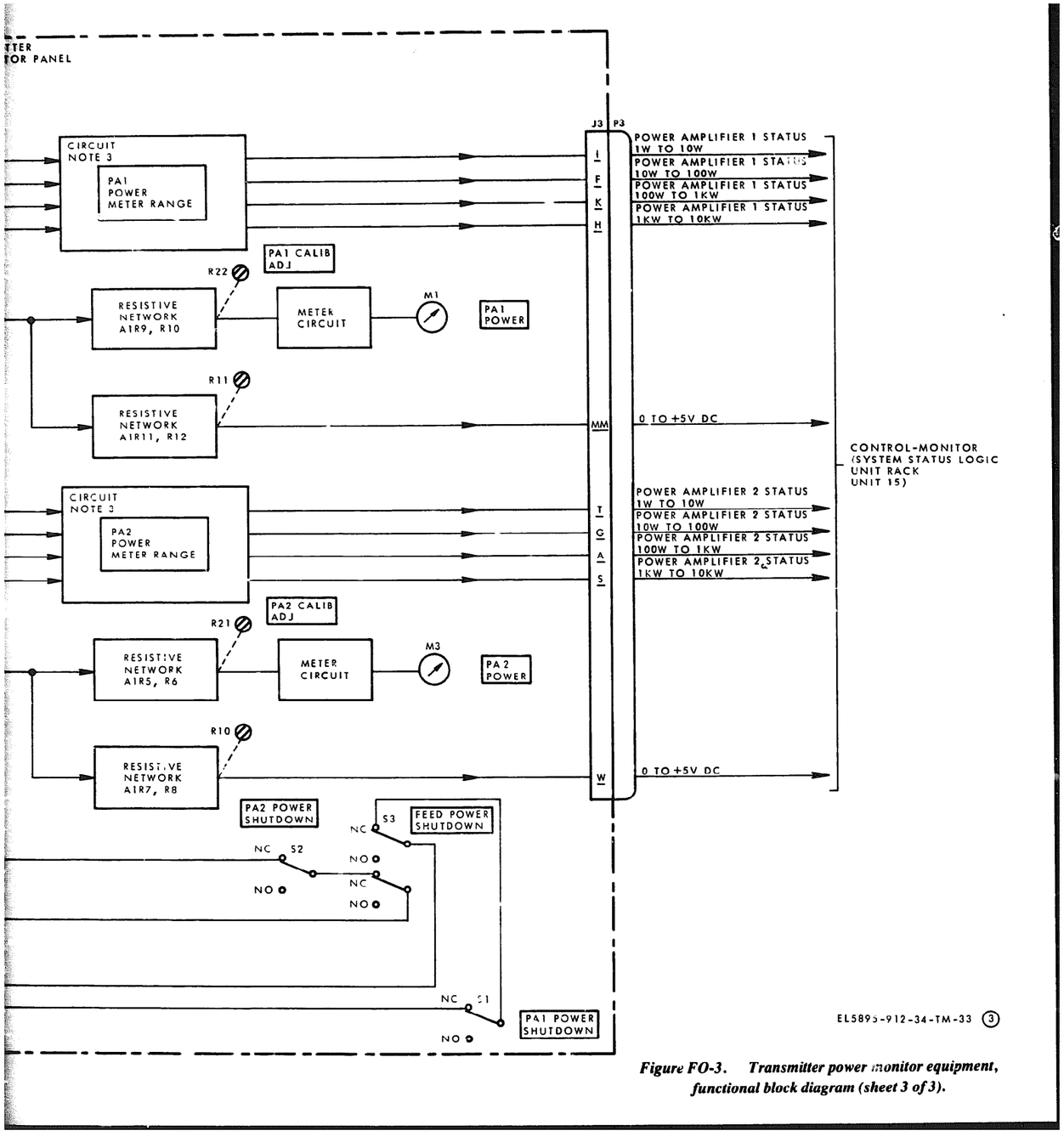
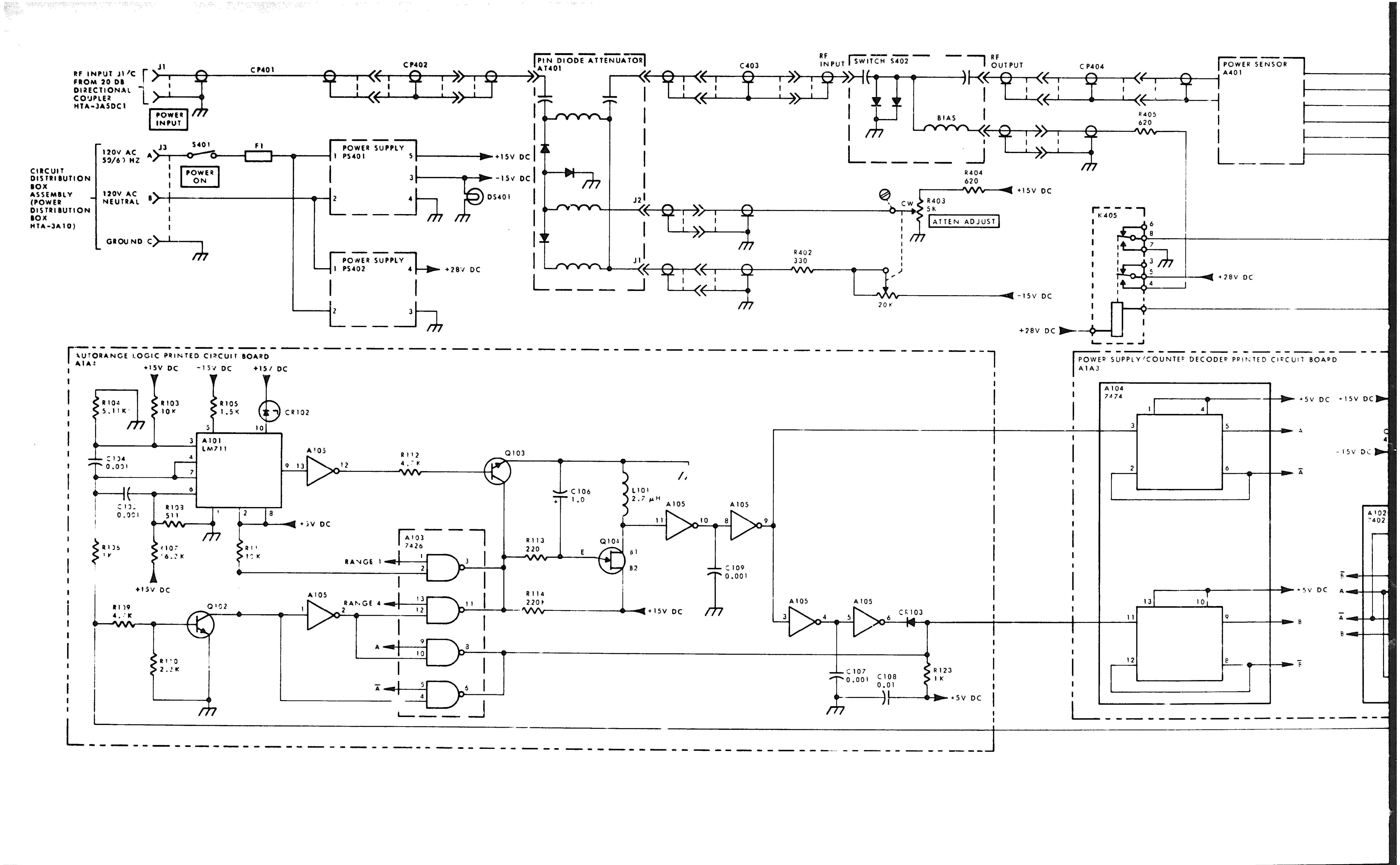


Figure FO-3. Transmitter power monitor equipment, functional block diagram (sheet 3 of 3).

Figure FO-3. Transmitter power monitor equipment, functional block diagram (sheet 3 of 3).


RF INPUT J1/C FROM 20 DB DIRECTIONAL COUPLER HTA-3A5DC1
POWER INPUT
CP401
CP402
PIN DIODE ATTENUATOR AT401
C403
RF INPUT
SWITCH S402
RF OUTPUT
CP404
POWER SENSOR A401
BIAS
R405 620
CIRCUIT DISTRIBUTION BOX ASSEMBLY (POWER DISTRIBUTION BOX HTA-3A10)
120V AC 50/60 HZ
120V AC NEUTRAL
GROUND
S401
POWER ON
F1
POWER SUPPLY PS401
+15V DC
-15V DC
DS401
POWER SUPPLY PS402
+28V DC
R404 620
R403 5K
ATTEN ADJUST
R402 330
20K
K405
AUTORANGE LOGIC PRINTED CIRCUIT BOARD A1A2
R104 5.11K
R103 10K
R105 1.5K
CR102
A101 LM711
A105
R112 4.7K
Q103
C106 1.0
L101 2.7 µH
C104 0.001
C103 0.001
R103 511
R106 1K
R107 16.2K
A103 7426
RANGE 1
RANGE 4
R113 220
R114 220K
Q104
C109 0.001
R139 4.7K
Q102
R110 2.2K
CR103
C107 0.001
C108 0.01
R123 1K
+5V DC
POWER SUPPLY/COUNTER DECODER PRINTED CIRCUIT BOARD A1A3
A104 7474
A102 7402

POWER SENSOR A401

COMPENSATION NETWORK A
COMPENSATION NETWORK B
INPUT SIGNAL C
INPUT SIGNAL D
SHIELD GROUND E
CHASSIS GROUND F
RANGE 4 G
RANGE 3 H
RANGE 2 J
RANGE 1 K
AUTO-ZERO L
SHEET 2

+28V DC

SIGNAL OUTPUT

AUTO-ZERO OUTPUT J2 K

TERMINAL BLOCK
COIL
RELAY K405
FRONT VIEW

UNTER DECODER PRINTED CIRCUIT BOARD

+5V DC
+15V DC
R101 68
Q101
C102 4.7
C101 4.7
R102 560
CR101
C103 0.01
-15V DC
A
$\bar{A}$
B
$\bar{B}$

A102 7402

RANGE 4
R115 2.2K
Q105
R116 100
R117 2.2K
Q106
R118 100
R119 2.2K
Q107
R120 100
R121 2.2K
Q108
R122 100
RANGE 1

P/O J4 P/O P4

+15V DC
-15V DC
+28V DC
L
A
B
I
H
G
F
E
C
D

E1
+15 V DC

RANGE SELECTOR STATUS RELAYS A2

K404
K403
K402
K401

RANGE STATUS 1KW-10KW E
RANGE STATUS 100W-1KW P
RANGE STATUS 10W-100W S
RANGE STATUS 1W-10W J

TRANSMITTER POWER MONITOR PANEL 14A27

RETURN SHIELD

A, B, C, D, F, G, H, L, N, P, T, U, V

0V DC TO +5V DC ANALOG SIGNAL M

M SHEET 2

NO

Figu

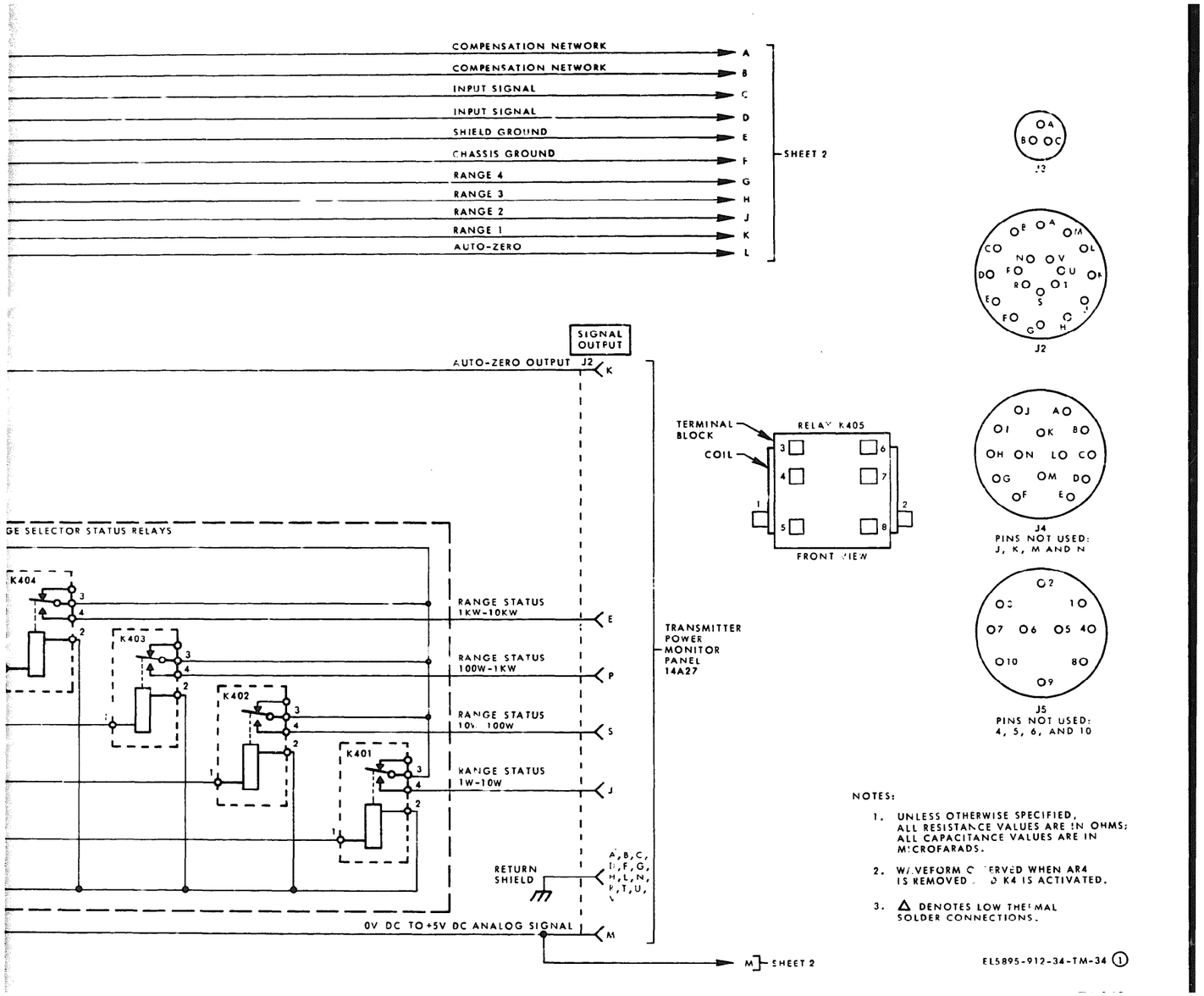
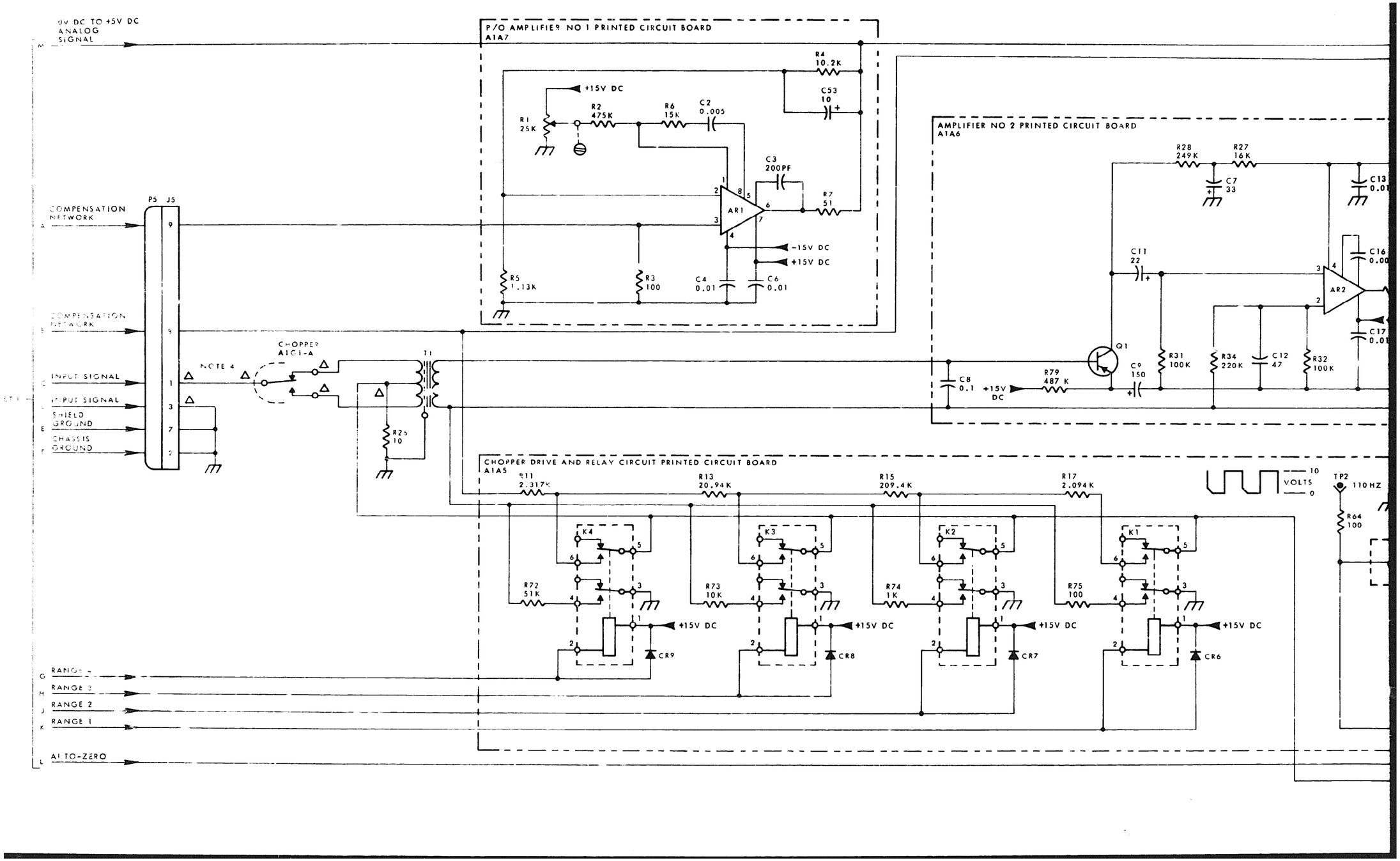
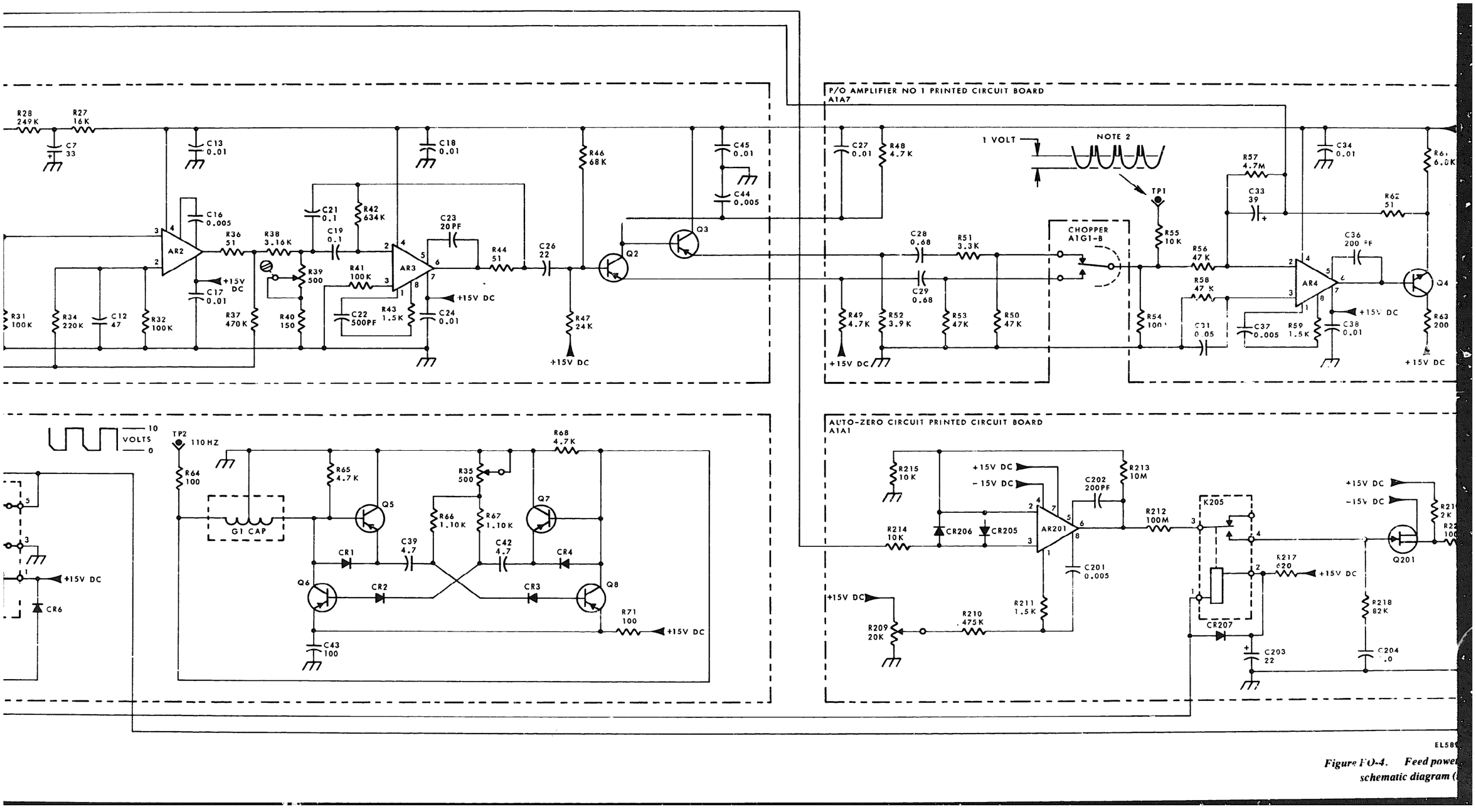


Figure FO-4. Feed power monitor HTA-3A9, schematic diagram (sheet 1 of 2).


0V DC TO +5V DC ANALOG SIGNAL
P/O AMPLIFIER NO 1 PRINTED CIRCUIT BOARD A1A7
R4 10.2K
C53 10
+15V DC
R1 25K
R2 475K
R6 15K
C2 0.005
C3 200PF
AR1
R7 51
-15V DC
+15V DC
R5 1.13K
R3 100
C4 0.01
C6 0.01
AMPLIFIER NO 2 PRINTED CIRCUIT BOARD A1A6
R28 249K
R27 16K
C7 33
C13 0.01
C11 22
AR2
C16 0.00
C17 0.01
Q1
C9 150
R31 100K
R34 220K
C12 47
R32 100K
C8 0.1
+15V DC
R79 487 K
P5 J5
COMPENSATION NETWORK
COMPENSATION NETWORK
INPUT SIGNAL
INPUT SIGNAL
SHIELD GROUND
CHASSIS GROUND
NOTE 4
CHOPPER A1G1-A
T1
R25 10
CHOPPER DRIVE AND RELAY CIRCUIT PRINTED CIRCUIT BOARD A1A5
R11 2.317K
R13 20.94K
R15 209.4K
R17 2.094K
10 VOLTS 0
TP2 110 HZ
R64 100
K4
K3
K2
K1
R72 51K
R73 10K
R74 1K
R75 100
+15V DC
CR9
CR8
CR7
CR6
RANGE 3
RANGE 2
RANGE 2
RANGE 1
AUTO-ZERO



EL58

Figure FO-4. Feed power monitor HTA-3A9, schematic diagram (sheet 2 of 2).

Figure FO-4. Feed power monitor HTA-3A9, schematic diagram (sheet 2 of 2).

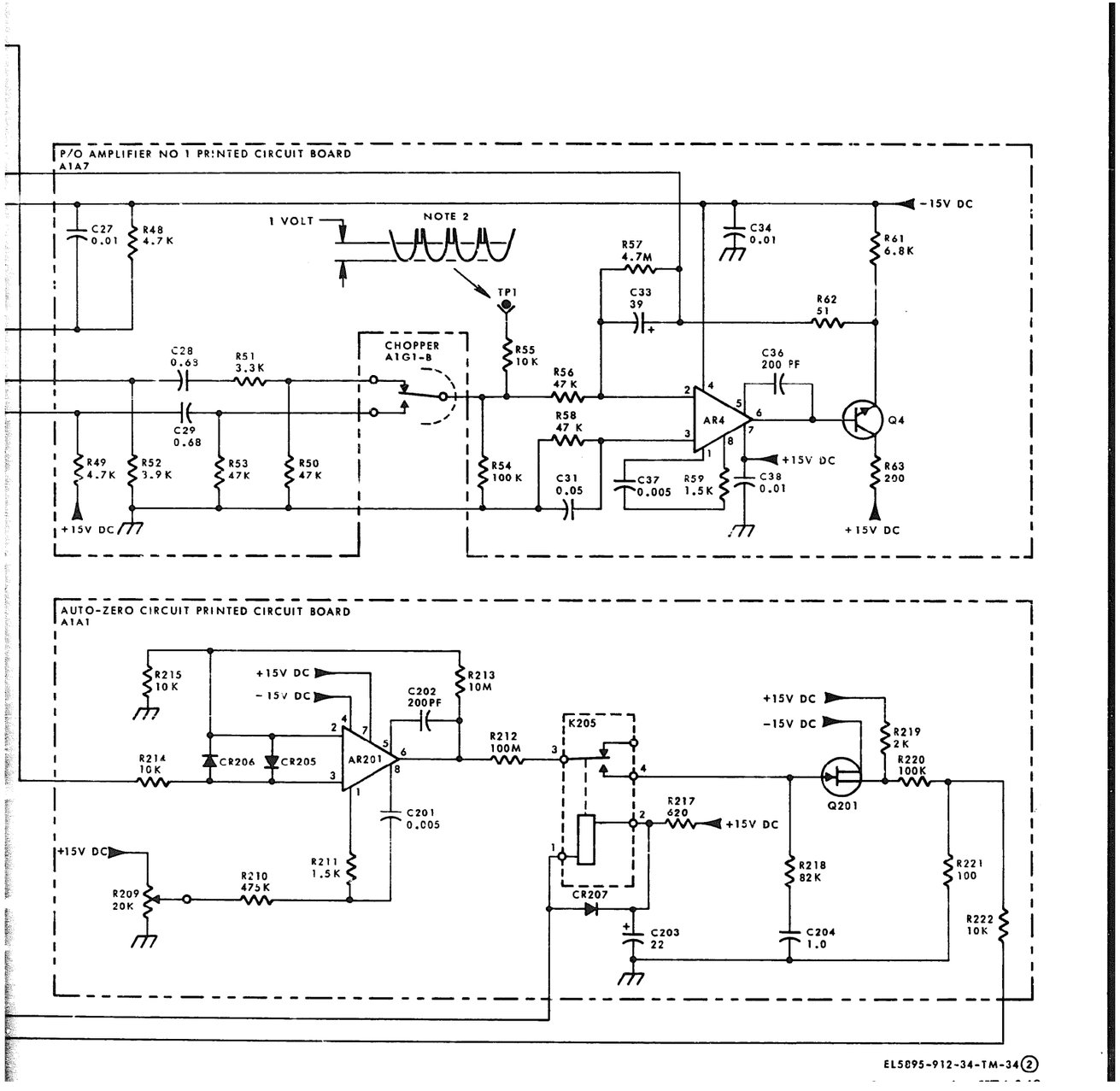


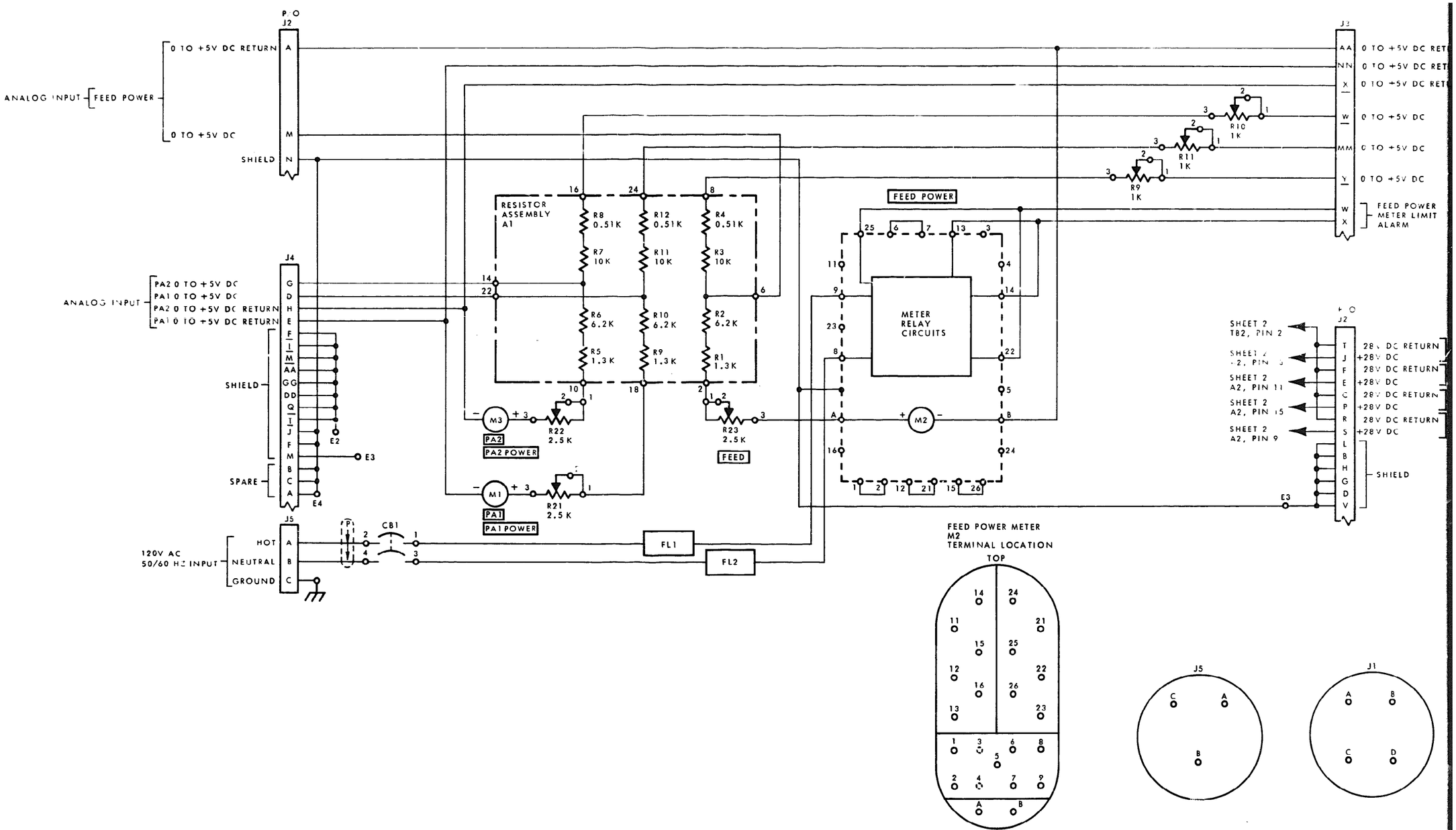
Figure FO-4. Feed power monitor HTA-3A9, schematic diagram (sheet2 of 2)

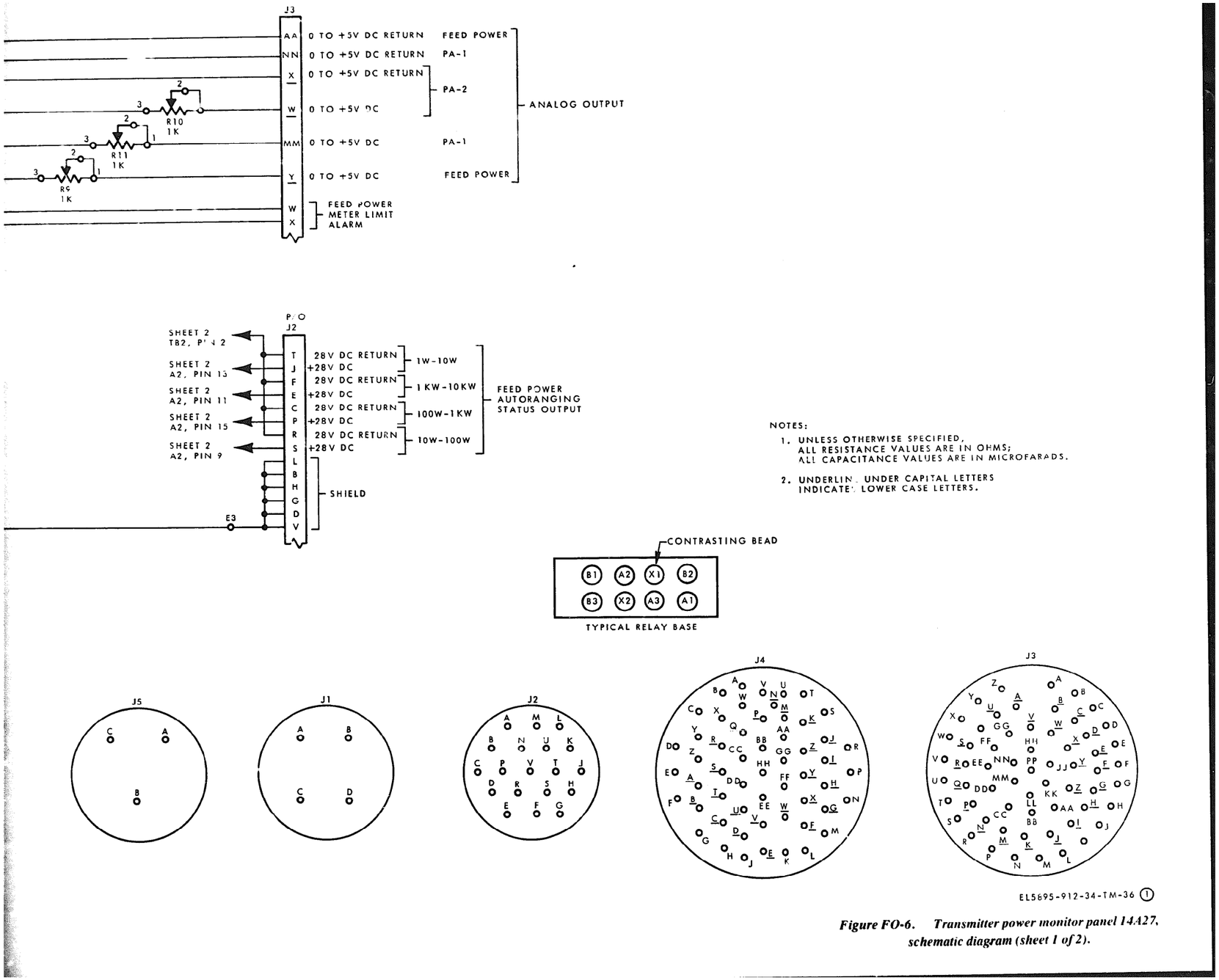
WIRE NO	COLOR(S)	AWG	FROM	TO	NOTES
1	WHT/RED	26	J4-A	6126-1, C101+	+15V DC
2	VIO	26	J4-B	6126-1, C102-	-15V DC
3	BLK	18	J4-C		GND
4	GRN	26	J4-D	6127, R109	
5	BLK	18	J4-E		GND
6	BLU	26	J4-F	6126-1, R122	RANGE 1
7	GRY	26	J4-G	6126-1, R120	RANGE 2
8	WHT	26	J4-H	6126-1, R118	RANGE 3
9	WHT/BRN	26	J4-I	6126-1, R116	RANGE 4
			J4-J	NC	
			J4-K	NC	
10	WHT/ORN		J4-L	7940-G2, K205-1	
			J4-M	NC	
			J4-N	NC	
11	BLK	18	FRONT PNL GND LUG, J4, 468	6126-1, C102+	GND
12	WHT/RED	26	6126-1, C101+	6127, R103	+15V DC
13	WHT/RED	26	6127, R103	7940-G2, R217	+15V DC
14	VIO	26	6126-1, C102-	6127, R105	-15V DC
15	VIO	26	6127, R105	7940-G2, R219	-15V DC
16	BLK	18	6126-1, C102+	6127, R106	GND
17	BLK	18	6127, R108	7940-G2, C203	GND
18	RED	26	6126-1, A104-11	6127, A103-6	
19	GRN	26	6126-1, A104-1	6127, R111	+5V DC
20	BRN	26	REAR PNL, R26	7940-G2, R222	
21	ORN	26	6126-1, A104-3	6127, A105-8	
22	YEL	26	6126-1, A104-5	6127, A103-9	(A)
23	WHT/YEL	26	6126-1, R121	6127, A103-1	RANGE 1
24	WHT/BLU	26	6126-1, R115	6127, A103-13	RANGE 4
25	WHT/GRN	26	6126-1, A102-2	6127, A103-5	(Ā)
26	GRN	26	6127, R109	7940-G2, R214	
27	WHT/RED	22	P4-A	PS 401-5	+15V DC
28	VIO	22	P4-B	PS 401-3	-15V DC
29	BLK	18	P4-C	FRONT PNL GND LUG	E1
30	GRN	26	P4-D	TERMINAL	E2
31	BLK	18	P4-E	FRONT PNL GND LUG	E1
32	BLU	26	P4-F	K401-1	
33	GRAY	26	P4-G	K402-1	
34	WHT	26	P4-H	K403-1	
35	WHT/BRN	26	P4-I	K404-1	
			P4-J	NC	
			P4-K	NC	
36	WHT/ORN	26	P4-L	K405, ARM	
			P4-M	NC	
			P4-N	NC	
37	BLK	18	J2-A	GND LUG, E1	
38	BLK	18	J2-B	GND LUG, E1	
39	BLK	18	J2-C	GND LUG, E1	
40	BLK	18	J2-D	GND LUG, E1	
41	BRN	26	J2-E	K404-4	
42	BLK	18	J2-F	GND LUG, E1	
43	BLK	18	J2-G	GND LUG, E1	
44	BLK	18	J2-H	GND LUG, E1	
45	RED	26	J2-J	K401-4	
46	ORN	26	J2-K	K405-1	
47	BLK	18	J2-L	GND LUG, E1	
48	YEL	26	J2-M	TERMINAL	E2
49	BLK	18	J2-N	GND LUG, E1	
50	GRN	26	J2-P	K403-4	
51	BLK	18	J2-R	GND LUG, E1	
52	BLU	26	J2-S	K402-4	
53	BLK	18	J2-T	GND LUG, E1	
54	BLK	18	J2-U	GND LUG, E1	
55	BLK	18	J2-V	GND LUG, E1	
56	RED	18	J3-A	S401	
57	VIO	18	J3-B	PS 401-2 AND PS 402-2	
58	BLK	18	J3-C	GND LUG	
59	WHT	22	S401	F1	
60	WHT/BLK	22	F1	PS 401-1 AND PS 402-1	
61	WHT/RED	22	PS 401-5	R404	
62	WHT/RED	22	PS 401-5	K401-2, K402-2, K403-2 AND K404-2	
63	VIO	22	PS 401-3	R403, REAR	
64	WHT/VIO	22	PS 402-4	K405-2, ARM	
65	WHT/VIO	22	PS 402-4	K405-2	
66	WHT/VIO	22	PS 402-4	K401-3, K402-3, K403-3 AND K404-3	
67	VIO	22	PS 401-3	DS401	
68	BLK	18	DS401	GND LUG, E1	
69	BLK	18	PS 402-3	GND LUG, E1	
70	BLK	18	PS 401-4	GND LUG, E1	
71	BLK	18	R403, FRONT CCW	GND LUG, E1	
72	BLK	18	K405-1, N O	GND LUG, E1	
73	BLU	26	R405	K405-2, N O	
74	RG174/U		R405	S402	
			R404	R403, FRONT CW	
75	RG174/U	BUS WIRE	R403, FRONT ARM	J2, AT401	
			R403, REAR ARM	R403, REAR W	
			R403, REAR CW	R402	
76	RG174/U		R402	J1, AT401	

EL5895-912-34-TM-35

Figure FO-5. Feed power monitor HTA-3A9, wiring list.

Figure FO-5. Feed power monitor HTA-3A9, wiring list.


P O J2
ANALOG INPUT
FEED POWER
0 TO +5V DC RETURN
0 TO +5V DC
SHIELD
J4
PA2 0 TO +5V DC
PA1 0 TO +5V DC
PA2 0 TO +5V DC RETURN
PA1 0 TO +5V DC RETURN
SHIELD
SPARE
E2
E3
E4
J5
120V AC
50/60 HZ INPUT
HOT
NEUTRAL
GROUND
P1
CB1
FL1
FL2
RESISTOR ASSEMBLY A1
R8 0.51K
R12 0.51K
R4 0.51K
R7 10K
R11 10K
R3 10K
R6 6.2K
R10 6.2K
R2 6.2K
R5 1.3K
R9 1.3K
R1 1.3K
M3
M1
M2
PA2
PA2 POWER
PA1
PA1 POWER
R22 2.5K
R21 2.5K
R23 2.5K
FEED
FEED POWER
METER RELAY CIRCUITS
R10 1K
R11 1K
R9 1K
J3
0 TO +5V DC RET
0 TO +5V DC
FEED POWER METER LIMIT ALARM
P O J2
SHEET 2 TB2, PIN 2
SHEET 2 A2, PIN 11
SHEET 2 A2, PIN 15
SHEET 2 A2, PIN 9
28V DC RETURN
+28V DC
SHIELD
FEED POWER METER M2 TERMINAL LOCATION
TOP
J5
J1

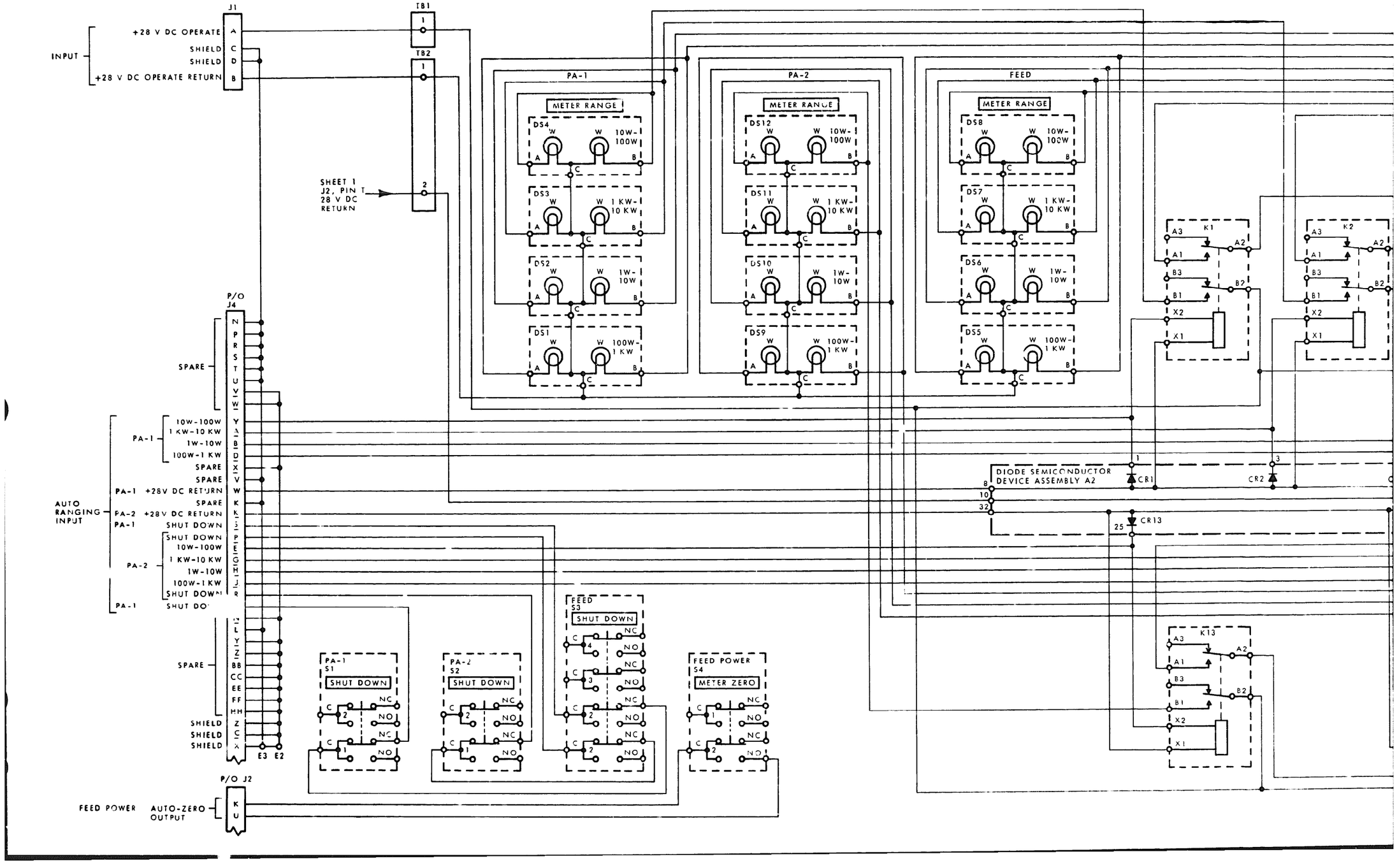


NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS; ALL CAPACITANCE VALUES ARE IN MICROFARADS.
2. UNDERLINE UNDER CAPITAL LETTERS INDICATES LOWER CASE LETTERS.

Figure FO-6. Transmitter power monitor panel 14A27, schematic diagram (sheet 1 of 2).

Figure FO-6. Transmitter power monitor panel 14A27, schematic diagram (sheet 1 of 2).


J1
INPUT
+28 V DC OPERATE
SHIELD
SHIELD
+28 V DC OPERATE RETURN
TB1
TB2
SHEET 1 J2, PIN T 28 V DC RETURN
PA-1
PA-2
FEED
METER RANGE
DS4
DS3
DS2
DS1
DS12
DS11
DS10
DS9
DS8
DS7
DS6
DS5
10W-100W
1 KW-10 KW
1W-10W
100W-1 KW
P/O J4
SPARE
PA-1
10W-100W
1 KW-10 KW
1W-10W
100W-1 KW
AUTO RANGING INPUT
PA-1 +28V DC RETURN
PA-2 +28V DC RETURN
PA-1 SHUT DOWN
PA-2 SHUT DOWN
SHIELD
SHIELD
SHIELD
E3 E2
DIODE SEMICONDUCTOR DEVICE ASSEMBLY A2
CR1
CR2
CR13
K1
K2
K13
A1
A2
A3
B1
B2
B3
X1
X2
PA-1 S1
PA-2 S2
FEED S3
FEED POWER S4
SHUT DOWN
METER ZERO
NC
NO
C
P/O J2
FEED POWER
AUTO-ZERO OUTPUT

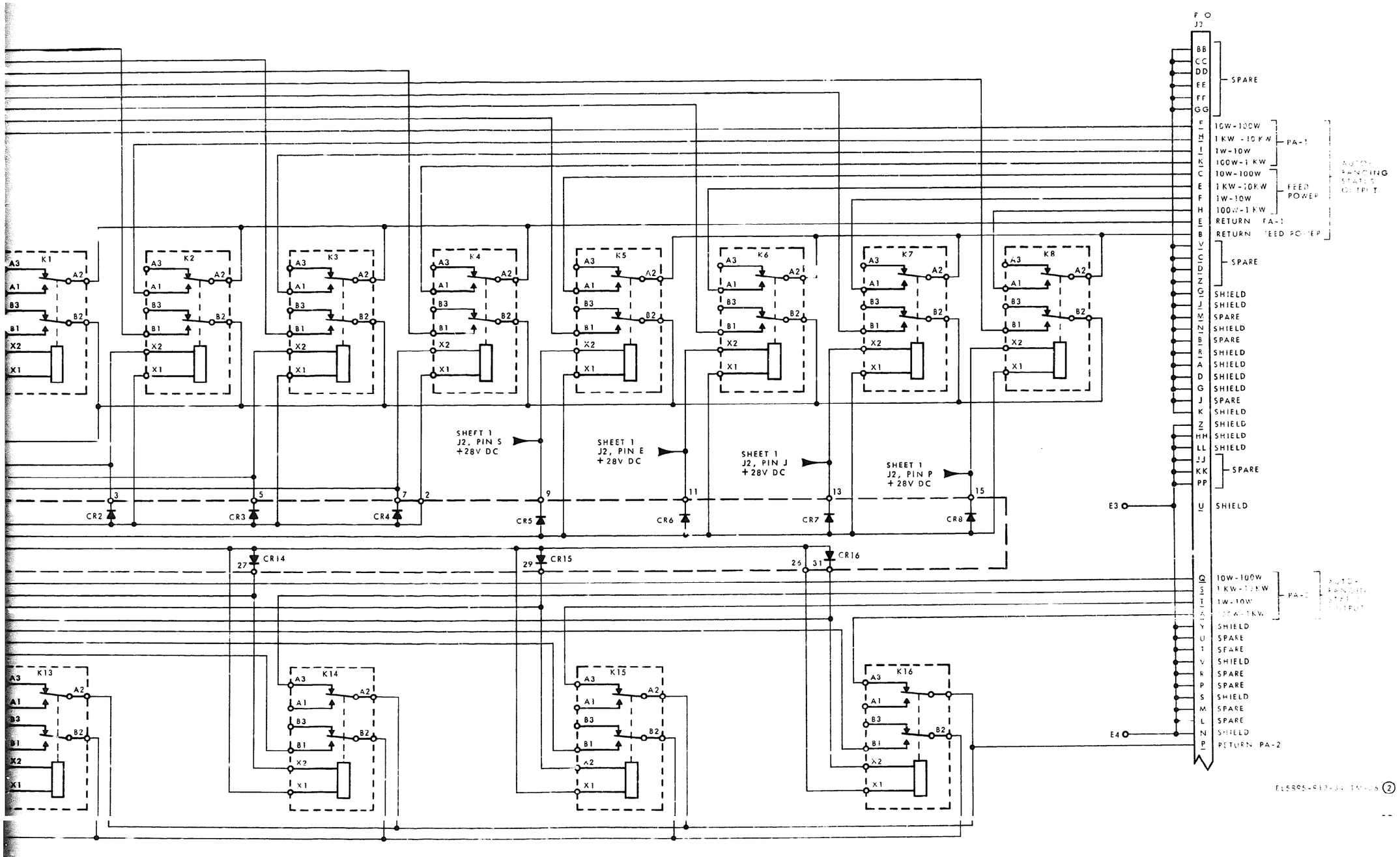


Figure FO-6. Transmitter power monitor panel 14A27, schematic diagram (sheet 2 of 2).

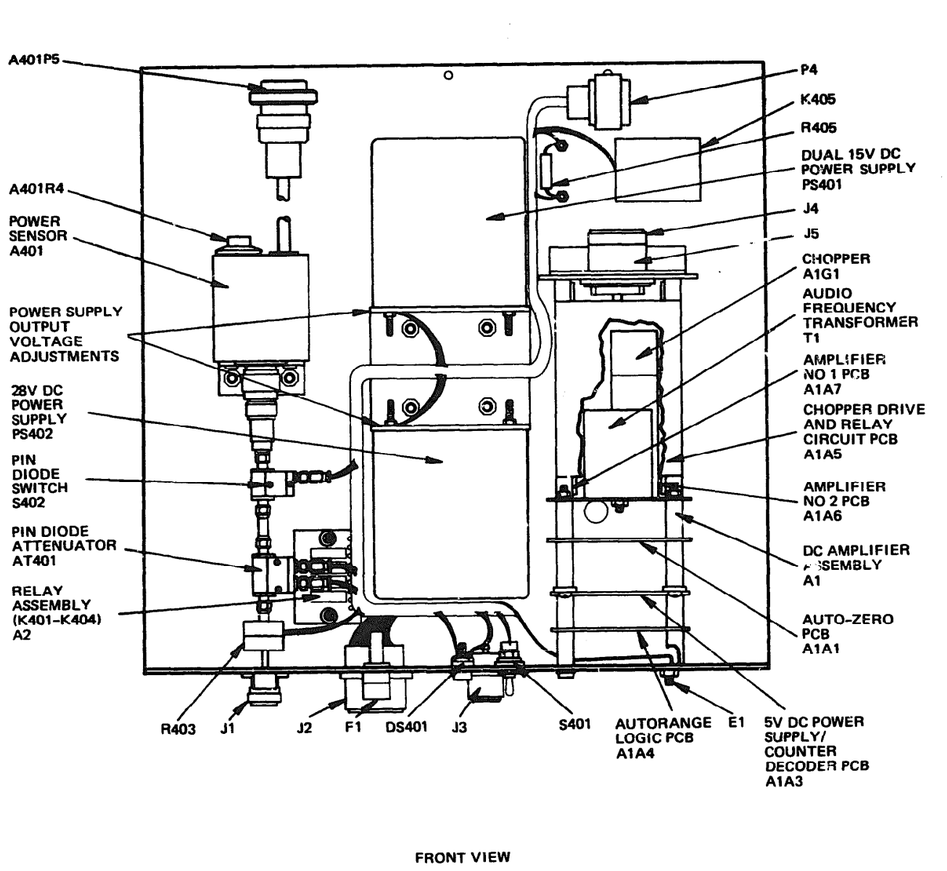


Figure FO-7. Feed power monitor HTA-3A9, assembly diagram.

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TM 11-5840-340-12	23 Jan 74	Radar Set AN/MPQ-76

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PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.
2-25	2-28		
3-10	3-3		3-1
5-6	5-8		
		F03	

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°.

REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.

Item 5, Function column. Change "2 db" to "3db."

REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.

Add new step f.1 to read, "Replace cover plate removed in step e.1, above."

REASON: To replace the cover plate.

Zone C 3. On J1-2, change "+24 VDC to "+5 VDC."

REASON: This is the output line of the 5 VDC power supply. + 24 VDC is the input voltage.

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:
SSG I. M. DeSpiritof 999-1776	SSG. I.M. DeSpiritof

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Army Dep (1) except
LBAD (14)
SAAD (30)
TOAD (14)
SHAD (3)
USA Dep (1)
Sig Sec USA Dep (1)
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29-610

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USAR: None
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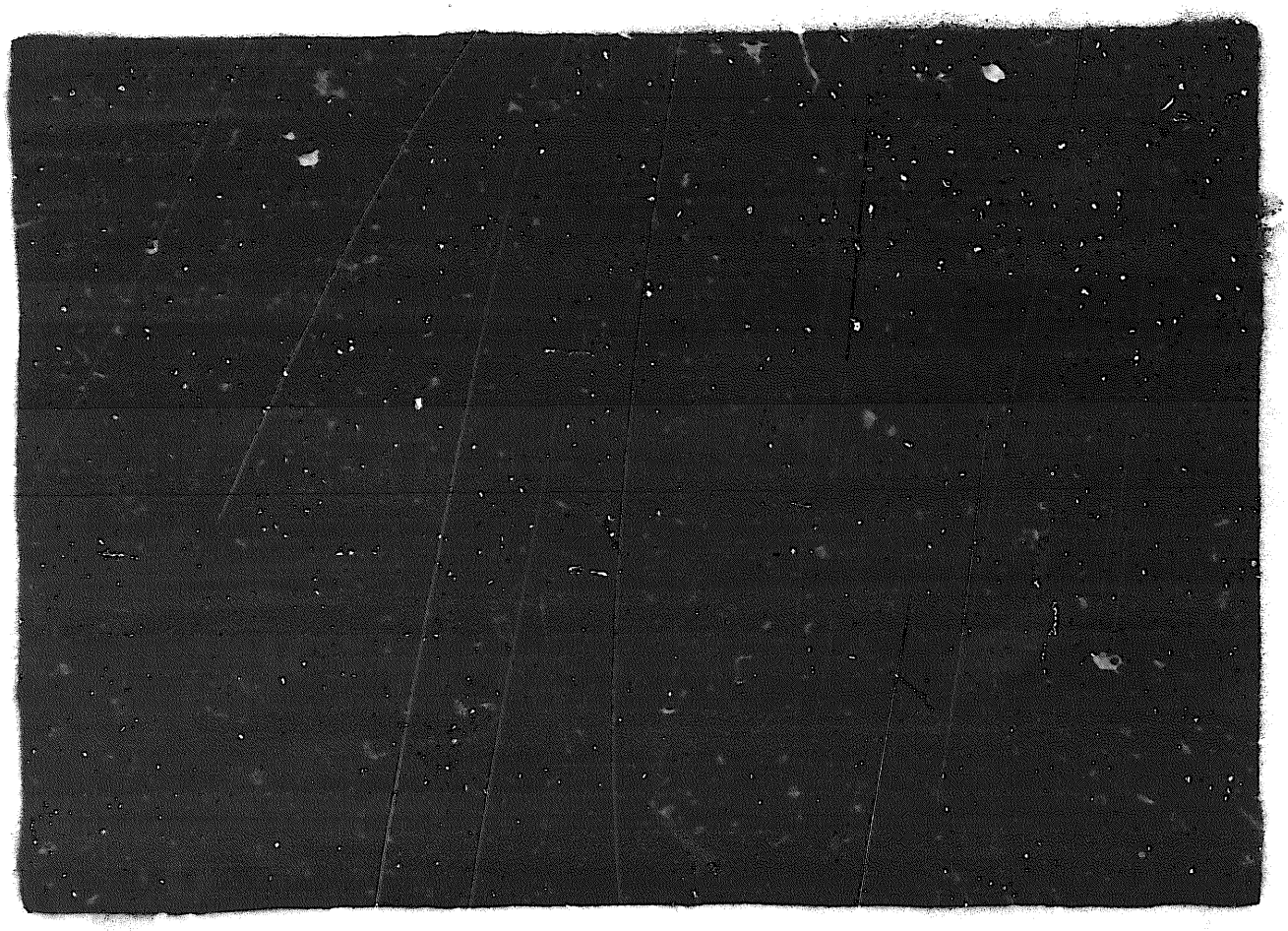

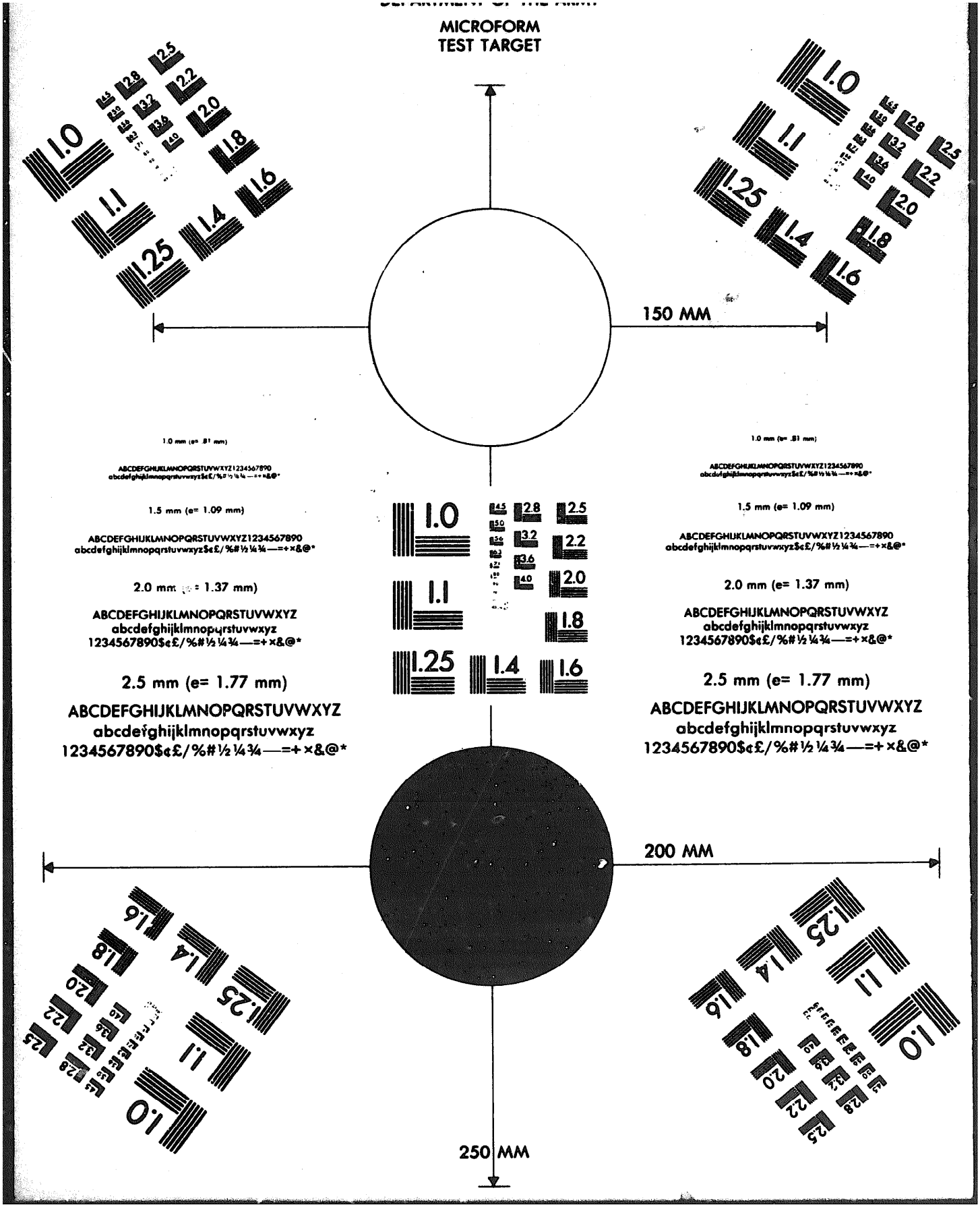
MICROFORM
TEST TARGET
150 MM
200 MM
250 MM
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abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*
2.0 mm (e= 1.37 mm)
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*
2.5 mm (e= 1.77 mm)
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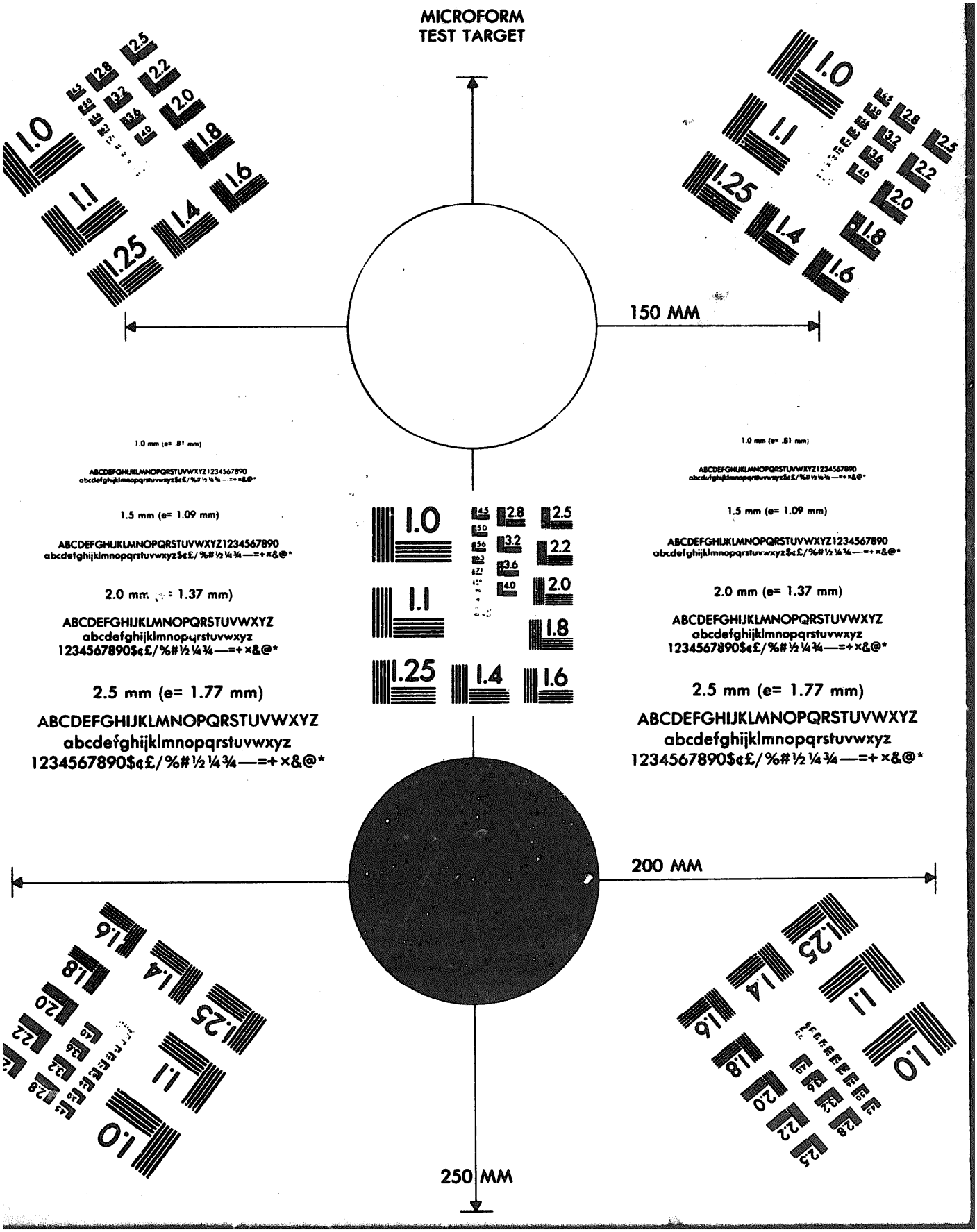
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*


MICROFORM
TEST TARGET
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200 MM
250 MM
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2.0 mm (e= 1.37 mm)
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*
2.5 mm (e= 1.77 mm)
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