TECHNICAL MANUAL

OPERATOR'S ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

SATELLITE COMMUNICATINS TERMINAL AN/TSC-86 (NSN 5895-01-083-6891)

HEADQUARTERS, DEPARTMENT OF THE ARMY

13 MAY 1983

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNINGS

The plug cover on the trailer electrical cable is under great tension when locked in the open position. Exercise extreme care when handling, otherwise injury to personnel may result.

Stay clear of the ceiling stow bracket, otherwise injury to personnel may result.

Handle the center section with care. Use four persons to install it. Failure to do so could result in injury to personnel because of its bulk and weight and/or damage to the equipment because of its delicate construction.

Ensure that all power circuit breakers in the shelter (all unit drawers and power distribution panel) and on the pallet power unit are in their OFF or down position.

Applying power to the terminal with the PHASE SEQUENCE lights on in the NO GO position will cause damage to the terminal equipment, the generator, or both.

An RF radiation hazard exists if the rack 3 or rack 4 RF output is not properly terminated into the waveguide inside or outside of the shelter. Check all waveguide connections before applying power.

Before starting any of these procedures, be sure that the terminal equipment is in a complete shutdown condition and that the generator set is not operating.

Wear work gloves to protect the hands while removing the anchor cables.

When placing the equipment in the shelter, stay clear of the ceiling stow bracket, otherwise injury to personnel may result.

Cleaning compound is flammable and its fumes are toxic. Do not use near a flame; provide adequate ventilation.

Prior to initiating inspection procedures, ensure that the equipment is in a shutdown condition. Observe conventional personnel safety precautions while working on the shelter and around the antenna.

Do not allow Turcoat solution to come in contact with skin.

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

Voltages dangerous to life are present in the power amplifier. Also, the potential for an RF radiation hazard exists should the front panel waveguide flange become uncovered while the unit is operational. On the power distribution panel, place the appropriate PA AUX and circuit breaker to the OFF position; Check that the AC POWER indicator on the power supply is extinguished. On the power supply, place the START and BLOWER circuit breakers to the OFF position and the OPERATE-STANDBY switch to the STANDBY position.

Because of the bulk and weight of the PA, two persons are required to remove it. Handle the PA with care; otherwise injury to personnel or damage to the PA may result.

The klystron weighs approximately 43 pounds. Most of its weight is concentrated towards the rear of the assembly.

During removal, be careful not to allow the rear of the assembly to tip downward; otherwise, injury to personnel or damage to the equipment may result.

Voltages dangerous to life are present in the power supply whenever the front panel AC POWER indicator is illuminated. On the power distribution panel, place the associated AUX and PA circuit breakers to the OFF position. Check that the AC POWER indicator on the power supply is extinguished. On the power supply, place the BLOWER START circuit breakers to the OFF position and the OPERATE-STANDBY switch to the STANDBY position.

Because of the bulk and weight of the power supply, two persons are required to move it. Dropping the power supply could cause injury to personnel or damage to the equipment.

Dangerous voltages exist in the LNA control/translator that may cause death or injury to personnel even when the unit POWER circuit breaker is in the OFF position. This voltage exists at TB1 (fig. 5-23). Exert caution if removing the 725 MHz source module A4; especially when loosening the rear captive screws. It is highly desirable to keep the receiver (on-line LNA) on the air. However, if the tactical situation permits otherwise, the AC power cable then can be disconnected from J1 on the rear panel.

Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuits breakers on the power distribution panel are in the OFF position.

Use two persons for this task, otherwise, personal injury and/or damage to the equipment may result. Do not attempt this task if winds exceed 40 mph (64 kmph).

ELECTROMAGNETIC RADIATION

DO NOT STAND IN THE DIRECT PATH OF THE ANTENNA WHEN THE POWER IS ONI DO NOT WORK ON THE WAVEGUIDE WHILE THE POWER IS ONI High frequency electromagnetic radiation can cause fatal internal burns. It can literally "cook" internal organs and flesh. If the slightest feeling of heat is experienced while cleaning this equipment, MOVE AWAY QUICKLY

To perform the following procedures, it is necessary to have access to the LNA BITE mounted on the antenna center section. Be careful not to disturb the cabling or the other mounted electronics. Avoid any radiation exposure; do NOT go in front of the antenna.

Voltages dangerous to life exist in the power switch box. Exercise extreme care if voltage checks must be performed. When performing continuity checks, disconnect the main power input cables from the generator 1 and 2 connectors.

Voltages dangerous to life exist in the power switch box. Exercise extreme care if voltage checks must be performed. When performing continuity checks, disconnect the main power input cables from the generator 1 and 2 connectors.

The protective grounding terminals of the test instrument and the calibration equipment must be connected to the equipment grounding (safety) conductor of the power cords. For electrical shock protection use only extension cords and power recepticles with a safety-ground connector or otherwise connect the chassis to a safety ground system.

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

Technical Manual

No. TM 11-5895-846-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, *13 May 1983*

OPERATOR'S, ORGANIZATIONAL,
DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL

SATELLITE COMMUNICATIONS TERMINAL
AN/TSC-86
(NSN 5895-01-083-6891)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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

A reply will be furnished direct to you.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual describes the installation, operation, and maintenance of Satellite Communications Terminal AN/TSC-86. The AN/TSC-86, or terminal, is shown in figure 1-1.

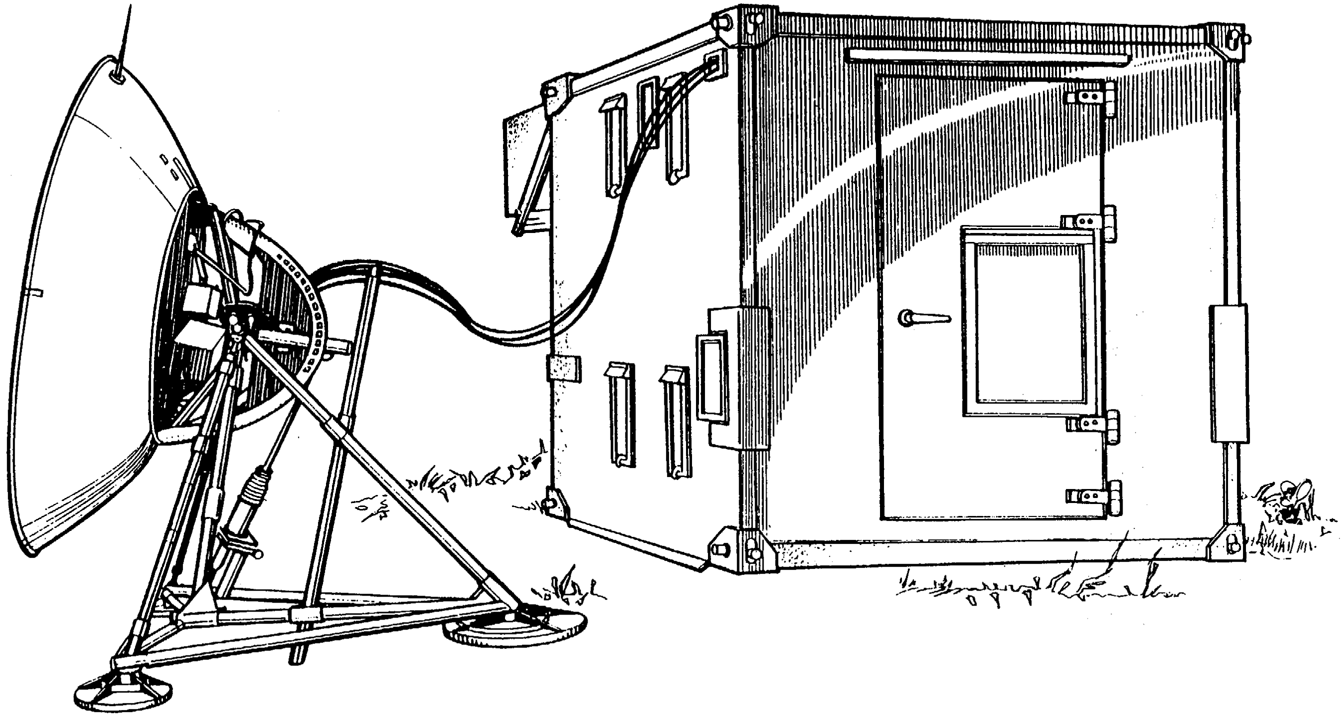


Figure 1-1. Communications terminal, satellite AN/TSC-86.

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

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

1-3. Maintenance Forms, Records, and Reports

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

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO p4610.19C/DLAR 4500.15.

1-4. Reporting Equipment Improvement Recommendations (EIR)

If your AN/TSC-86 needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-MEMP, Fort Monmouth,, NJ 07703. We'll send you a reply.

1.5. Administrative Storage

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

1-6. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

Section II. DESCRIPTION AND DATA

1-7. Purpose and Use

The terminal contains equipment for the reception, transmission and processing of medium and high capacity multiplexed voice, data and TTY. With the addition of encryption equipment it will process secure as well as non-secure traffic. The terminal is intended for multi-point operation in trunking systems. It is capable of simultaneous transmission and reception of up to four carriers. The terminal provides three racks of modulation, demodulation and signal processing equipment. Communication interfaces are established. Provision is also made for external connection to a four-wire telephone. The terminal consists of an antenna group (including controls), a receiving group, a transmitting group, a communications subsystem, a power source and distribution group, and interfacing capability. The terminal includes two air conditioners (with heating capability) for personnel comfort and cooling of CSS racks.

1-8. Description

a. Shelter. The terminal is contained within a modified S-280 shelter. The electronic equipment is mounted in racks which have been secured to both sides of the shelter. Access to the shelter is through a door in the rear end. Two air conditioners are mounted on the front of the shelter. Air louvers are provided on the roadside of the shelter and signal, power and antenna entry panels are provided on the roadside and curbside of the shelter.

b. Pallet. Two power generators are mounted on a power pallet. The pallet contains a switch box for changing over from the main to the standby generator.

c. Transport Mode. In the transport mode, the shelter and power pallets are placed on a mobilizer for transport. The antenna center section and all other antenna parts (petals, legs, etc.), anchors, guys and power cables are stowed within the shelter.

d. Operating Mode. When the terminal is positioned for operation, the antenna is placed on the ground adjacent to the shelter. In this assembled condition, the antenna is an eight-foot disk mounted on a dual tripod (a 20-foot antenna may also be used). The antenna may be positioned so as to face in any direction and from 10° to 900 in elevation.The power pallet will be positioned approximately 40 feet from the shelter and interconnected to the shelter with two power cables.

1-9. Differences Between Models

There are no differences in the models of this terminal.

1-10. Systems Application

This terminal may be used as a communication link (via satellite) with from one to four other TSC-86 terminals.

1-11. Tabulated Data

Performance data for the units which affect the system performance of the terminal are given in table 1-1 and the system complement is given in table 1-2.

Table 1-1. System Performance

Characteristic	Data
a TERMINAL	
Frequency	
Receiver	7.250 GHz to 7.750 GHz
Transmit	7.900 GHz to 8.399999 GHz
Antenna	
Reflector	8-foot parabolic
Polarization	
Receive	left hand circular
Transmit	right hand circular
Power Output	1000 watts (nominal)
Interface	70 MHz IF with a 40 MHz bandwidth
Noise Temperature	300°K max
Interface	± 0.25 radian over 40 MHz bandwidth @ 70 MHz input
Amplitude Response	±0.5 dB over any 10 MHz bandwidth over the 40 MHz passband for 70 MHz
Phase Linearity	
Receiver	± 0.1 radian over 30 MHz bandwidth @ 70 MHz output
	± 0.25 radian over 40 MHz bandwidth @ 70 MHz output
Transmitter	±0.1 radian over 30 MHz bandwidth @ 70 MHz input
Prime Power	120/208 ± 10% volts, 50/60 Hz +5%, three phase
b UNITS	
POWER AMPLIFIER	
RF Input Power (Nominal)	+ 19.2 dBm to + 22.0 dBm
Gain-Saturated (Nominal)	4 dB
Frequency Range	7.9-8.4 GHz
Tuning	Five Stage Calibrated
Instantaneous Bandwidth	40 MHz
Input VSWR	1.30:1
Power Output (PA Flange)	1200 watts
Power Output Adjustment Range	23 dB min
Harmonic Output Level	- 60 dB
Tube Noise Figure	33 dB
Spurious Output Level	-80 dB
Output VSWR	1.25:1
Gain Stability	± 0.3 dB/8 Hr
In-Band Noise	- 92 dBm/Hz
Out-of-Band Noise	- 202 dBm/Hz
Warm-Up Time	5 minutes
UPCONVERTER	
Input Frequency	70 MHz ± 20 MHz
Input Level	- 10 dBm, ± 2.0 dB
Input Impedance	50 ohms ± 10% unbalanced
2nd IF	700 MHz ± 20 MHz
1st LO Frequency	630 MHz
Output Frequency (fo)	7900 to 8399.999 MHz
Frequency Selection	1 kHz steps
Output Level	+ 20.8 dBm, nominal (power controlled)
Output VSWR 1.3:1	
2nd LO Frequency	7200 to 7699.999 MHz (1 kHz Steps)
DOWNCONVERTER	
RF Input Frequency	7250 to 7750 MHz
Frequency Selection	1 kHz Steps
RF Input VSWR	1.5:1
RF to IF Gain	+ 52 dB to + 44 dB (adjustable)
Noise Figure	10 dB, maximum
1st LO Frequency	6550 to 7050 MHz (1 kHz Steps)
1st LO Frequency	
at RF Input-	-35 dBm maximum
1st IF	700 MHz ± 20 MHz
2nd LO Frequency	630 MHz
IF Output	70 MHz ±20 MHz
IF Output Impedance	50 ohms, + 10% unbalanced
Dynamic Range	-35 Bm input, 1 dB compression
LNA ASSEMBLY	
Frequency Range	7.25 to 7.75 GHz (fixed tuned)
Bandwidth	500 MHz
Gain	37 dB minimum, 41 dB maximum
Gain Stability	±0.1 dB/minute
	±0.5 dB/8 hours with 540 F temp. change
Gain Compression	0.5 dB maximum for -60 dBm input in-band
Noise Temperature	165K at maximum operating temperature
Amplitude Response	±0.25 dB over any 40 MHz band
	±0.15 dB over any 10 MHz band
Phase Linearity	± 6 degrees per 40 MHz
	± 3 degrees per 10 MHz
AMPLIFIER/MIXER	
RF Input Power per Channel	+ 21 dBm (nominal)
Frequency Range	7.9 to 8.4 GHz
Gain Index Multicarrier	1 dBm
Gain under Single Carrier	ldB
Power Output: Multicarrier	+ 22 dBm (nominal)
Power Output: Single Carrier	+ 22 dBm (nominal)
Input Impedance	50 ohm
Gain Stability	± 0.3 dB/8 hr.
Warm-up Time	3 minutes
Prime Power	130 watts at 120 volts 50/60 Hz

Table 1-2. Equipment Complement

Qty	Nomenclature	Common Name	Weight (lbs/ea)
1	Shelter	shelter	
1	Panel, Power Distribution SM-F-935007	power distribution panel	
1	Panel, Communications Track Patch SM-D-935073	track patch panel	
5	Converter, Frequency, Electronic CV-3200/TSC	downconverter	32
1	Control, Antenna C-10273/TSC	antenna control	34
1	Control, Antenna C-10817/TSC	remote control	
2	Amplifier/Mixer AM-6704/TSC	amplifier/mixer	46
4	Converter, Frequency, Electronic CV-3199/TSC	upconverter	40
2	Amplifier, Radio Frequency AM-6703/TSC	power amplifier	84
2	Power Supply PP-7087/TSC	power supply	62
1	Monitor, Alarm SM-D-936383	alarm monitor	
1	Control/Translator, LNA SM-D-775327	control/translator	20
1	Amplifier, Frequency Standard HP-5087A	frequency standard	
1	Oscilloscope R-7704, including	scope	
	• Timebase 7B92A		
	• Dual Trace	Amplifier AM-6785/U	
	• Counter 7D15		
1	Teletype AN/UGC-74A(V)3	TTY	
1	Test Set, C/N TS-3580	C/N test set	
2	Modem MD-1002/G	modem	
2	Encoder-Decoder KY-801A/GSC	encoder-decoder	
1	Monitor Panel, AC Regulator SM-D-936692	AC regulator panel	
1	Analyzer, Spectrum IP-1216/PRC including	spectrum analyzer	
	• Tuning section, PL-1399(HP-8553B)		
	• IF Section, PL-1388 (HP-8552B)		
1	Panel, Communication Data Patch SM-A-936517	data patch panel	
1	Test Set, Digital CommunicationsTS-3642	digital communications test set	
1	Orderwire RT-964(V) GRC	orderwire	
2	Farinon Type 70100 Converter, A/D CV-3034 N/G	A/D converter	
2	Multiplexer, PDM AN/FCC-98	multiplexer	
Grp	Line Isolation Equipment consisting of:		
3	Isolator, Telegraph Line CU-1819/T	TLG line isolator	
1	Power Supply CMT-0696	power supply	
1	Patch Panel, TTY/Low Level Comm SM-A-937861	TTY/low level patch panel	
1	Test Set, Telephone AN/USM-181B SM-F-935746	transmission test set	
1	Monitor, Teletype Loop SM-D-936640	TTY loop monitor	
Grp	Key/Converter consisting of:		
4	Keyer, Frequency Shift TK-201F	FSK	
4	Converter, Frequency Shift TC-301F	frequency shift converter	
16	Filter, Bridge SM-A-935292	bridge filter	
2	Generator, Key KG-81	key generator KG-81	
2	Power Supply, KG-81	KG-81 power supply	
1	Suppressor, Echo ES3B	echo suppressor	
1	Patch Panel, COMM/VF SM-A-935851	COMM/VF patch panel	
Grp	Line Conditioning Equipment consisting of:		
12	Convertor, 20-Hz Ringdown CV-3250/FTC	20-Hz ringdown converter	
12	Board, Carrier MT-4722	carrier board	
1	Control/Monitor/Timer		
12	Terminating Set TA-945/FTC	terminating set	
12	Signal Unit, Freq TA-941/FTC	FREQ SIG unit TA-941	
12	Signal Unit, Freq TA-942/FTC	FREQ SIG unit TA-942	
2	Signaling Supply TA-943/FTC	SIG SPLY TA-943	
2	Signaling Supply TA-944/FTC	SIG SPLY TA-944	
1	Antenna Control, Remote SM-D-936104	remote control	
1	Antenna AS-3036/TSC	Antenna AS-3036	
	Antenna AS-3199/TSC (Optional)	Antenna AS-3199	
Grp	Antenna Mounted Elctronics consisting of:		
2	Amplifier, Parametic AM-6700/TSC	Low noise amplifier (LNA)	

Table 1-2. Equipment Complement-Continued

Qty	Nomenclature	Common Name	Weight (lbs/ea)
1	LNA BITE SM-D-775322	LNA BITE	
1	Waveguide Switch SM-A-776191	waveguide switch	
1	Directional Coupler SM-A-776193	directional coupler	
1	Wideband Preselector SM-A-776192	wideband preselector	
1	Panel, EMI Power Entry SM-D-936380	EMI power entry panel	
1	Panel, TTY/VF Entry SM-F-935010	TTY/VF entry panel	
1	Panel, Antenna Entry SM-F-935501	antenna entry panel	
1	Panel, SHF Input Entry SM-D-935070	SHF input entry panel	
1	Panel, IF/FREQ Standard/Telephone Entry SM-F-935719	IF/FREQ standard/telephone entry panel	
1	Transmit Patch SM-F-935105	transmit patch	
1	RF Test Patch Panel SM-D-736339	RF patch	
2	Air Conditioner	air conditioner	
1	Meter, Power HP-436A	power meter	
1	Generator, Pattern PG-404	pattern generator	
1	Analyzer, Data DA-404	data analyzer	
1	Frame Assembly, Central Distribution SM-F-935726	CDF	
1	Regulator, AC Line SM-C-936847	AC line regulator	
1	Patch Panel, IF SM-F-935727	IF patch panel	
1	Test Translator Patch Panel SM-D-936339	Test trans. patch panel	
1	TTY/FSK Patch Panel SM-A-935888	TTY patch panel	
2	48V Power Supply SM-F-935778	48V power supply	
1	20-,Hz Ring Generator SM-F-935784	20-Hz ring generator	
1	Data Signal Entry Panel SM-F-935096	Data entry panel	

Section III. FUNCTIONAL DESCRIPTION

1-12. General

The following paragraphs describe the equipment on a functional basis (see the block diagram in fig. 1-2).

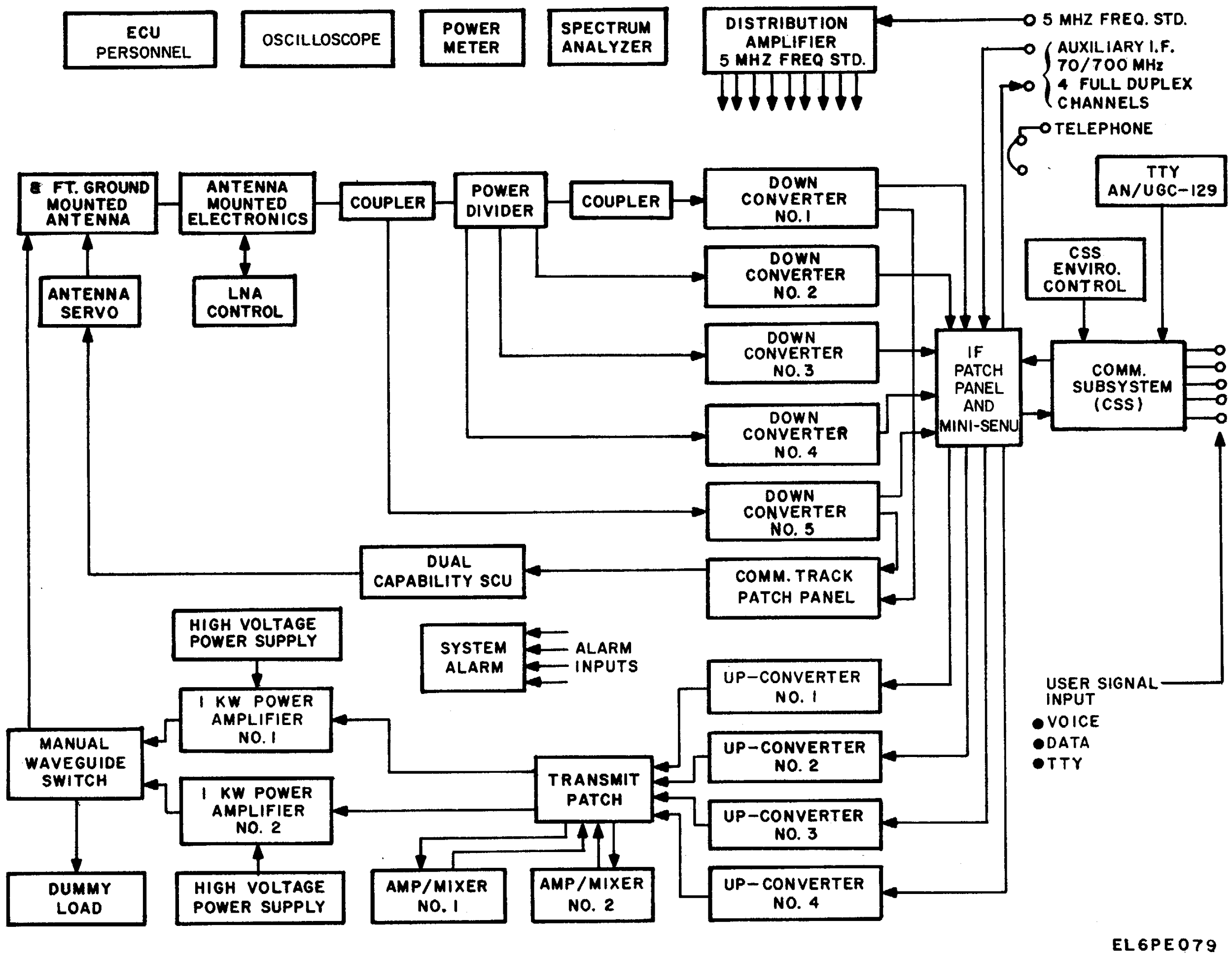


Figure 1-2. System Functional Block Diagram AN/TSC-86 Terminal.

a. Antenna Group (8-foot). The antenna group consists of the reflector, feed assemblies, drives and controls. The reflector consists of a center section and four quarter-section panels which are easily assembled on a sturdy support structure. The antenna contains both elevation and cross-elevation actuators for satellite acquisition and tracking. It is electrically connected to an antenna control assembly mounted within the shelter and may also be connected to a remote control unit.

b. Receiving Group. The receiving group in the terminal includes the antenna mounted electronics and the downconverters. The antenna mounted electronics includes two low noise amplifiers (LNA), an LNA BITE box, a wideband preselector, a directional coupler and waveguide switch. There are five downconverters which convert the received carrier frequency to the 70 MHz IF or 700 MHz IF. The 70 MHz IF frequency is used for input to associated modems in the communications group. The 700 MHz IF is used with external systems. The receiving group includes a five-way power division which provides a receive signal input to each of the five downconverters.

c. Transmitting Group. The transmitting group consists of two amplifier/mixers, four upconverters and two power amplifiers (with separate power supplies). One of the power amplifier units and one of the amplifier/mixer units is a standby. The amplifier/mixer units are used in the multiple carrier configuration. The incoming IF signals are fed to the upconverter. The upconverter accepts and translates the 70 MHz input to 700 MHz and accepts the 700 MHz input. After amplifying and filtering it, the upconverter translates it to the selected transmit frequency (7.9 to 8.399999 GHz) and it is again amplified in the IPA module of the upconverter. The output of the on-line up-converters are used to drive the on-line amplifier/mixer which drives the on-line power amplifier. The output of the power amplifier (at the desired level) goes to the antenna feed through a waveguide system. In the multiple carrier configuration, as many as four upconverters may be patched to the amplifier/mixer unit where they are adjusted for a prescribed power level, combined and routed to the on-line power amplifier. The 20-foot Antenna AS-3199/TSC must be used in multicarrier operation.

d. Power Source and Distribution Group. The terminal is normally operated from one of two 30 kW diesel generator sets mounted on the power pallet; however, it may also be operated from an external source of power. Circuit breaker control and protection is provided by the power distribution panel. The power distribution panel contains circuits for sensing and circuit breaker control for over and under voltage and over and under frequency conditions.

1-13. Detailed Terminal System Description.

This section provides a more detailed functional description of the AN/TSC-86 terminal.

a. Transmit Section. Figure 1-3 provides a functional block diagram of the transmit section of the terminal. The terminal accepts external 70 MHz and 700 MHz signals for conversion to 7900 to 8400 MHz. If more than one carrier is to be transmitted, special units for combining and monitoring the carriers are patched into use by means of the transmit patch panel.

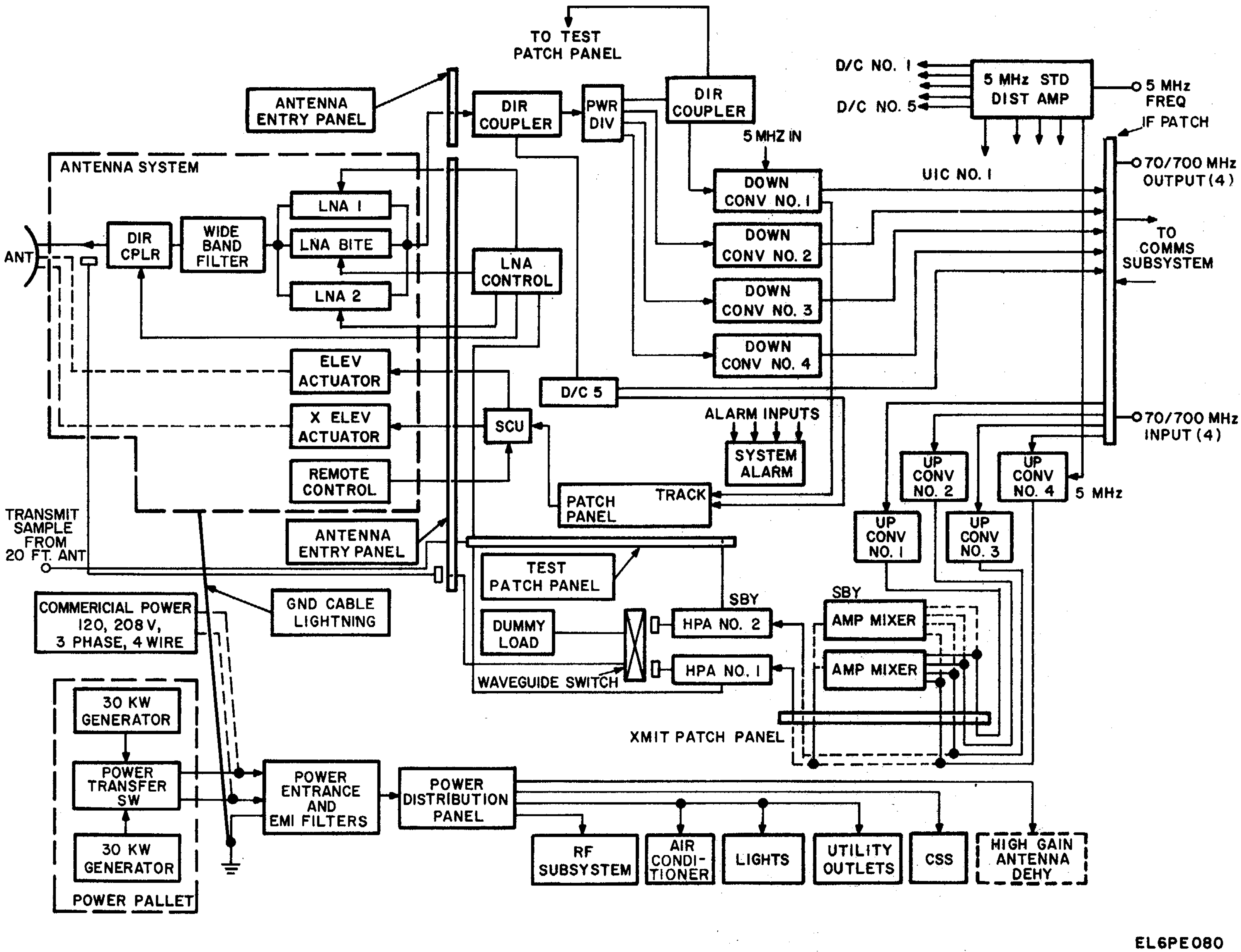


Figure 1-3. Radio Subsystem Block Diagram.

(1) The transmitter section of the terminal (defined as the portion of the terminal from IF input to the SHF output of the power amplifier) consists of a redundant configuration of amplifier/mixer, power amplifier and high voltage power supply configured as on-line and off-line units. The selection of on-line units is performed by manual patching between appropriate connectors on the transmit patch panel and the inputs and outputs of every unit shown in the block diagram of figure 1-3 that is accessible on the patch panel.

(2) On the transmitter side of the radio set, the 70 MHz input to the on-line upconverter is translated to 700 MHz. After amplification and filtering, the 700 MHz is translated to the transmit output frequency of 7.9 to 8.399999 GHz.

(3) The output of the upconverter is filtered and amplified by a solid state intermediate power amplifier to a level suitable for driving either the amplifier/mixer or the power amplifier. The upconverter drawers contains an upconverter, frequency synthesizer, intermediate power amplifier and power supply.

(4) If a single carrier is to be transmitted, the output of the on-line upconverter drives the on-line power amplifier. The power amplifier is a five cavity Klystron amplifier tunable over the 500 MHz transmit band with five calibrated tuning adjustments accessible through a small door in the front panel. The output of the power amplifier goes to the antenna " through a manual waveguide switch which is used to select the on-line and off-line unit. Power from the offline unit is routed to a dummy load.

(5) If multiple carriers are to be transmitted, the output of each on-line upconverter is routed to the online amplifier/mixer unit. This unit is used to set the relative power levels of the carriers and reamplify the combined signal to drive the on-line power amplifier.

(6) The off-line power amplifier is terminated in a dummy load allowing the unit to be turned on and monitored. Each power amplifier has a high efficiency switching converter, high voltage power supply and complete monitoring capability. The output of the online power amplifier is then routed to the transmit port of the antenna for transmission to the satellite.

b. Receive Section. Figure 1-4 shows a functional block diagram of the receive section of the terminal.

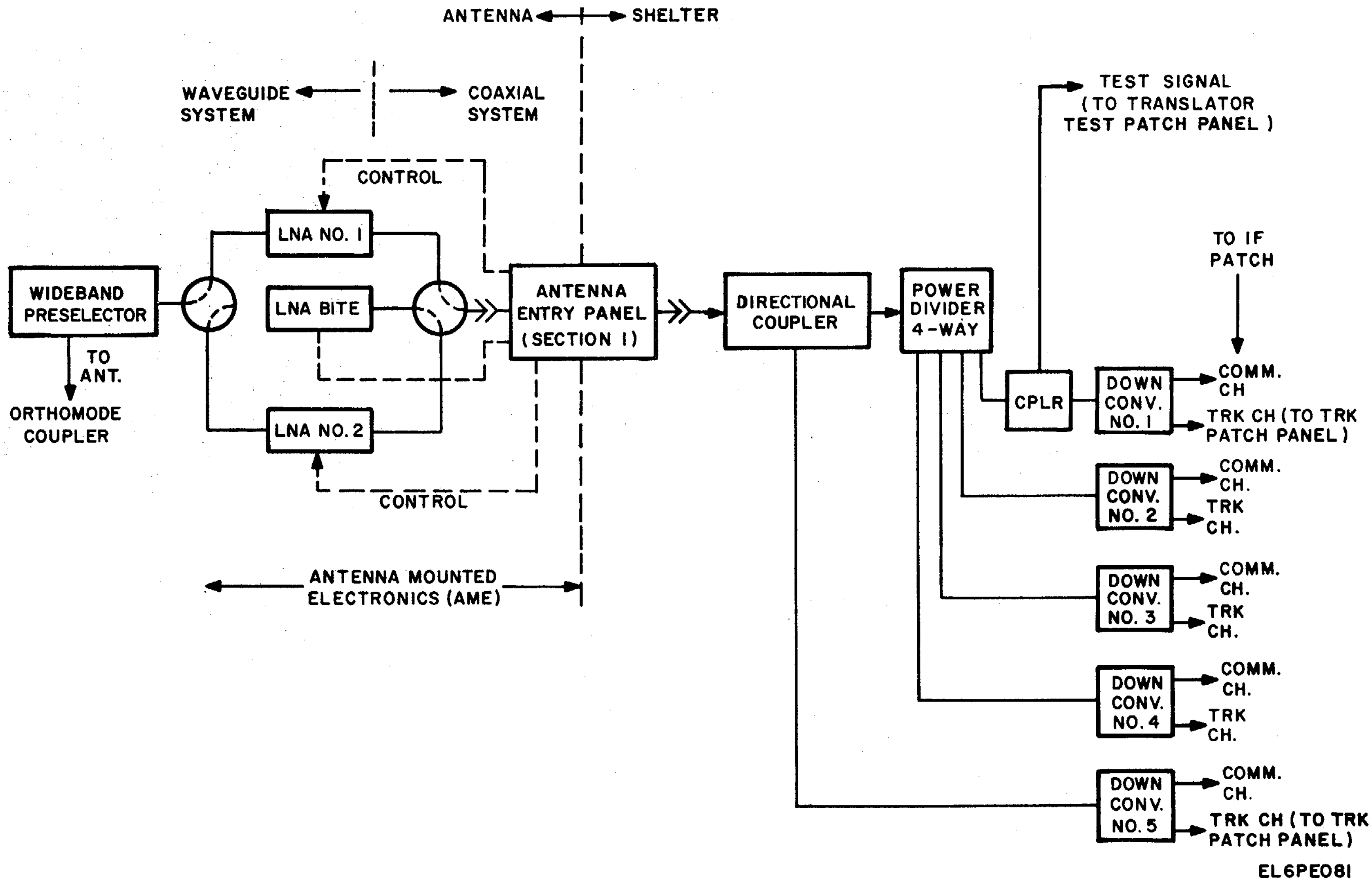


Figure 1-4. Receiver Section Block Diagram.

(1) With the antenna properly pointed to the satellite, the terminal receives communications SHF signals in the frequency band of 7250 to 7750 MHz and converts these to 70 MHz signals. It also receives a beacon signal in the same frequency band which is converted and detected as a low frequency control signal for directing the acquisition and tracking function of the antenna system.

(2) The antenna group for the AN/TSC-86 terminal consists of an eight foot parabolic reflector and attached electronic package. The movable part of the antenna is supported in a wide yoke which is controlled by cross-elevation and elevation actuators. The antenna is mounted on a double tripod space frame structure. Each axis is driven by a linear actuator. Satellite tracking is accomplished by a random step scan using the satellite beacon signal as a data source.

(3) Antenna signal acquisition is accomplished by placing the MODE switch on the antenna control to the MANUAL position and using the axis control switch to scan through the area of uncertainty while observing the carrier level meter for signal acquisition. Upon acquisition of the satellite's beacon signal in the manual mode, decrease the MGC switch to the lowest level that will maintain a track signal. This procedure will provide a fine adjustment between the satellite and antenna. The final antenna adjustment will be made by placing the MODE switch to AUTO TRACK. This will allow the Antenna Control Unit to track on the signal strength automatically. These procedures may be made using either the Antenna Control Unit (ACU) or the Remote Control Unit (RCU).

(4) After satellite acquisition, the tracking loop is closed and a random scan pattern is initiated. The scan pattern is a randomly determined series of motions of one or two second periods at 0.05 and 0.1 degrees which are applied to the elevation and cross-elevation axis. The sequence has a 50 percent duty cycle (64 seconds cross-elevation, 64 seconds off, 64 seconds elevation and 64 seconds off).

(5) Half hemispheric (180°) coverage is provided without vehicle orientation, although limited tracking motion of + 12.5 degrees is provided. This sector can be oriented to any point in space by the setting of the double tripod antenna mount and selection of the linear actuator drive position. Both open loop manual control of the drive motors and emergency use of a hand crank at the actuator are provided in the design. Either of these manual drives can be used for the initial acquisition or for emergency manual track.

(6) The reflector-feed arrangement provides a minimum aperture efficiency of 55% which, for the eight-foot reflector, gives a minimum receive signal gain of 42.5 dB and a minimum transmit signal gain of 42.5 dB. Side-lobe levels are 15 dB down from the main lobe or better.

(7) Received communications SHF signals at the antenna receive flange are fed to a redundant receiver section of the terminal (defined as that portion of the terminal from the receive antenna feed to the 700 MHz or 70 MHz IF output) consisting of a low noise amplifier (LNA) and downconverter. The LNA's are mounted on the back of the antenna center section with the other antenna mounted electronics (fig. 2-5).

(8) The received signal from the antenna is routed through a test directional coupler and wideband preselector to a changeover switch which is used to place LNA #1 or LNA #2 in the on-line mode via controls on the LNA control/translator unit inside the shelter.

(9) A Gunn oscillator, located in the LNA BITE unit and energized from the LNA control/translator, provides a test input signal for checking the performance of the standby LNA. The Gunn oscillator injects a signal to the input of the off-line LNA. The off-line LNA can be physically removed without affecting terminal operation.

(10) After 39 dB amplification in the low noise amplifier the signal is carried by coaxial cable via a directional coupler and a power splitter to the online downconverters in the shelter equipment. The downconverters are dual frequency conversion units. The five downconverters are each complete units containing a frequency downconverter, synthesizer and power supply.

(11) The downconverted 70 MHz signal from each on-line downconverter is then routed to the communications subsystem for additional processing and the 700 MHz signal is routed to the entry panel.

c. Communications subsystem (CSS). The CSS provides the interface and signal processing functions between the individual field user lines and the RF subsystem of the AN/TSC-86 terminal. Baseband and signal conditioning equipment included in the CSS provides processing of user VF, teletype and digital signals into a single PCM signal. Bulk encryption of this signal is provided by the TSEC-KG-81 prior to application to the QPSK/BPSK digital data modem. The 70 MHz output from the latter equipment is applied to the transmitter section of the RF subsystem. A central distribution frame (CDF) included as a portion of the CSS houses a matrix programming board which provides a traffic path reconfiguration capability.

d. Other Functions. Other functions are provided in the terminal including separate external standard interfaces that allow all reference frequencies and local oscillator sources of the transmitter and receiver to be derived from external frequency standards.

(1) Power generating equipment is supplied by pallet mounted generators which can be located up to 45 feet from the shelter. A switch box on the pallet allows either generator to be switched on-line. The terminal may also operate from commercial power of proper voltage and frequency range.

(2) The primary power enters the shelter through line filters and is distributed through a power distribution panel containing circuit breakers and voltage and frequency protect circuits. Personnel environmental control includes an air conditioner/heater mounted in the front of the shelter toward the roadside. The other air conditioner is for CSS cooling.

e. Equipment Location. The electronic equipment is mounted in racks which are secured to both sides of the shelter. Figure 1-5 shows the equipment on the roadside of the shelter and figure 1-6 shows the location of equipment mounted on the curbside of the shelter.

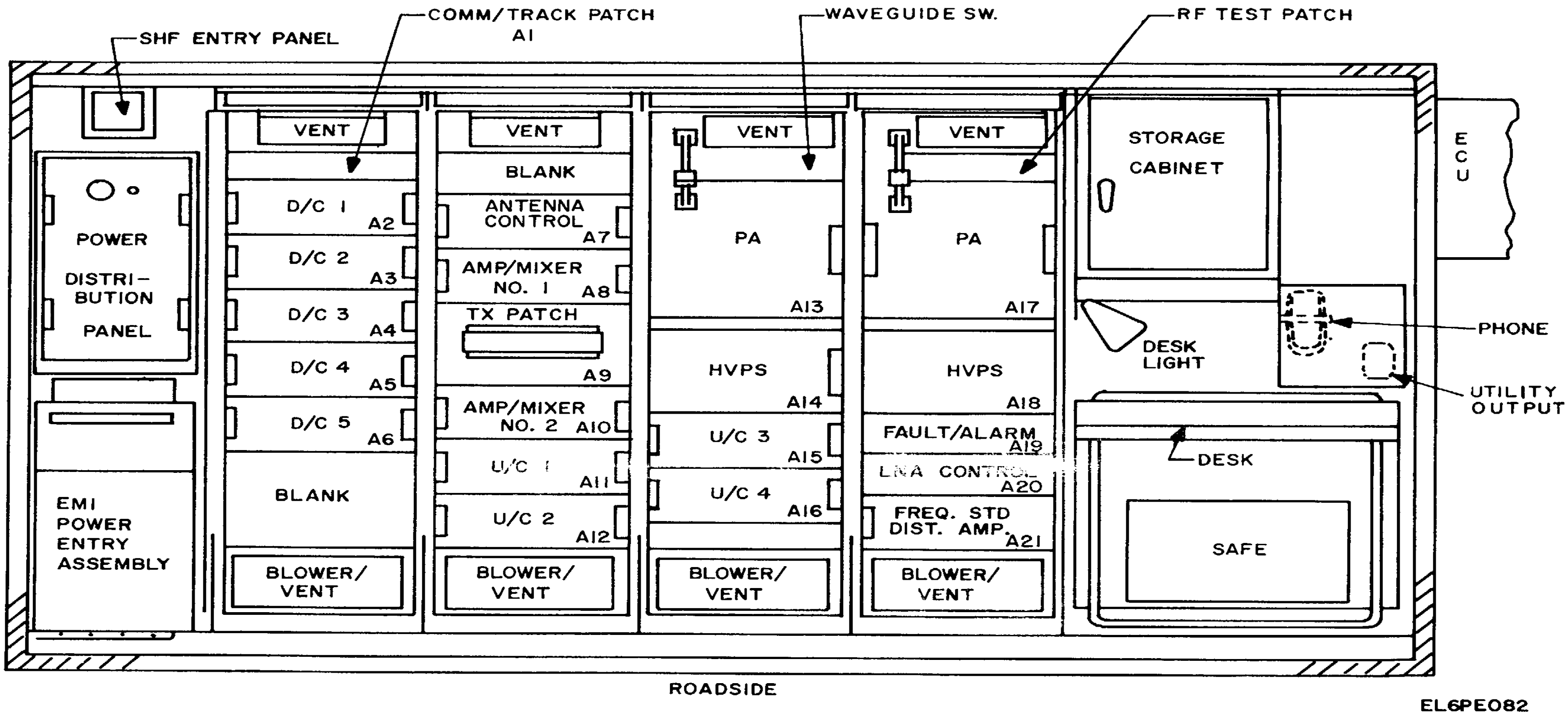
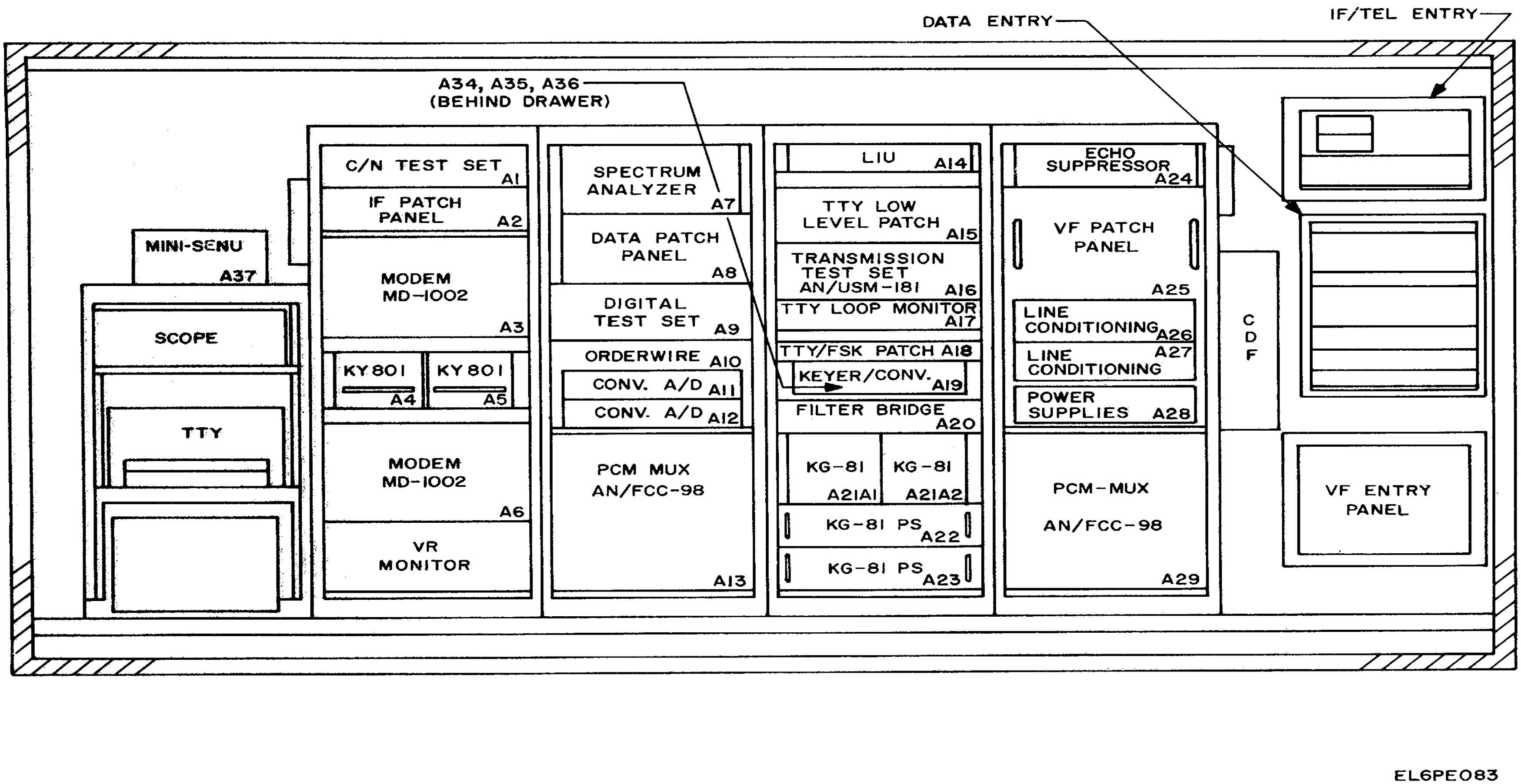


Figure 1-5. Equipment Location, Roadside of Shelter.


DATA ENTRY
IF/TEL ENTRY
A34, A35, A36
(BEHIND DRAWER)
MINI-SENU
A37
SCOPE
TTY
C/N TEST SET
A1
IF PATCH
PANEL
A2
MODEM
MD-1002
A3
KY801
A4
KY801
A5
MODEM
MD-1002
A6
VR
MONITOR
SPECTRUM
ANALYZER
A7
DATA PATCH
PANEL
A8
DIGITAL
TEST SET
A9
ORDERWIRE
A10
CONV. A/D
A11
CONV. A/D
A12
PCM MUX
AN/FCC-98
A13
LIU
A14
TTY LOW
LEVEL PATCH
A15
TRANSMISSION
TEST SET
AN/USM-181
A16
TTY LOOP MONITOR
A17
TTY/FSK PATCH A18
KEYER/CONV.
A19
FILTER BRIDGE
A20
KG-81
A21A1
KG-81
A21A2
KG-81 PS
A22
KG-81 PS
A23
ECHO
SUPPRESSOR
A24
VF PATCH
PANEL
A25
LINE
CONDITIONING
A26
LINE
CONDITIONING
A27
POWER
SUPPLIES
A28
PCM-MUX
AN/FCC-98
A29
C
D
F
VF ENTRY
PANEL
EL6PE083

CURBSIDE

CHAPTER 2
SERVICE UPON RECEIPT AND INSTALLATION

Section I. SYSTEMS PLANNING

2-1. Scope

This chapter provides the information and instructions necessary to select a terminal site assemble and point the AS-3036/TSC antenna, ground the equipment, and to interconnect signal and power cables and external connections.

2-2. System Interface Capability of Terminal The field user interface equipment accepts voice frequency (VF), teletype (TTY), baseband digital signals and externally modulated 70 or 700 MHz signals through shelter entry panels. The various types of defense communications systems field user equipments and the radio subsystem are interfaced via the communications subsystem group.

2-3. Description of Communications Network

The multicarrier operation is provided when intermodulation free Antenna AS-3199/TSC is used as the radiating element. The individual tracking signals car function using communications signal or satellite beacon signal. Tracking signal selection is made per mission profile or at the operator's discretion. Figure 2-1 illustrates typical deployment of the communications network.

2-4. External Connection Interface

Six shelter entry panels provide the major terminals for external connection interface for full operation in the network. These terminals provide connections for the telephone, external IF, 5 MHz standard, VF TTY, TTY TX/RX, SHF IN/OUT, antennas, AUX LNA BITE, LNA, elevation, cross elevation, loop test, remote antenna control, and main power inputs 1 and 2.

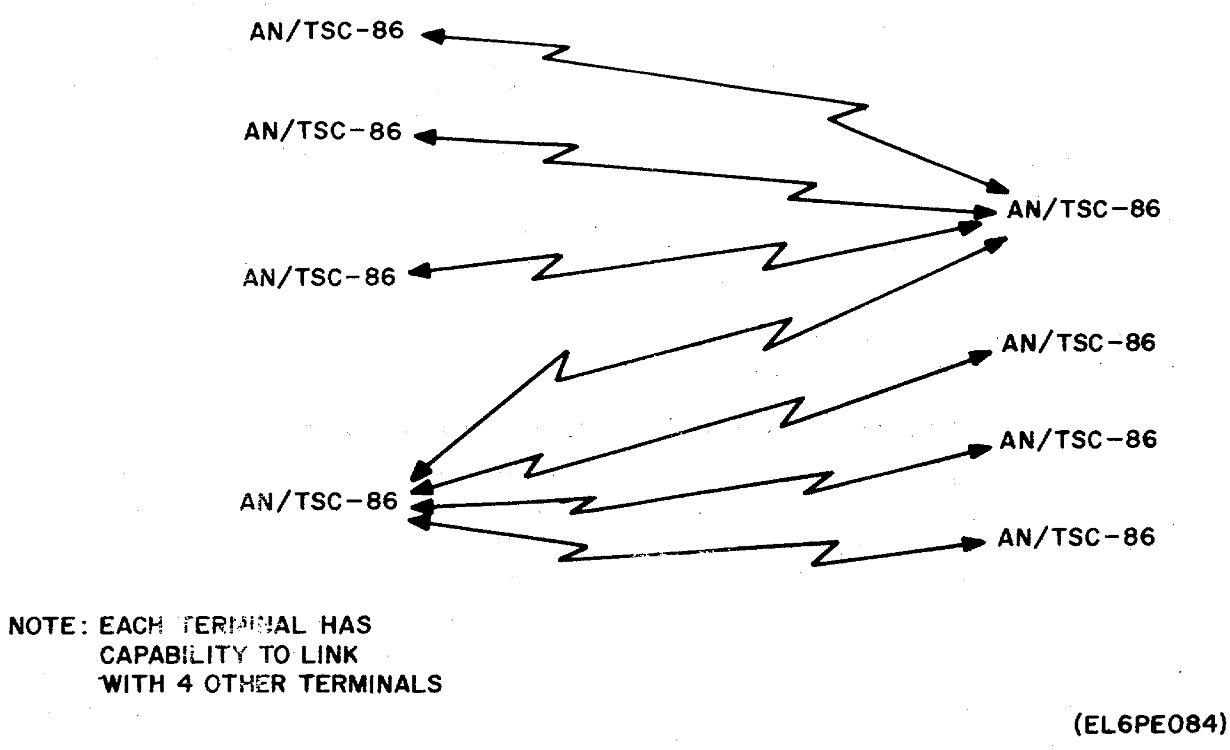


Figure 2-1. Typical Terminal Communications Network.

2-5. Site Area Briefing Data

The overall site is selected by the communications officer, and the operating crew is thoroughly briefed prior to departure for the site. The information given to the crew includes the following:

a. Precise azimuth and elevation settings for the antenna relative to the selected site location.

b. Site area location and instructions for reaching and identifying the site area.

c. Topographic maps of the area.

d. Details relative to exact equipment installation position and site layout requirements.

e. Alternate site locations in the event unforeseen difficulties are encountered with the primary site location.

f. The operating mode assignments for the terminal such as transmit and receive frequencies, power output, etc.

g. A procedure to be used in the event signal contact is not made after the normal antenna alinement schedule has been completed.

Section II. SITE AND SHELTER REQUIREMENTS

2-6. Factors Affecting Site Selection

Prior to leaving for the site area, the crew should consider the following factors in their selection of the specific site location. Also, they should assign priorities as to the level of importance of these factors in meeting the overall site requirements.

a. Topography.

(1) The specific site location should be within 20 nautical miles (32.2 km) of the general site area selected at the briefing.

(2) No natural or man-made obstructions shall be in the line-of-sight path between the antenna and satellite.

(3) A relatively clear area approximately 40 feet wide by 100 feet long (12.2m by 30.5m). The length dimension shall aline with the line-of-sight path as closely as possible.

(4) Ground slope should not exceed 5°.

b. Soil Conditions.

(1) Compact enough to support the weight of the equipment.

(2) Provide adequate holding for tie-down anchors and yet not be too rock-infested to prevent secure anchoring.

(3) Avoid loose sand and marshy-type soil having poor drainage characteristics and holding power.

c. Interference. As much as possible, the antenna line-of-sight should not point directly towards nearby electrical interference sources such as:

(1) Power lines.
(2) Electric generators.
(3) Hospital equipment.
(4) High speed computers.
(5) Radar and other RF transmitters.

d. Other Factors. Having one or both of the following factors included in the overall site requirements is desirable, but not necessarily mandatory in the selection of the specific site area.

(1) Electric company power of 120/208 ± 10% 50/60 Hertz ±5%, three-phase as an alternate/ emergency power source.

(2) Good road access to the site. However, since the equipment is mobile, its strategic function practically dictates there should be little or no traffic flow to and from the site area.

2-7. Shelter Requirements

Building requirements for a permanent shelter are not applicable since the terminal equipment (except the antenna) is housed and operated in a transportable shelter.

Section III. SERVICE UPON ARRIVAL AT SITE

2-8. Selecting the Site

NOTE

Refer to TM 11-5985-359-13 for planning and erecting the 20-foot antenna.

Upon arrival at the selected area (per briefing session) the crew will visually survey the area terrain. They will base their final selection of a specific site location on the factors listed in paragraph 2-6. Ideally, the selected site will meet all the listed requirements. But in the practical realm, a compromise of some factors may have to be made. Factor priorities, then, should now be applied in choosing the specific site location.

2-9. Locating the Sighting Points (fig. 2-2)

A preliminary determination is made as to the spacing requirements for the equipment prior to locating the sighting points. Also allow for a 60-foot long (18.3m) (approx) radiation hazard area in front of the antenna. Allow no more than 2 feet (0.6m) between the rear edge of the 24-inch rear ground pad of the antenna and the antenna entry panel on left-rear (roadside) sidewall of the shelter.

For starting reference, locate the first sighting point about 1 foot (0.3m) directly behind the proposed location of the 24-inch rear ground pad. When sighting, make sure the shelter and pallet are at least 15 yards (13.7 m) from the transit. Proceed as follows:

a. Unstow the transit from the accessories stowage bag (refer to table 2-1 for stowage location). The bag is mounted on the inside of the shelter door.

b. See figure 2-2. Locate the first sighting point about 1 foot (0.3 m) directly behind the proposed location of the antenna's 24-inch rear ground pad. Mark this point.

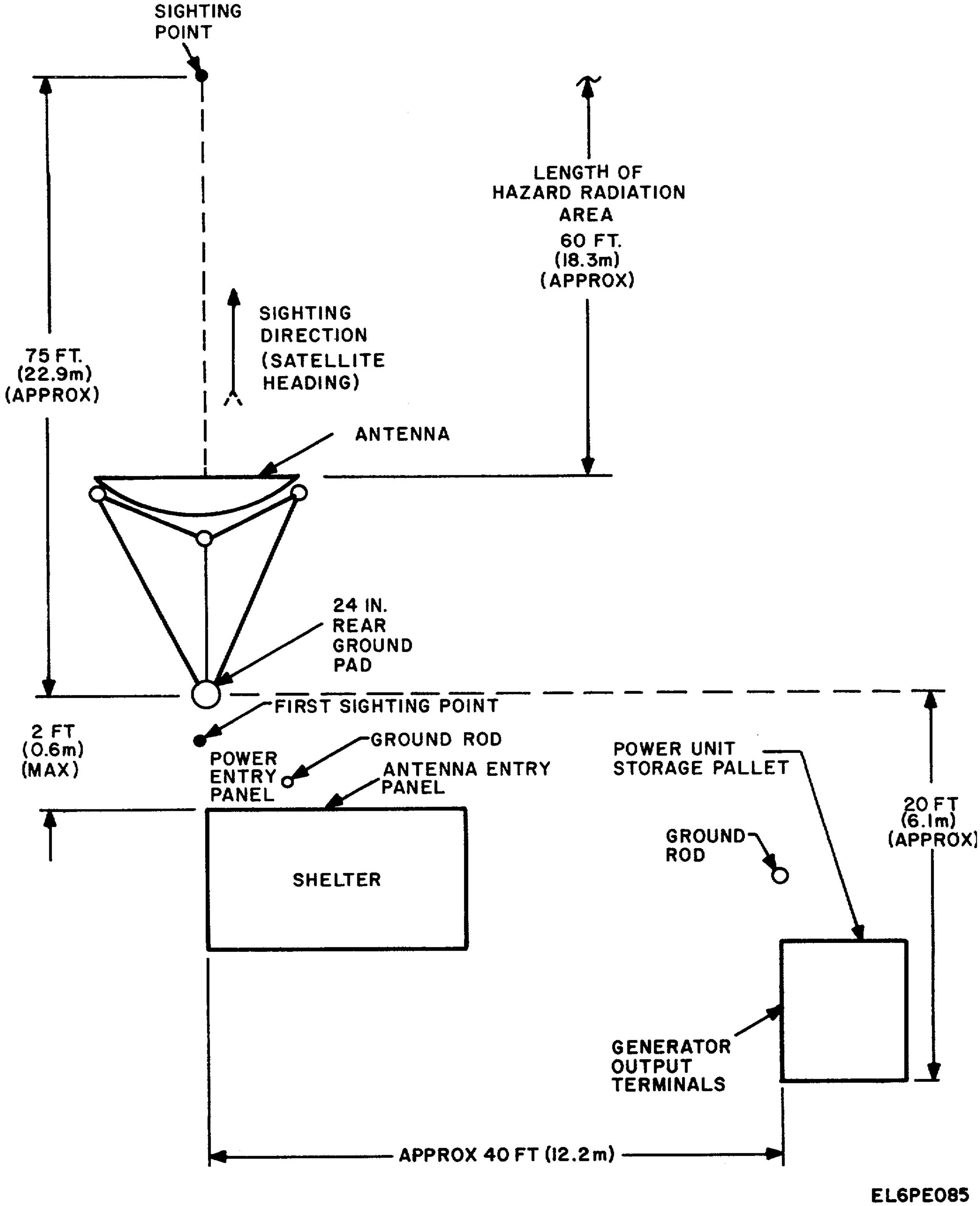


Figure 2-2. Sighting and Typical Placement of 8-foot Antenna and Equipment.

c. Refer to paragraph 2-11 on using the pocket transit. While aiming through the pocket transit on the satellite heading, locate the second sighting point about 75 feet (22.9 m) down the sighting line from the first point. Mark This second sighting point.

d. Repeat step *c* above and recheck the satellite heading. Move the second sighting point in the crosselevation plane (azimuth), as necessary, to obtain the exact satellite heading from the first sighting point.

2-10. Placement of Terminal and Power Pallet (fig. 2-2)

Locate the terminal and power pallet positions approximately as illustrated. Of prime importance is the positioning and orientation of the terminal shelter. On the shelter, note the location of the antenna entry panel. Antenna cabling length limitations dictate that this panel, as much as possible, should face directly into the rear of the antenna and be no more than 2 feet (0.6 m) from the rear edge of the rear 24-inch ground pad. Once the shelter position and orientation has been established, the location of the power pallet can be determined. The power pallet should be positioned in a direction directly opposite to the rear of the shelter to minimize noise pickup from the power unit. The orientation of the pallet as illustrated, with the generator output terminals facing towards the shelter, allows for optimum use of the power cable. This position and orientation of the pallet can be changed to suit the conditions of the site area. Maneuver the shelter and pallet to the selected positions.

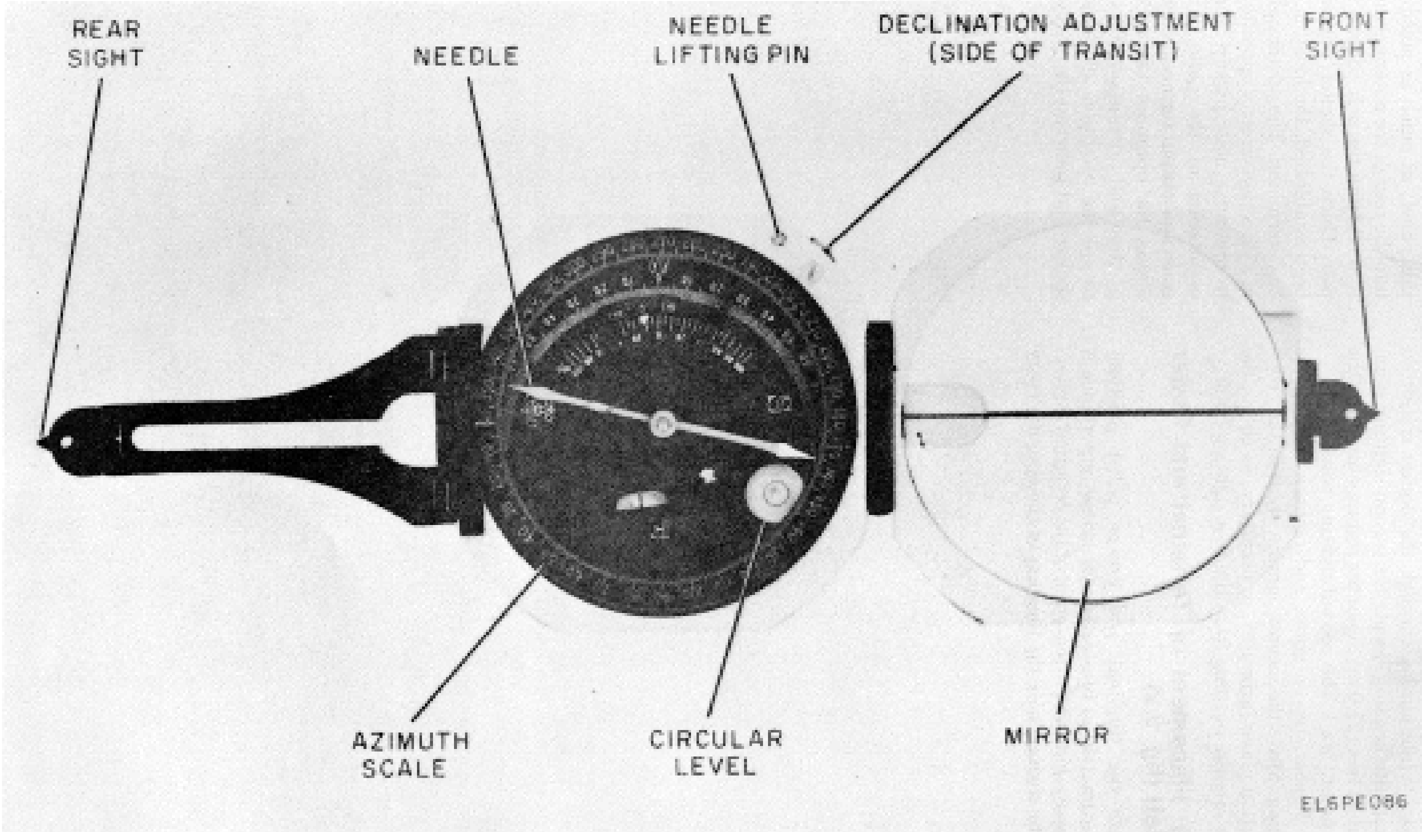


Figure 2-3. Pocket Transit.

2-11. Using the Pocket Transit (fig. 2-3)

The following procedures should be followed when using the pocket transit.

a. The following precautions should be observed when using the pocket transit.

(1) Handle the pocket transit with extreme care.

(2) When not in use, close the pocket transit and replace it in its case or mount. In this way, it will not only be protected from possible damage, but it will be readily available for future use.

(3) Never take pocket transit readings near visible masses of iron or electrical circuits. Refer to the following minimum safe distances:

(a) High-tension power lines - 60 yards (54.9 m).

(b) Field gun - 15 yards (13.7 m).

(c) Truck, shelter or tank - 15 yards (13.7 m).

(d) Telegraph wires - 10 yards (9.1 m).

(e) Barbed wire - 10 yards (9.1 m).

(f) Machine gun - 3 yards (2.7m).

(g) Helmet or rifle - 1 yard (0.9 m).

b. While standing at the first sighting point (behind the antenna location) direct the location of the second sighting point as follows:

(1) Open the pocket transit and set magnetic, grid, or true azimuth in the following manner:

(a) Magnetic azimuth. Rotate the scale to set the 0° mark on the azimuth scale under the scale index by turning the declination screw.

(b) Grid or true azimuth. Determine the direction and magnitude of true north from magnetic north. This information can be obtained from the declination diagram of the appropriate military map. Set the azimuth scale so that the desired declination value is under the azimuth scale index.

(2) Turn the rear sight so that it is perpendicular (90°) to the rear sight holder.

(3) Holding the pocket transit in both hands, brace arms against the body and view through the rear sight.

(4) the mirrored cover at an angle of approximately 45-degrees to the rear of the pocket transit in order to readily view the scale reflection in the mirror.

(5) Level the pocket transit by viewing the circular level in the mirror.

(6) Rotate the body until the south-seeking end (black and/or wire coil end) of the needle is pointed toward the desired azimuth angle (for example 450), as viewed in the mirror.

(7) Direct the location of the second sighting point.

Section IV. INSTALLATION INSTRUCTIONS

2-12. Sequence of Installation

NOTE

The following procedures apply to the 8foot antenna. Refer to TM 11-5985-359-13 for procedures applicable to the 20-foot antenna.

The overall installation procedure can readily be accomplished by a four-person crew. Several of the tasks can be performed simultaneously. Two persons can start the major task of assembling the antenna. The other two can start to install the ground and power cables. Thereafter, the team combination can be varied to accomplish other task requirements (all four, three and one, etc.). The following is a suggested basic sequence of installation. The crew may change the sequence, as necessary, to enable them to perform the installation in the most efficient manner.

a. Assemble the antenna.
b. Install ground and power cables.
c. Anchor the antenna and shelter.
d. Install the radiation hazard fence.
e. Install external signal cables.

2-13. Precautions During Installation.

When performing the installation and assembly procedures observe the following precautions, especially in regard to antenna assembly.

a. On side leg assemblies; bottom ball joints are loose.

b. Front and rear leg assemblies; bottom ball joints are loose.

c. All quick-release (expanding) pins are inserted in the proper stowage position and are closed and locked. Be sure that pins are unlocked before attempting to release the handles.

d. All items are not unnecessarily subjected to excessive dust, dirt, mud or other foreign materials.

e. Antenna quarter section reflector assemblies (petals) are handled with care due to the light weight and delicate construction of the assemblies. The reflective surfaces must not be damaged.

f. The antenna mounted electronics (center section) is handled with care 'due to the heavy weight and delicate construction of the equipment.

g. Feed tube assembly is handled with care to prevent dirt, dust, moisture or any foreign material from entering the opening. Also do not allow anything, including fingers, to come in contact with the dielectric membrane at the opening.

h. Elevation actuator and cross elevation actuator are handled with care and the rod ends are not rotated to put torsional stress on the boots.

2-14. Unpacking of Stowed Items (fig. 2-4, table 2-1)

Items to be used for the antenna installation are stowed on the pallet (power unit) and inside the shelter. Figure 2-4 shows the location of all installation and housekeeping items. Table 2-1 lists all of the stowed installation and/or housekeeping items. Remove only those items required for the actual installation. Proceed as follows.

CAUTION

When removing the items, place them in a convenient position but away from the shelter and the antenna location so that the assembly may proceed without interference or damage to the items. Observe the precautions of paragraph 2-13.

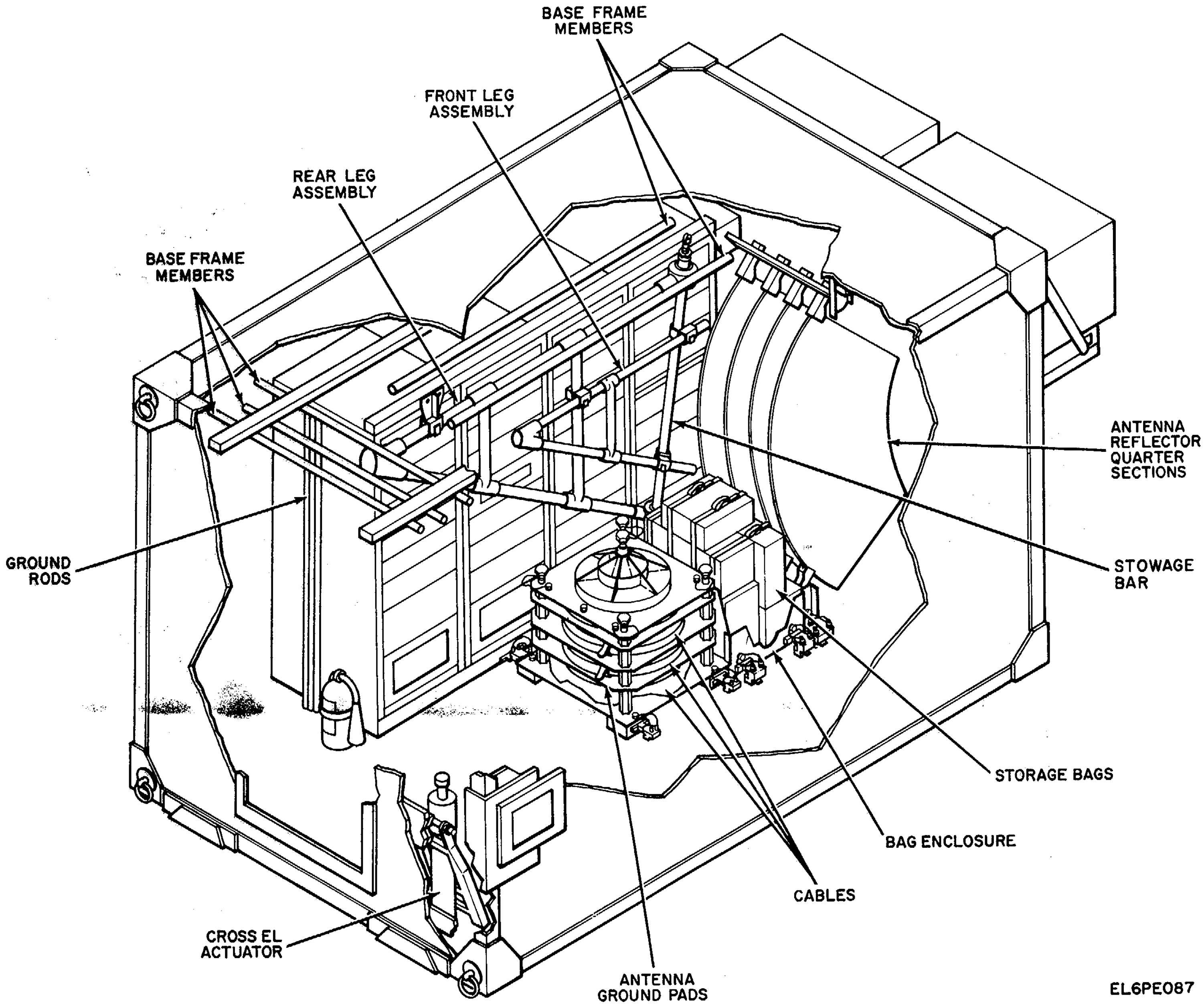


Figure 2-4. Location of Stowed Items (Sheet 1 of 3).

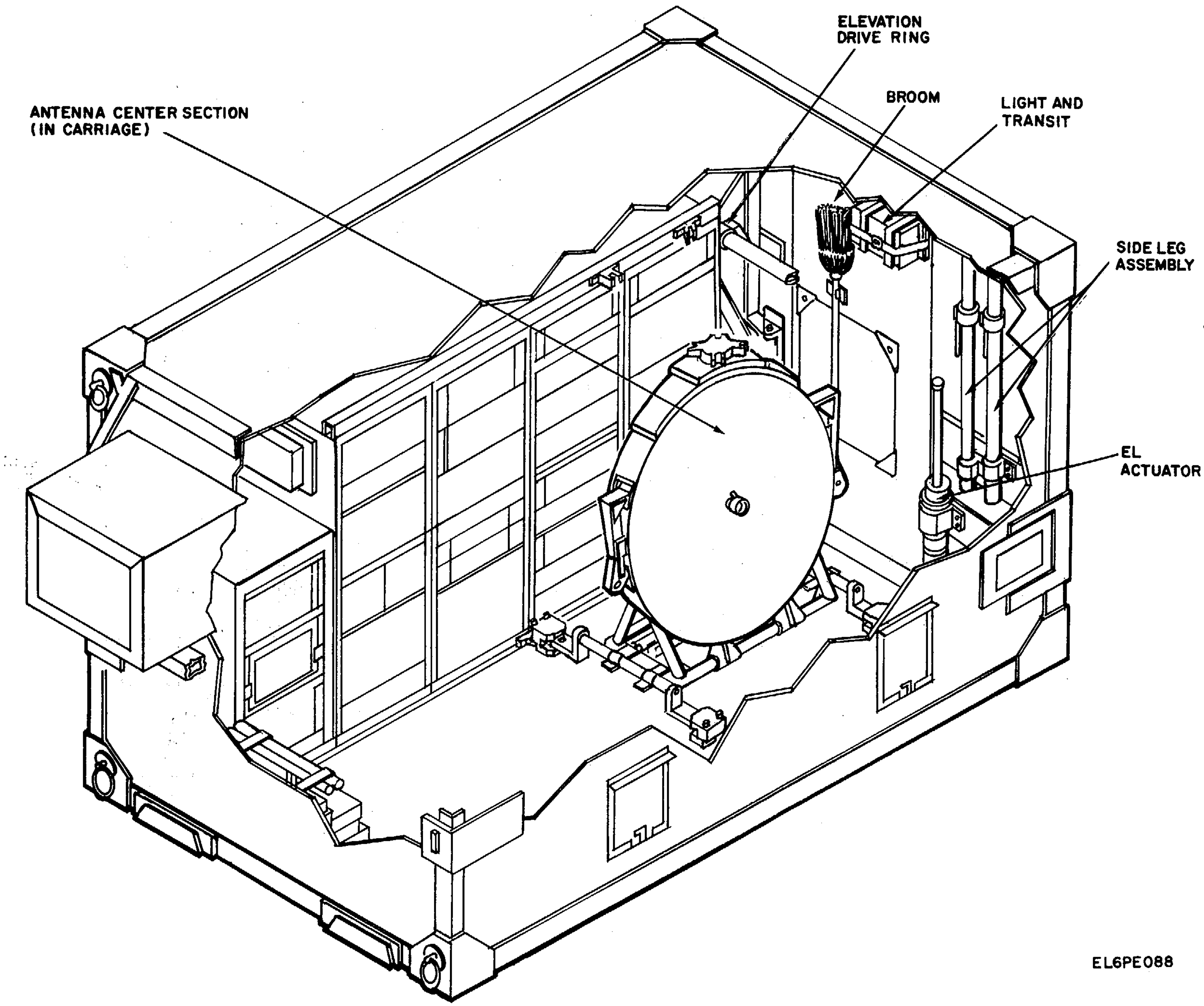


Figure 2-4. Location of Stowed Items (Sheet 2 of 3).

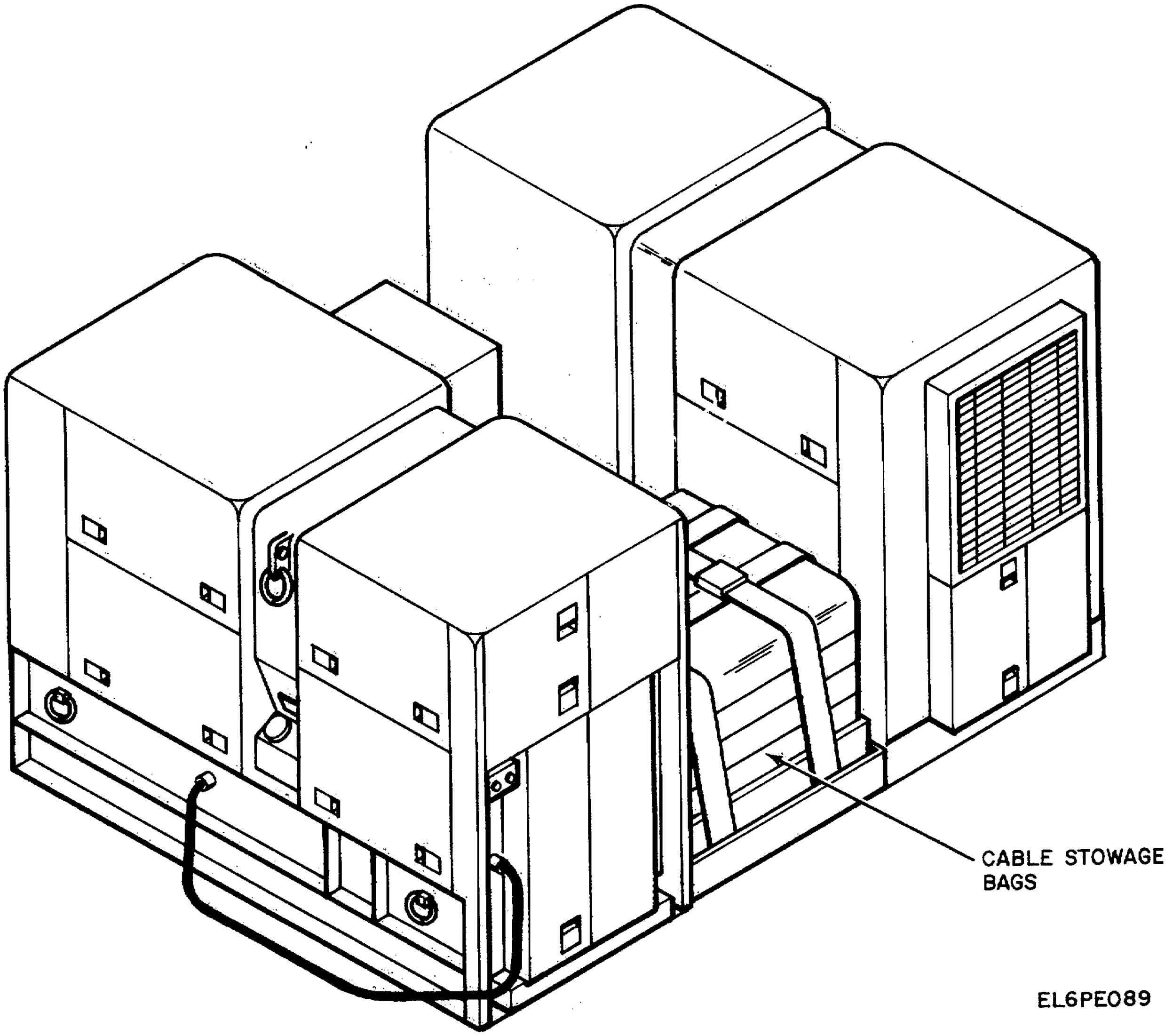


Figure 2-4. Location of Stowed Items (Sheet 3 of 3).

a. Open the shelter door and remove the broom.

b. Remove the antenna center section (on the carriage assembly) from the shelter as described in steps (1) thru (14) below (fig. 2-5.).

CAUTION

Possible damage to the equipment could result due to the delicate construction of the mounted electronics and the bulk and weight of the combined assemblies. Handle with care and use four persons to move the equipment.

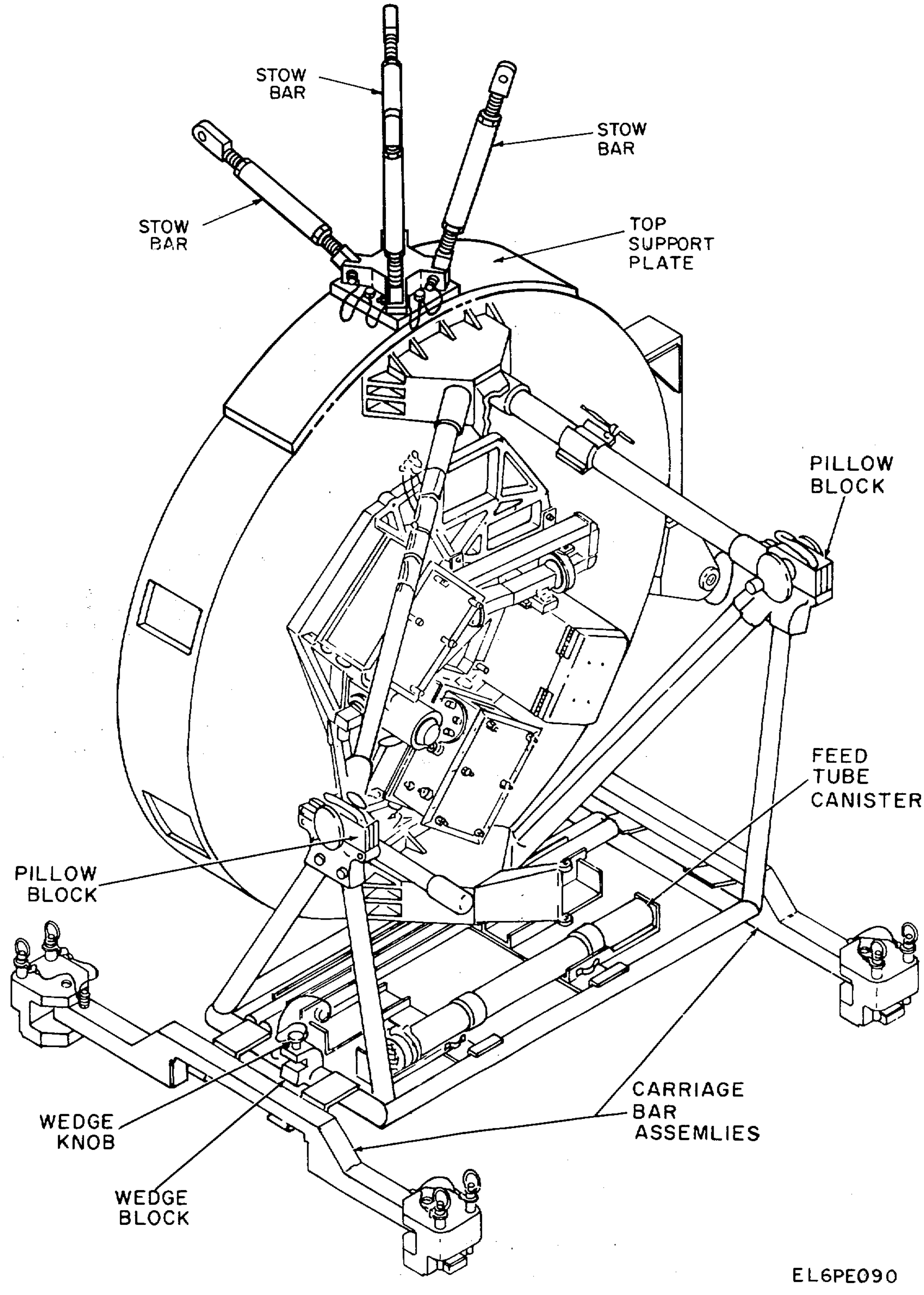


Figure 2-5. Antenna center Section and Carriage Assembly, Unstowing and Lifting Items (Sheet 1 of 2).

Table 2-1. List of Stowed Items

Ref. Design	Item	Qty
	IN SHELTER	
	Antenna Ground Pad, 16-inch	3
	Antenna Ground Pad, 24-inch	1
	Antenna Base Frame Front Member	2
	Antenna Base Frame Side Member	2
	Antenna Base Frame Center Member	1
	Antenna Front Leg Assembly	1
	Antenna Rear Leg Assembly	1
	Antenna Side Leg Assembly	2
	Antenna Reflector Quarter Section (Petal)	4
	Elevation Drive Ring	1
	Cmr-Elevation Actuator and Right Trailing Arm	1
	Elevation Actuator	1
	Messenger Cable Support Pole	1
	Stowage Bag SM-D-916639	2
	° Fence Post	11
	Stowage Bag, SM-C-937354-3	1
W1	° Cable, Elevation	1
W2	° Cable, Cross-Elevation	1
W4	° Cable, Remote Control	1
	Stowage Bag SM-C-916640	1
	° Barrier Rope	1
	° Warning Sign	6
	° Drive Cap	1
	Stowage Bag SM-C-916645	1
	° Hazard Light	1
	Stowage Bag, SM-C-937348-1	1
W3	° Waveguide	1
	Stowage Bag, SM-C-937348-2	1
	° Remote Control Unit	1
	Stowage Bag, SM-C-937354-4	I
	° Power Cable SM-A-935859-4	1
	° Cable SM-C-935487-7	1
	° Cable SM-C-935482-1	1
	° Cable, Coax, SM-C-937240	2
	° Cable, SM-C-935488-1	1
	° Cable, Power Head SM-A-935859-3	1
	° Adapter, UG-29B/U	1
	° Adapter, UG-349/U	1
	° Adapter SM-A-937679	1
	Stowage Bag SM-D-937699-2	4
	° Ring-Sling Assembly SM-C-983183	1
	° Leg-Sling Assembly SM-C-983182	3
	Stowage Bag SM-C-937354-2	1
	° Shelter Ground	1
	° Antenna Ground	1
	Stowage Bag SM-C-937348-3	1
	° Trouble Light	
	° Transit	1
	Reflector Carriage	1
	° Antenna Center Section	1
	° Stowage Cable	1
	° Feed Tube	1
	Power Cable SM-D-936605	2
	Power Cable SM-D-936606	2
	Stowage Bag SM-D-936957	1
	° Patch Cable SM-A-936518-1	24
	° Patch Cable SM-A-936518-2	55
	° Patch Cable SM-A-936518-3	15
	° Patch Cable SM-A-936518-8	12
	° Patch Cable SM-A-936519-3	5

Table 2-1. List of Stowed Items-Continued

° Ref Design	Item	Qty.
	° Patch Cable SM-A-936561-1	8
	° Patch Cable SM-A-936520-3	5
	° Patch Cable SM-A-936561-2	8
	° Patch Cable SM-A-936519-2	5
	° Patch Cable SM-A-936561-3	2
	° Patch Cable SM-A-936520-2	5
	Stowage Bag, SM-D-936962	1
	° Bantam Patch, SM-A-936563-1	22
	° Bantam Patch, SM-A-936563-2	16
	° Bantam Patch, SM-A-936563-3	8
	° Bantam Patch, SM-A-936563-21	18
	° Bantam Patch, SM-A-936563-22	18
	° Bantam Patch, SM-A-936563-23	18
	° Bantam Patch, SM-A-936563-26	2
	° Bantam Patch, SM-A-936563-27	2
	° Cable, T.T.S. SM-C-983189	2
	Stowage Bag SM-C-937355-1	1
	° Anchor, 8-inch	2
	° Assembly, Tie-down	2
	° Cable, Messenger	1
	Stowage Bag SM-C-937355-3	1
	° Hold Handle	1
	° Tool Kit SM-A-777797	1
	° Drive Head	1
	° Drive Handle	1
	°Extension Cord	1
	Stowage Bag SM-C-937355-2	1
	° Anchor, 6-inch	4
	° Cable Adjustment	4
	Ground Rod	2
	Drive Rod	1
	Fire Extinguisher	1
	Elevation Drive Disc	1
	Broom	1
	Stowage Bag, SM-D-938961	1
	° Limiter SM-A-934943	1
	° Attenuator (14 dB), SM-A-937237-1	1
	° Attenuator (10 dB), SM-A-937237-2	1
	° Attenuator (6 dB), SM-A-937237-3	1
	° Filter, SM-A-937224	1
	° Attenuator (9 dB), SM-A-937225	1
	° Adapter (N-N), UG-29 B/U	1
	° Adapter (1005-0804), SM-A-937238	1
	° Power Sensor (HP-8484A)	1
	° Power Sensor (HP-8481A)	1
	° Attenuator (HP-11708A)	1
	ON POWER PALLET	
	Fire Extinguisher -	2
	Ground Rod	1
	Junction Box	4
	Lift Sling	4
	Cable, Interface SM-D-936655	4

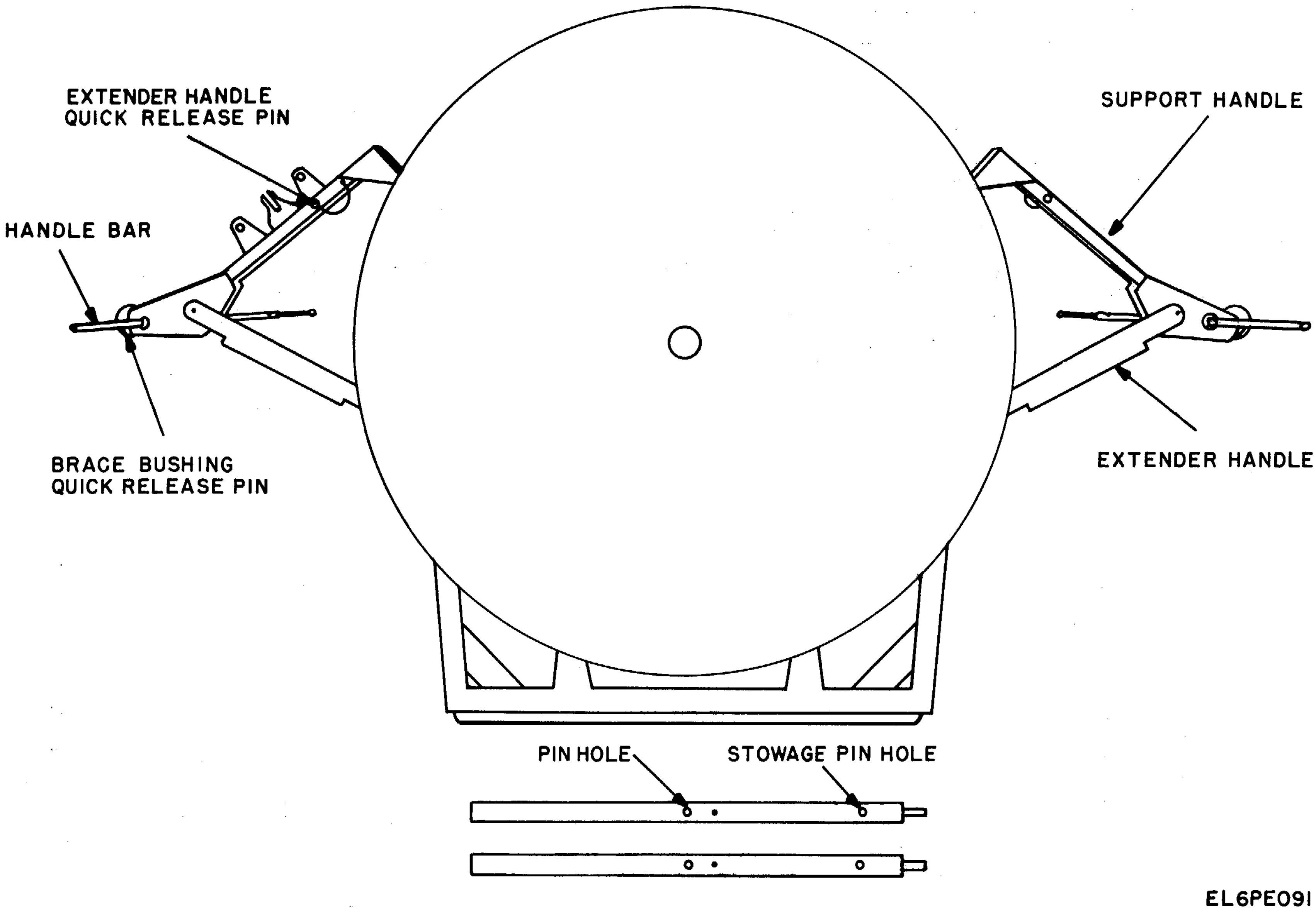


Figure 2-5. Antenna Center Section and Carriage Assembly, Unstowing and Lifting Items (Sheet 2 of 2).

NOTE

In the following step mark the carriage bar assemblies for curbside/roadside orientation prior to their removal.

(1) On the floor-level carriage bar assembly, remove the quick release pin from the shaft of the wedge knob. Rotate the wedge knob CCW to loosen the wedge block, remove the carriage bar assembly, and then replace the quick release pin (fig. 2-5 sheet 1).

NOTE

In the following step, mark the position of each ceiling stow bar prior to its removal.

(2) At the top of the center section, loosen the lock nuts on the ceiling and rack stow bars. Remove the stow bars

WARNING

Stay clear of the ceiling stow bracket otherwise injury to personnel may result.

(3) At the top of the center section, remove the plate which secures the center section to the ceiling.

CAUTION

When removing the carriage assembly, be careful not to touch the rack front panels, otherwise damage to the equipment may result.

(4) Remove the carriage assembly through the shelter door and place on the ground at least 4 feet away from the shelter.

(5) At each support handle, remove the center section locking pin from the lower bushing (large brace end).

(6) Near the upper end of each support handle, remove the quick release pin which secures the extender handle.

(7) Swing out each support handle, lower the extender handle and then engage its free-end bushing in the center section; insert the center section locking pin. Replace the extender handle quick release pin.

(8) At the base of the carriage assembly by the right-front corner, remove the quick release pin which secures the handle bars. Remove the handle bars.

(9) Orient the handle bars behind the support handles so the extension bars in the support handles are pointing in the same direction as the rear of the center section.

(10) At the large brace end of each. support handle remove the quick release pin from the large bushing.

(11) Insert the handle bars (forward movement) into the support handle bushings until stopped.

(12) Aline the holes in the handle bars with the bushing holes, insert the quick release pins through the holes. Extend the extension bars from the handle bars.

(13) Lift the carriage assembly and place it in front of the proposed antenna location with the front of the center section facing down the sighting line.

NOTE

In the following step mark the carriage bar assemblies for curbside/roadside orientation prior to their removal.

(14) Remove the carriage bar assemblies and stow bars from the shelter.

c. Remove both the elevation and cross-elevation actuator. Handle these items with care.

d. Remove the side leg assemblies.

e. Remove the elevation drive ring.

f. Remove the antenna ground pads (the three 16-inch pads are mounted on top of the 24-inch pad).

g. Remove the stowage bags which are mounted on the floor of the shelter.

h. Remove the front and rear leg assemblies with the storage bar attached. These assemblies are mounted in front of equipment drawer and care must be exercised in order to not damage controls and indicators.

i. Remove the base frame members which are located in the inside top of the shelter.

j. Remove the ground rods.

k. Remove the four antenna reflector quarter sections.

l. Remove and stow for future use all of the mounting hardware and straps.

2-15. Assembling the Antenna

The only tool required for assembling the antenna is a 5/16-inch hex wrench. Remove this wrench from the tool kit stowed in the shelter (refer to table 2-1). Proceed as follows:

a. *Placement of Ground Pads.* (fig. 2-6).

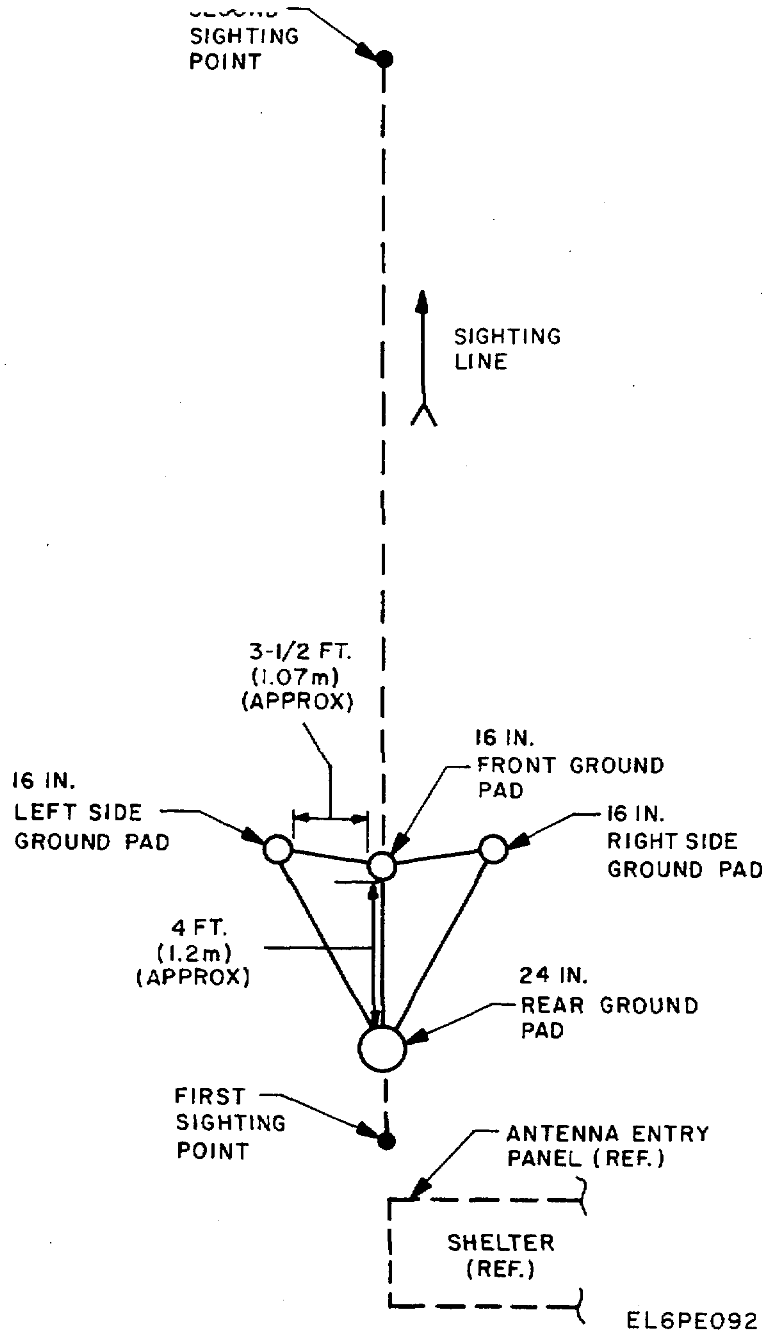


Figure 2-6. Placement of Antenna Ground Pads.

(1) Place the 24-inch rear ground pad about 1 foot (0.3m) in front of the first sighting point and centered along the sighting line.

(2) Place the 16-inch front ground pad at a position along the sighting line approximately 4 feet (1.2m) in front of the 24-inch rear ground pad.

(3) Place the two 16-inch side ground pads approximately 31/2 feet (1.07m) to either side and slightly forward of the 16-inch front ground pad.

b. Installation of Front and Rear Leg Assemblies (fig. 2-7).

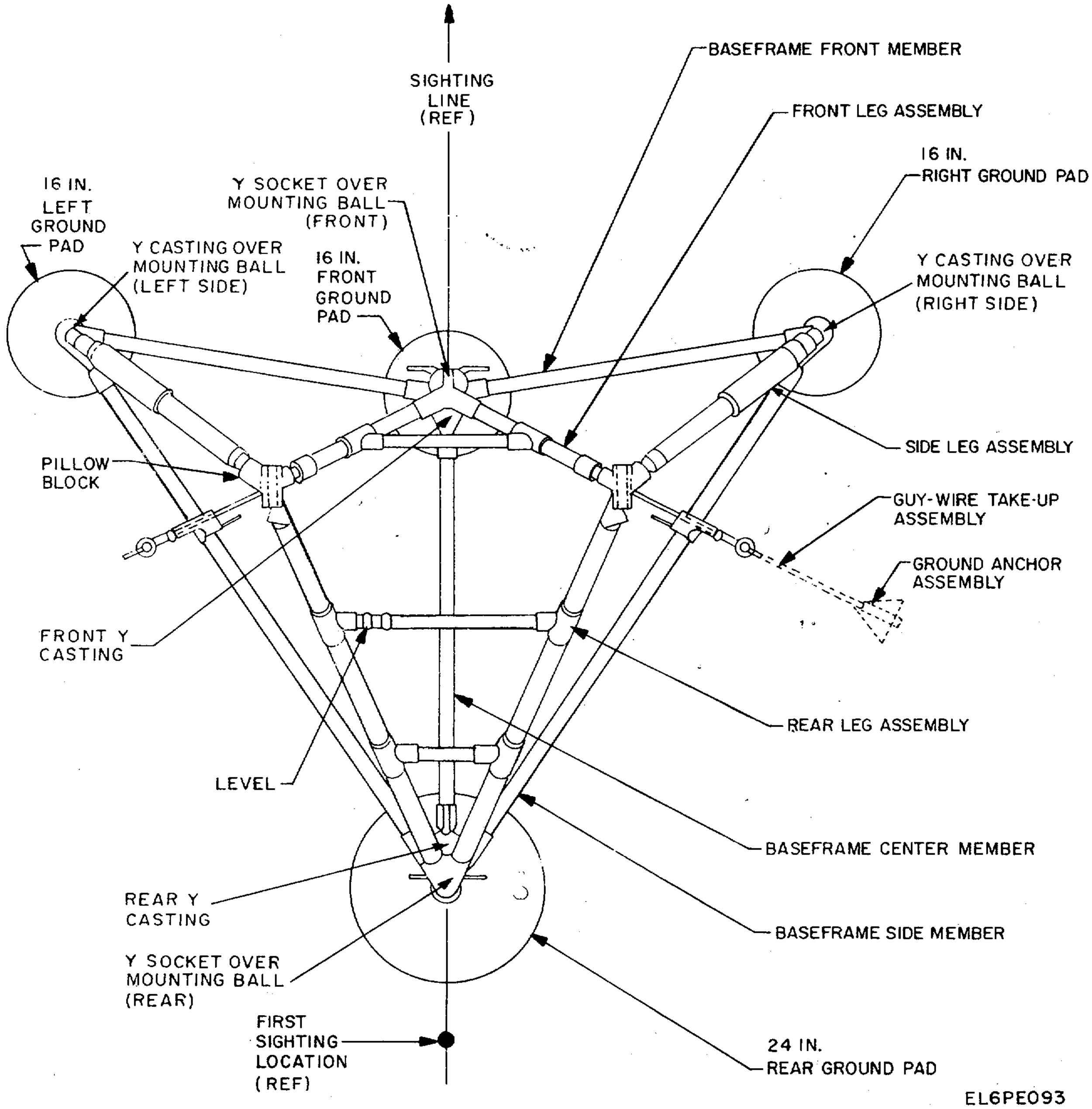


Figure 2-7. Assembled Antenna Support Structure, Plan View.

(1) Place the Y socket of the rear leg assembly over the mounting ball of the rear ground pad.

(2) While one person holds the rear leg assembly in position and with the pillow blocks at their approximate position, engage the mounting ball of the front pad with the Y socket of the front leg assembly.

(3) Manipulate the rear and front leg assemblies to accomplish a junction of the ball joints on the front leg assembly with the pillow block sockets on the rear leg assembly. Turn the knurled-threaded sleeve to loosely connect these items.

NOTE

Both leg assemblies must now be supported during the installation of the base frame members and side leg assemblies.

c. Installation of Base Frame Members. (fig. 2-7).

(1) Mate the center base frame member with the rear Y casting and insert the assembly pin.

Do not lock the pin.

(2) Mate the other end of the center base frame member with the front Y casting. Move the front pad along the sighting line as required to accomplish this mating. Insert the assembly pin and lock the pin. Also lock the pin inserted in step (1) above.

(3) Recheck that the boresight alinement is correct. This can be checked from the front sighting stake by observing that the V formed by the front and rear legs are in coincidence. Move only the front ground pad to accomplish this.

(4) Install the front base frame members by mating the bushing end with the front Y casting and inserting the assembly pins. Do not lock the pins.

(5) Move the side ground pads, as necessary, to engage the pad mounting balls with the Y castings on the front base frame members.

(6) Mate each of the side base frame members with the rear Y casting and insert the assembly pins. Do not lock pins.

(7) Move the side ground pins, as necessary, and mate the Y castings with the side base frame members.
Insert the assembly pins. Lock all assembly pins including those installed in steps (4) and (6) above.

d. Installation of Side Leg Assemblies (fig. 2-7).

(1) Release the clamp-type handle on one of the side leg assemblies (fig. 2-9). This will allow the leg to be extended or retracted.

(2) Attach the leg to the ball joint on the left pillow block and the left side ground pad Y casting.
Orient the leg with the handle section upward toward the pillow block.

(3) Observe the level (fig. 2-7) on the rear leg assembly upper cross member and move the leg in and out until a level indication is obtained.

NOTE

It may be necessary to stand on the left base frame member to prevent any movement during this adjustment.

(4) Close the clamp-type handle on the left front leg assembly to lock the entire framework in position.

(5) Release the clamp type handle on the other side leg assembly.

(6) Attach the leg to the ball joint on the right pillow block and the right side ground pad Y casting.
Orient the leg with the handle section upward toward the pillow block.

(7) Stand on the right side Y casting and close the clamp-type handle on the leg.

NOTE

After performing step (7) above, the structure is free standing and will not require support.

(8) Set each of the ground pads by standing on them and jumping slightly. Depending on the type of soil, complete setting of the pads may have to await anchoring installation. The level may be off now but this will be corrected in a final adjustment procedure.

e. Installation of Center Section.

WARNING

Handle the center section with care. Use four persons to install it. Failure to do so could result in injury to personnel because of its bulk and weight and/or damage to the equipment because of its delicate construction.

(1) During the unstowing procedure, the center section (on its carriage assembly) was removed from the shelter and placed in front of the antenna location.

CAUTION

Remove the feed tube from the carriage assembly storage container only when it is ready to be installed. Do not uncoil the mounted electronic cables at this time.

(2) Unlock and open the pillow blocks on the antenna support structure (fig. 2-7). Unlock and open the pillow blocks on the carriage assembly (fig. 2-5, sheet 1). Release and remove the two quick-release pins at the bottom of the center section on the base of the carriage assembly.

(3) Carefully lift the center section from the carriage assembly and set it into the position on the antenna support structure pillow blocks.

(4) Allow the center section to rotate downward and come to rest on the leg assembly.

(5) Close and lock the pillow blocks on the antenna support structure.

(6) Remove the handle bars from the support handles and stow them on the base of the carriage assembly (fig. 2-5, sheet 2).

(7) Remove the support handles from the center section and then pin the extender handles in a closed position.

(8) Remove the carriage assembly from the installation area. (Unstow the feed tube only when it is ready to be installed.) (9) On the center section gimbal loosen the straps which secure the mounted electronics cables. Uncoil these cables and dress them over the upper cross member of the rear leg assembly (but not on the level glass).

(10) As much as possible, dress the cables toward the left side of the cross member so that they will break out to the left of the drive ring after is installed.

f. Installation of Elevation Drive Ring and Actuators (fig. 2-8 and 2-9).

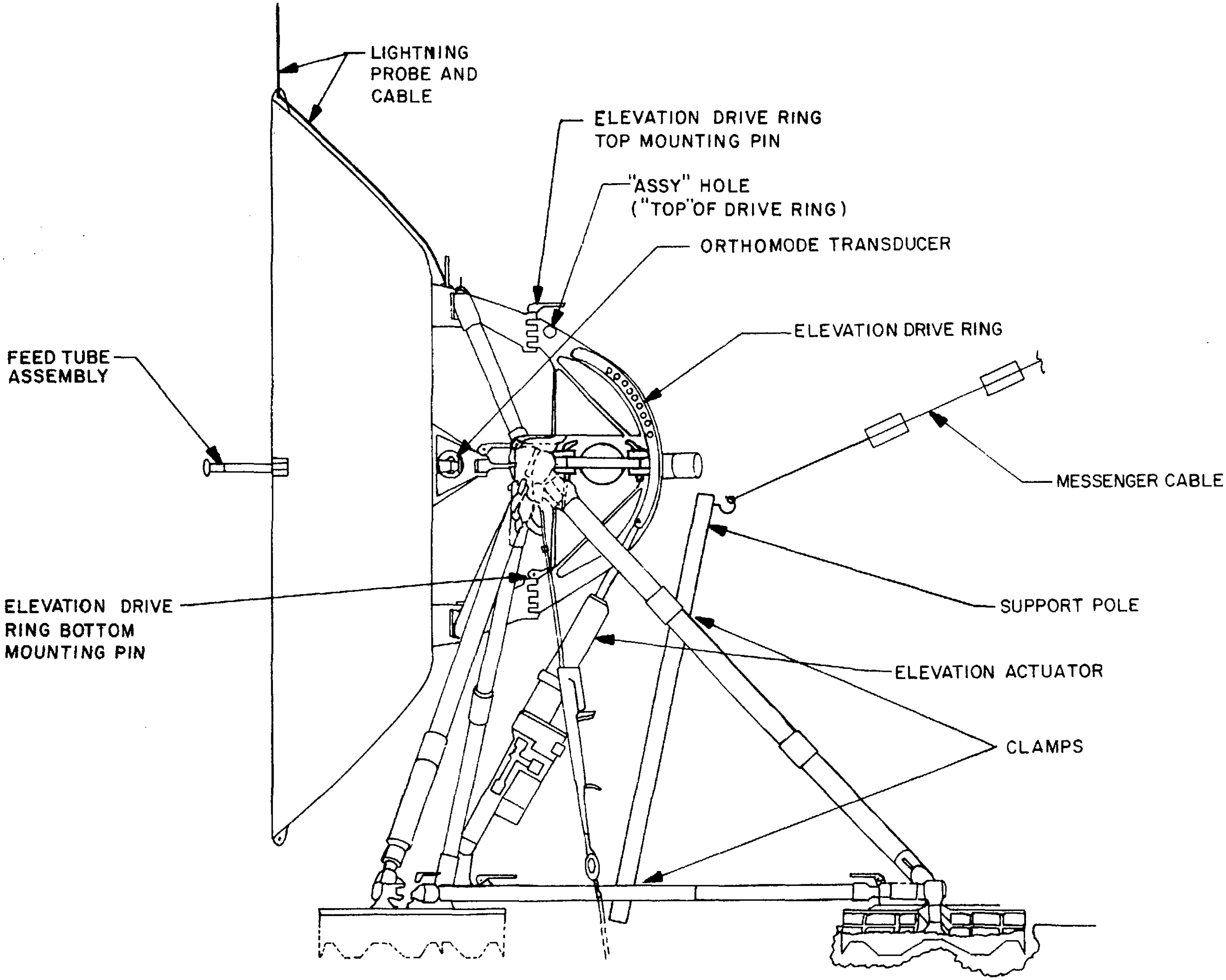


Figure 2-8. Assembled Antenna. Left Side View.

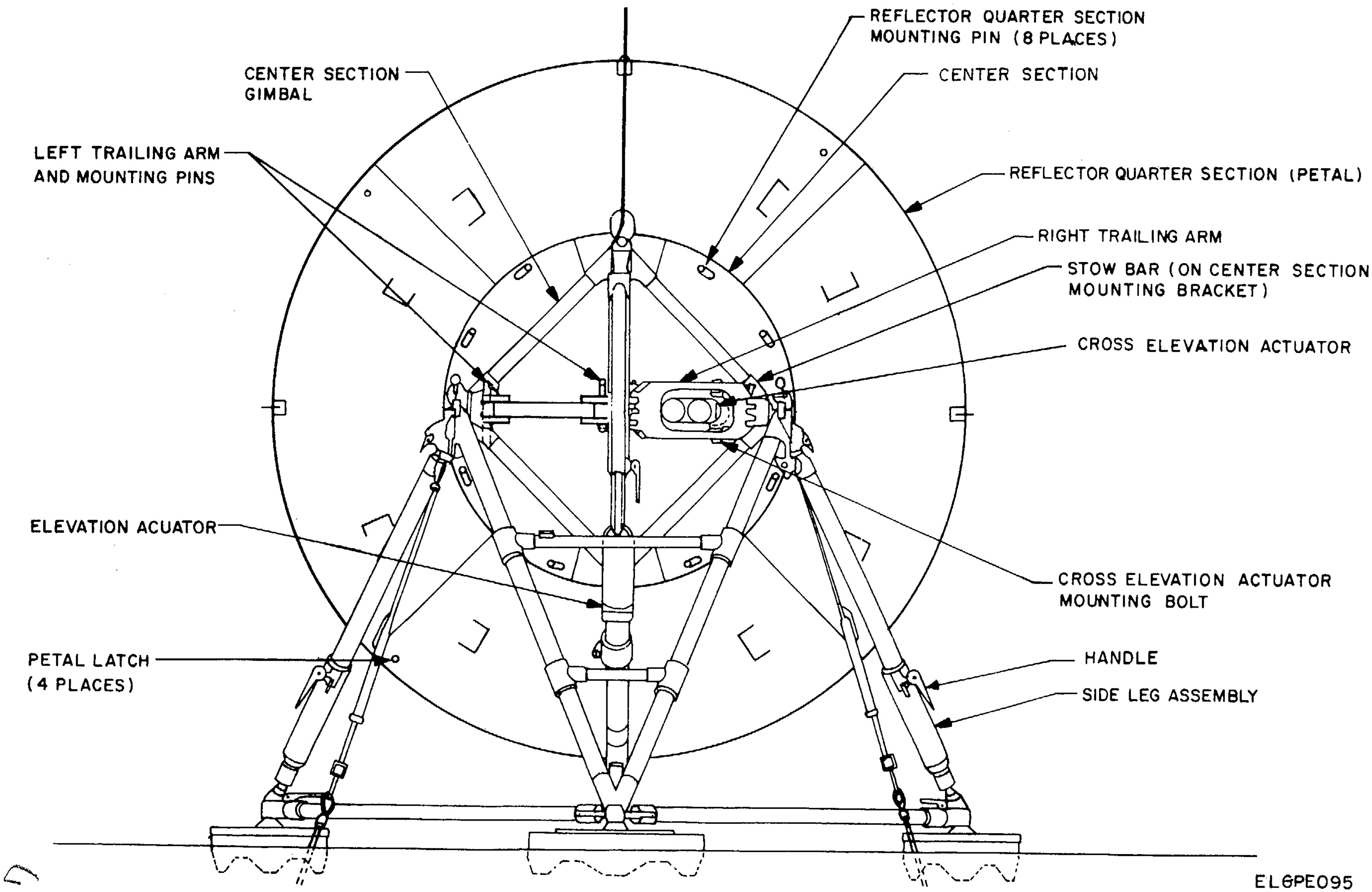


Figure 2-9. Assembled Antenna, Rear View.

(1) Unlock and remove the two mounting pins which will be used to mount the elevation drive ring. These pins are located top and bottom of the center section mounting frame (fig. 2-8).

(2) Place the elevation drive ring in place in the mounting and insert the mounting pins. The elevation drive ring is installed with the ASSY hole at the top.

(3) Remove the two mounting pins which will secure the left trailing arm between the elevation drive ring and the center section gimbal left elevation axis (fig. 2-9).

(4) Place the left trailing arm in position to connect the center section gimbal and the elevation drive ring. Insert the two mounting pins. Do not lock the pins.

(5) Release and remove the stow bar pin which holds the stow bar between the center section and right pillow block. Stow the bar on the center section and replace the stow bar pin (fig. 2-9).

(6) Lift the cross elevation actuator (with attached trailing arm) into position between the drive ring and right pillow block. Insert two mounting pins in the drive ring and pillow block mounting brackets. Maneuver the center section in the cross elevation plane to aid in inserting the actuator rod end pin in the center section stow bar bracket. Lock these three pins and the two pins in step (4) above.

CAUTION

Exercise care when handling the elevation actuator (step 7 below to insure that the rod end is not rotated. Rotation of the rod end may damage the protective boot covering the plunger screw. Using fingers only, check and relieve the torsional stress on the boot by slightly rotating the rod end to insure that the rod end is centered relative to the boot.

(7) Place the elevation actuator in place between the center front pad casting and the elevation drive ring. The rod end should be toward the elevation drive ring and forward of the upper cross member of the rear leg assembly. Orient the actuator housing so it is facing inward, that is, toward the rear (the connector will be on the left side).

(8) Insert the mounting pin in the Y casting bracket to secure the bottom of the elevation actuator.

(9) Note the level or sloping condition of the antenna support structure in the elevation plane. Rotate the center section (drive ring) in elevation so it is pointing at approximately 90 degrees relative to the ground mounting plane. Aline the actuator rod end with the degree hole in the drive ring that will best maintain this position (80, 85, 90, ASSY (110). Insert the mounting pin. Close and lock both mounting pins ((8) & (9)).

NOTE

This position of the center section will allow the easier access to the latches when installing the quarter section reflectors (petals) and the lightning probe.

g. Installation of Reflector Quarter Sections and Feed Tube Assembly (fig. 2-8 and 2-9).

(1) Remove the mounting pins (8) around the rim of the center section (fig. 2-9).

(2) Place the upper quarter section in place and insert and lock the two mounting pins.

(3) Place the right quarter section in place and insert and lock the two mounting pins.

(4) Place the left quarter section in place and insert and lock the two mounting pins.

(5) Place the lower quarter section in place and insert and lock the two mounting pins.

(6) Using the 5/16-inch hex wrench close and lock the petal latches between the installed quarter sections (fig. 2-9). Rotate 3/4 turn CCW to lock each latch.

(7) Remove the lightning probe from its stowage bracket on the back of the center section and install it on the upper quarter section. Orient the probe so that it will point upward when the antenna elevation is set to its final position (fig. 2-8).

(8) Hold the antenna and elevation actuator and remove the pin holding the rod end to the elevation drive ring hole.

(9) Rotate the antenna downward until the 10 degree on the elevation drive ring is alined with the actuator rod end. Insert the mounting pin.

(10) Dress the lightning probe cable over to the left pillow block and connect it to the ground lug.

(11) Remove the feed tube from its stowage container on the carriage assembly. Replace the cap on the container.

(12) On the center section unscrew and remove the feed tube adapter cover.

(13) Clip the feed tube adapter cover to the feed tube adapter.

CAUTION

Exercise care when handling and working with the feed tube assembly and the feed tube adapter. At the opening, the feed tube adapter has a thin dielectric membrane which is extremely fragile and easily ruptured. Do not allow anything, including fingers, to come in contact with the membrane. In addition, special care must be exercised to prevent dirt, dust, moisture or any foreign material from entering the open ports of the feed tube and the adapter.

(14) Aline the keyed feed tube connector with the feed tube adapter and carefully screw it on.

(15) Replace the 5/16-inch hex wrench in the tool kit.

h. Installation of Messenger Pole and Cable (fig. 2-8).

(1) Place the messenger pole (with the eye hook upward) in place in back of the upper cross member of the rear leg assembly and to the left of the center base frame member.

(2) Using the U-clamps supplied, loosely clamp the pole to both the cross member and the base frame member. Check that the upper section of the pole leans away (backwards and to the left) from the drive ring so it will not interfere with antenna movement. Position the clamps accordingly to obtain the desired pole angle. Rotate the pole so the eye hook at the top points toward the antenna entry panel. Tighten the clamps.

(3) Attach the messenger cable to the eye hook on the top of the pole and to the ring on the top of the shelter adjacent to the antenna entry panel. Orient the take-up device towards the shelter.

(4) Using the take-up device tighten the messenger cable, however leave a slightly slack loop. (Refer to paragraph 2-19 (anchoring instructions) for use of take-up device).

(5) Check that the cable hanger straps are spaced approximately 24 inches apart on the messenger cable. Loosen the straps enough to open large loops for accepting the antenna cables.

2-16. Installation of Antenna Cables and Final Adjustment

a. Installation of Antenna Cables and Waveguide. (fig. 2-8 and 2-10).

(1) he following mounted electronics cables were loosened and uncoiled previously from the center section support frame (gimbal) and dressed over the rear leg assembly. Note that these cables are already connected to their respective mounted electronics terminations as follows:

(*a*) 30A1W1-Receive SHF (from BITE)

(*b*) 30A1W5-LNA power and control (from LNA 1)

(*c*) 30A1W6-LNA 2 power and control (from LNA 2)

(*d*) 30A1W7-LNA BITE power and control, (from BITE)

(*e*) 30A1W8-Antenna Auxiliary (from 30J4) (f) 30A1W10-Loop test (from directional coupler)

(2) Check the cables from the center section to the rear leg assembly. If any cable appears to have too sharp a bend radius, redress the cable so it will lay across the other side of the drive ring. As much as possible, dress the above cables under the left trailing arm of the cross-elevation actuator.

(3) Carefully dress the cables through the messenger cable hanger straps towards the antenna entry panel. Do not cross or twist the cables.

(4) With the P1 plug ends oriented towards the shelter, dress the elevation (W1) and cross-elevation (W2) drive cables through the hanger straps.

CAUTION

Handle the waveguide with care. Do not let flange ends touch the ground nor let foreign matter get inside the waveguide channel. Avoid sharp bends and heavy impact with other objects to prevent any damage.

(5) Unstow the transmit waveguide (W3) and dress it through the hanger straps.

(6) See figure 2-10. Connect the cables and the waveguide to the antenna entry panel in the following order:

(a) Receive SHF (30A1W1).

(b) Transmit waveguide (W3).

(c) Loop test (30A1W10).

(d) LNA BITE power and control (30A1W7).

(e) LNA 1 power and control (30A1W5).

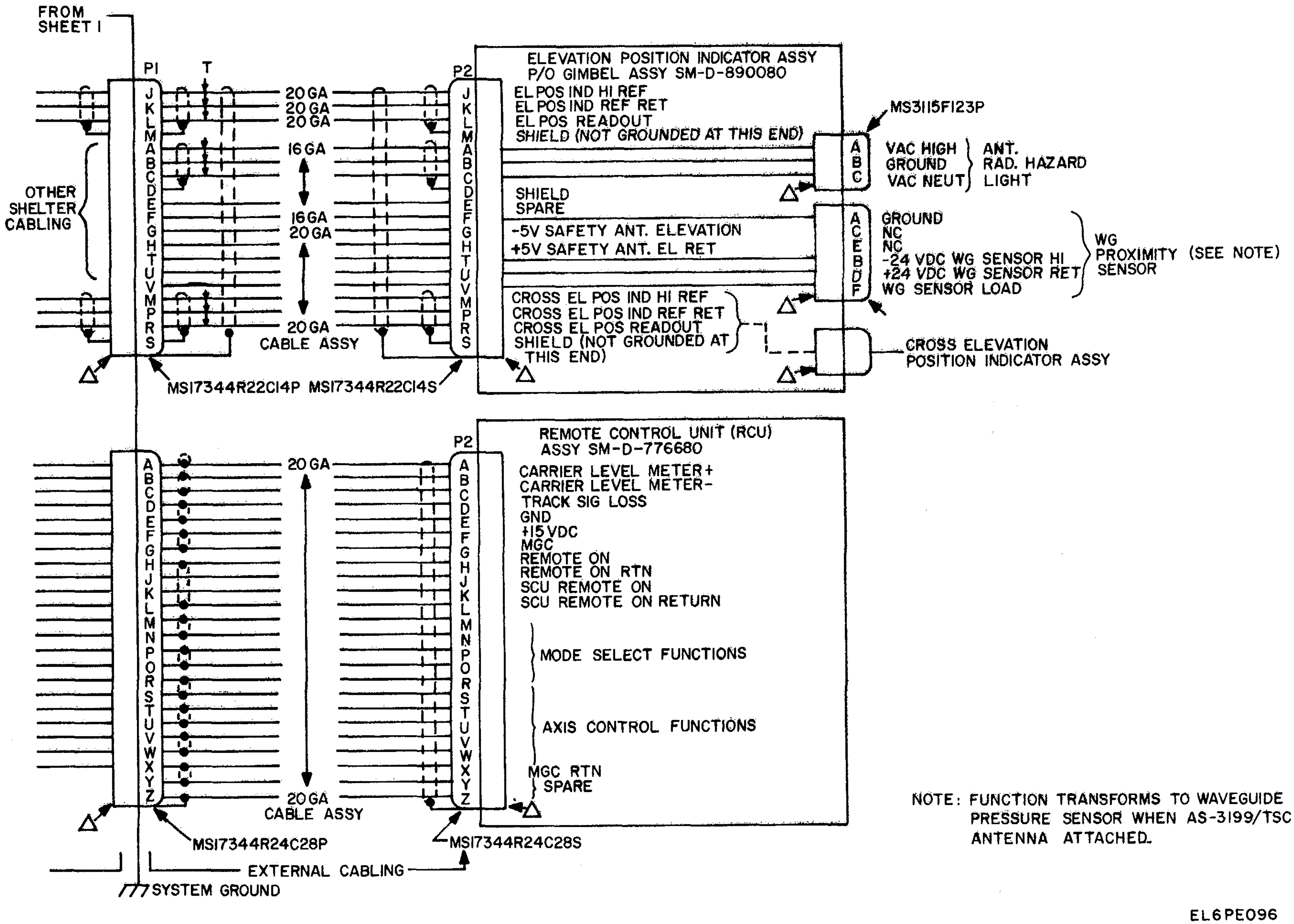


Figure 2-10. Antenna and Power Cable Connections and Entry Panels (Sheet 1 of 2)

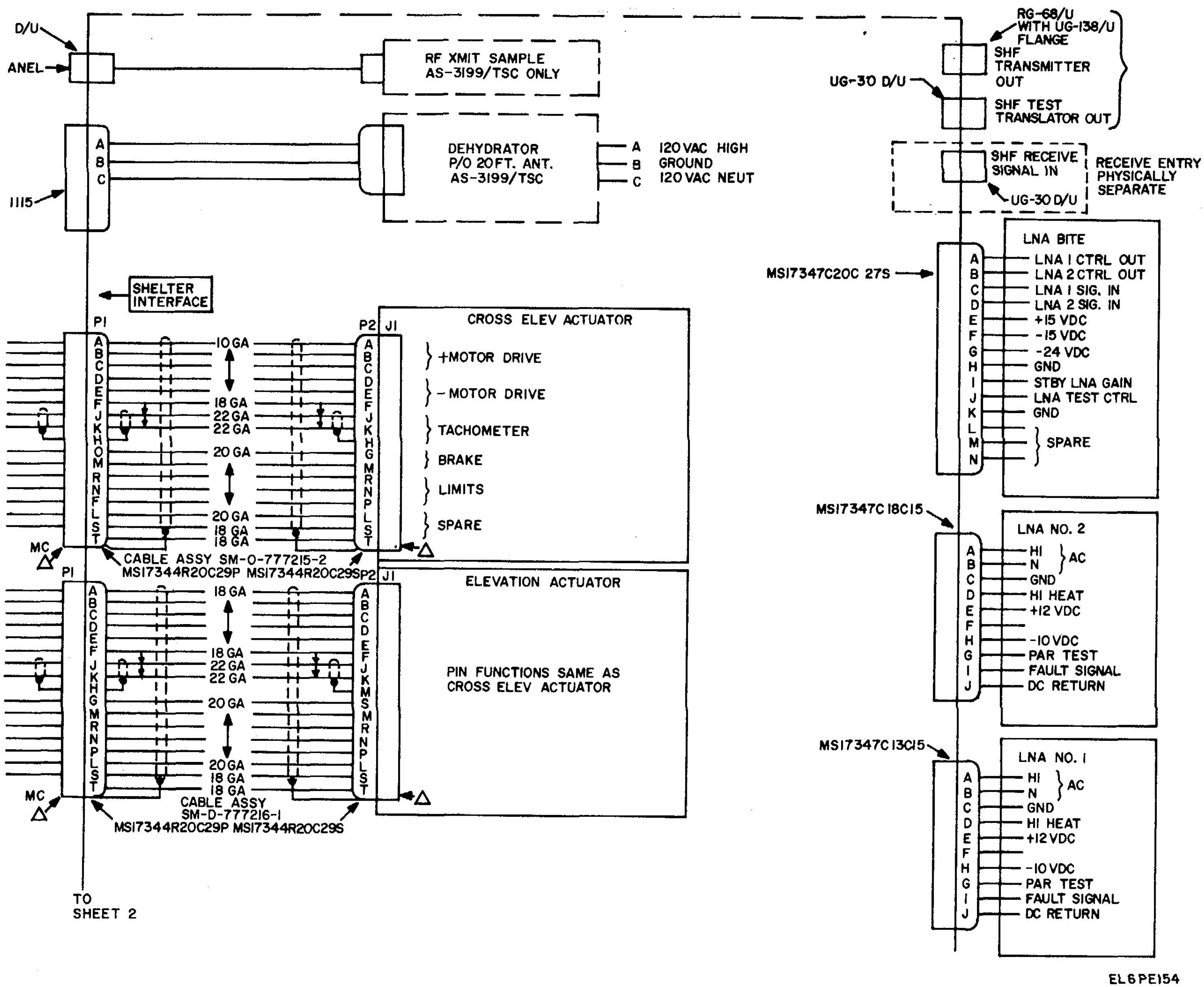


Figure 2-10. Antenna and Power Cable Connections and Entry Panels (Sheet 2 of 2).

(f) LNA 2 power and control (30AIW6).

(g) Antenna auxiliary (30A1W8).

(h) Elevation drive (W1).

(i) Cross-elevation drive (W2).

(7) Dress any excess waveguide and cable away from the shelter and toward the antenna to allow maximum flexing loops for unrestricted antenna movement. Do not tighten the hanger straps as yet.

(8) At the antenna end of the messenger cable dress the transmit waveguide to the left of the drive ring and above the left trailing arm. Connect the waveguide to the or the mode transducer.

(9) Dress the elevation drive cable to the left of the drive ring and between the left trailing arm and the upper cross member of the rear leg assembly.
Connect the cable plug to the elevation actuator connector.

(10) Dress the cross elevation drive cable to the right of the drive ring. Connect the cable plug to the cross elevation actuator connector.

b. Final Alinement and Adjustment.

(1) Determine the final antenna elevation angle setting as follows:

(a) If the antenna structure is on approximately level ground in the elevation plane, the final elevation angle setting is the. same as the ephermeric angle of the satellite.

(*b*) If the rear pad is higher than the front pad, add this slope angle to the ephermeric angle.

(*c*) If the rear pad is lower than the front pad, subtract this slope angle from the ephermeric angle.

(2) Hold the antenna and the elevation actuator rod end. Remove the pin from the drive ring hole.

(3) Rotate the antenna in elevation until the rod end is alined with a drive ring degree hole which is closest to the final elevation angle setting as determined in step (1) above. Insert and lock the mounting pin. For example: if the final angle is 37.50 degrees, pin the 40 degree hole; if 37.49 degrees, pin the 35 degree hole.

(4) Check the dress of the cables and the flexing loops between the antenna and the messenger pole. Adjust the cables and waver guide accordingly to allow maximum flexing loops for unrestricted antenna movement. Tighten the hanger straps on the messenger cable.

(5) Check the level on the upper cross member of the rear leg assembly. If the level does not indicate that the structure is level in the cross elevation (azimuth) plane, perform steps (6) through (8) below. If the structure is level, proceed to step (9) below.

(6) With a person on each side of the Y casting, maintain the level and leg clamps.

(7) Adjust the frame until the entire structure is level.

(8) With one person standing on each side of the Y casting, maintain the level and close the side leg clamps.

(9) At the left pillow block on top of the elevation readout assembly rotate the elevation safety switch knurled knob CCW to a setting of 0 (zero degrees; fig. 3-14).

(10) At the left pillow block adjust the elevation readout vernier knob for a level indication on the attached level (fig. 3-14).

(11) Check the elevation angle of the antenna as indicated on the elevation readout dial. Depending on the last shutdown position of the elevation actuator, the readout angle may indicate anywhere between ± 13 degrees of the final elevation angle. No further adjustment is required.

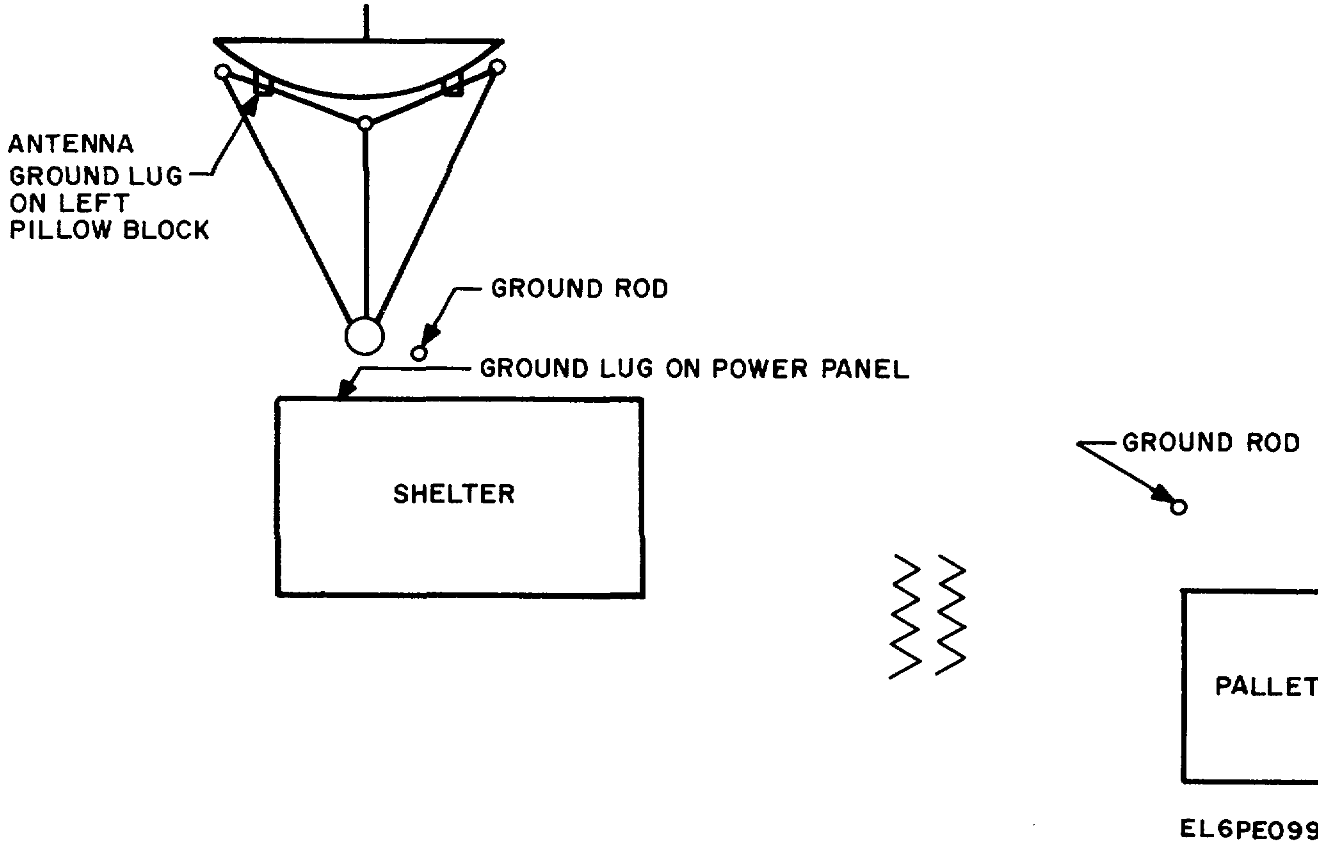


Figure 2-11. Ground Rod Locations.

2-17. Installing Ground and Power Cables (fig. 2.11)

a. Power Pallet Primary Power.

(1) Remove the following items (fig. 2-4):

(*a*) Ground rods (two sets).

(*b*) Hammer (2) Drive two ground rods at the locations as shown in figure 2-11. Using a ground clamp, securely fasten the stripped ends of the shelter ground cable (W7) and antenna ground cable (W9) to the shelter ground rod.

(3) At the shelter power entry panel connect the terminal lug end of the shelter ground cable (W7) to the GROUND lug. Tighten the wing nut securely.

(4) At the antenna connect the terminal lug end of the antenna ground cable (W9) to the wing-nut ground lug on the left pillow block.

(5) Using a ground clamp, securely fasten the stripped end of the power ground cable (W8) to the pallet ground rod.

(6) At the power pallet, connect the terminal lug end of the ground cable (W8) to the ground lug of the power switch box. Tighten the wing nut securely.

(7) Connect the primary power cable between the shelter and power pallet. The distance between the two (their power connections) may not exceed 40 feet. Two W5 cables (50 feet each) connect between Main Power 1 and 2 of the shelter to Load Feed-i and Load Feed-2 of the switch box.

b. Base or Commercial Primary Power. When 120/208, 3-phase, 4-wire, 50/60 Hz base or commercial power is available the following procedure is followed.

(1) The power drop must be within 40 feet of the shelter.

(2) Power drop connections should accept 3/8 inch ring terminals.

(3) Remove the following items (fig. 2-4):

(*a*) Ground rods (two sets).

(*b*) Hammer.

(4) Drive two ground rods; one near the shelter as shown in figure 2-11 and the other near the base power drop. Using a ground clamp, securely fasten the stripped ends of the shelter ground cable (W7) and antenna ground cable (W9) to the shelter ground rod.

(5) At the shelter power entry panel connect the terminal lug end of the shelter ground cable (W7) to the GROUND lug. Tighten the wing nut securely.

(6) At the antenna connect the terminal lug end of the antennal ground cable (W9) to the wing-nut lug on the left pillow block.

(7) Using a ground clamp, securely fasten the stripped end of the power ground cable (W8) to the power drop ground rod.

(8) Connect the two W5 power cables at the shelter power entrance panel Main Power 1 and Main Power 2.

(9) Connect the two power adaptor cables, W6, to the free ends of the W5 cables.

WARNING

Insure power drop (commercial) has no voltage present during hookup. Insure all shelter power circuit breakers are off.

(10) Join each of the corresponding fly-leads of each W6 cable to the power drop junction terminals as follows:

Ground Rod	Power Drop Phase	W6 (Main-1) Phase	W6 (Main-2) Phase
-	A	Phase A (L1)	Phase A (L1)
-	B	Phase B (L2)	Phase B (L2)
-	C	Phase C (L3)	Phase C (L3)
Ground (Note #1)	Neutral Ground	Neutral Green Wire	Neutral Green Wire

WARNING

Insure ground (green) and neutral (white) are tied together at power drop ground rod.

NOTE

The AN/TSC-86 requires the neutral wire to be grounded. If this earth ground is not made at the generator or transformer secondary of the drop being supplied, the power drop neutral should be grounded as noted. Close coordination with the power supplier is necessary to assure proper neutral grounding.

(11) Once these connections are made the lines should be checked for proper phase sequence (phase rotation).

(12) With power turned on at the drop, set terminal main power breakers ON.

(13) If the GO lamps light the phase rotation is OK.

(14) If the NO GO lamps light and the main breaker repeatedly trips, the phase rotation is wrong. Two phases must be reversed.

WARNING

Turn off power at the power drop before reversing terminals.

(15) To reverse phase rotation to the terminal interchange phases A and B of both W6 (Main-1) and W6 (Main-2) at the power drop.

(16) Restore power at the drop.

(17) Recheck for proper phase rotation, steps (12) and (13) above.

2.18. Installing the Radiation Hazard Fence (fig. 2-12 and 2-13)

a. Remove the radiation hazard fence kit. Refer to table 2-1 for the location of stowed items.

b. Locate one each of two fence posts alongside each 16 inch side ground pad and about 1 foot (0.3m) out (fig. 2-12).

c. Orient each fence post so that the warning sign support studs (the front) face outward and away from the hazard area. Using the driving cap and hammer, drive these fence posts into the ground to a depth of about 15 inches (0.4m).

d. Drive a third fence post 59 feet (18m) out in front of the 16 inch front center ground pad (along the sighting line). Orient the front of this fence post to face down the sighting line (satellite heading).

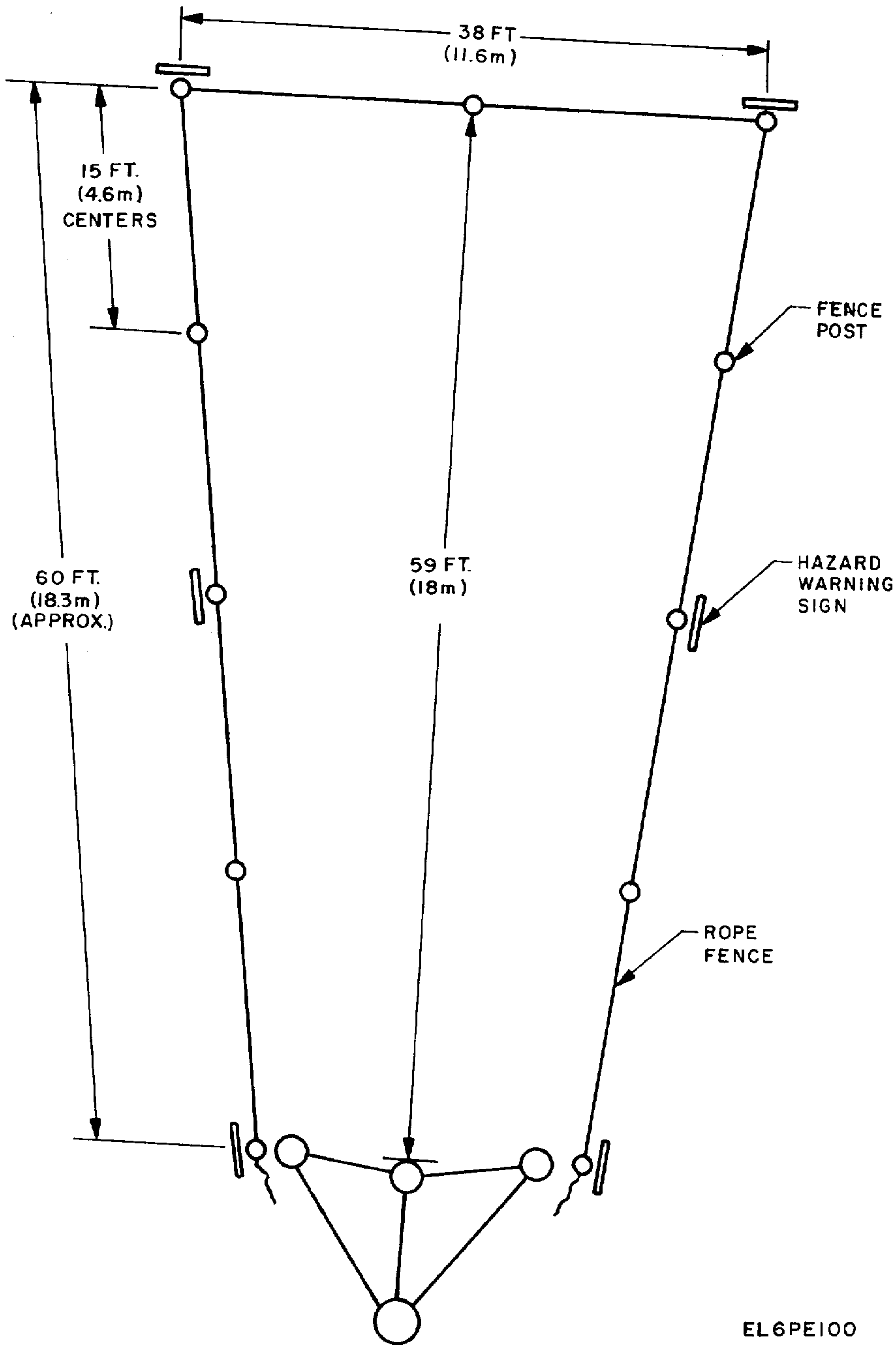


Figure 2-12. Installation of Hazard Area Fence.

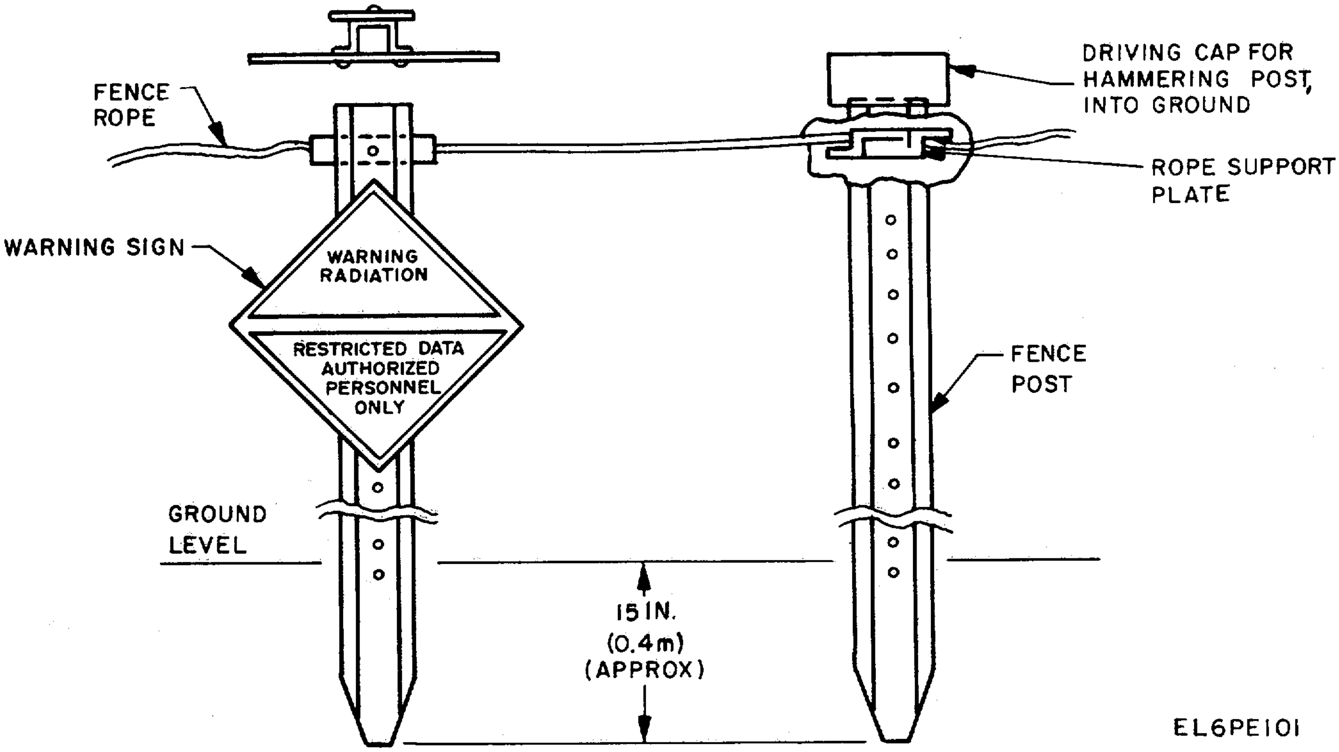


Figure 2-13. Hazard area Fence Posts, Rope and Warning Signs; Assembly Details.

e. Using the above third fence post as a reference, locate and drive one each of two corner fence posts 19 feet (5.8m) on either side of the reference fence post and at right angles to the sighting line. Orientation shall be the same as for the reference fence post.

f. Lay out the rope on the ground and around the five fence posts starting and ending at the 16 inch side ground pads. Momentarily place tension on the entire rope loop to straighten the side runs to each corner fence post. Balance out the excess rope at the two ends.

g. Using the rope side runs as a marker line, locate three fence posts on each side (six total) on 15-foot (4.6m) centers starting from the corner fence posts.

h. Orient the front of these fence posts to face away from the hazard area and then drive them into the ground. Replace the driving cap in its stowage bag.

i. Starting at one end, thread the rope through the notches of the rope support plate of the first fence post.

j. Attach the rope to the remaining fence posts in turn. Leave a slight loop drop between fence posts; extreme tension is not required.

k. Attach the six warning signs to the selected fence posts as shown in figure 2-12. Engage the elongated holes in each warning sign on the support studs on front of each fence post.

2-19. Anchoring the Antenna and Shelter

a. Factors to be Considered. Due to the close spacing of the antenna and shelter as well as weather conditions around the site area, the following should be considered prior to performing any anchoring procedures:

(1) Anchor the antenna if winds in excess of 15 miles per hour (24 kph) are expected or if the terminal is to be operated for a considerable period of time. Anchor the shelter if winds in excess of 40 miles per hour (64 kph) are expected.

(2) The shelter tie-down assemblies must not interfere with the antenna structure or its tie-down assemblies.

(3) The shelter anchors must be placed at least 5 feet (1.5m) from the antenna anchors so that each will load an independent volume of soil.

(4) Try to minimize the effects of hammering on the antenna structure. Hammer the anchors more frequently and with lighter strokes rather than bulldozing them into the ground with fewer but much heavier strokes.

b. *Anchoring the Antenna*. (fig. 2-14 and 2-15).

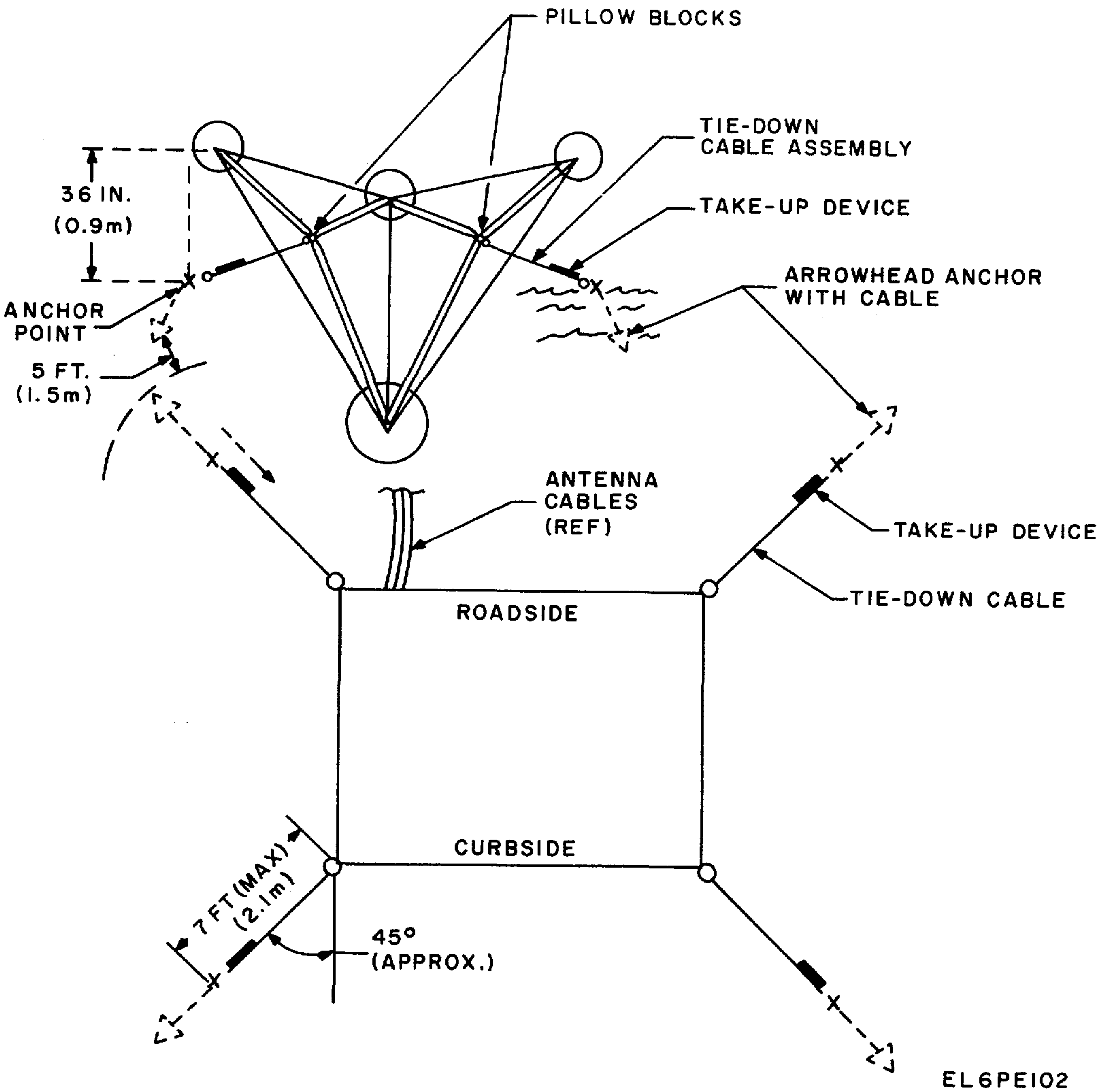


Figure 2-14. Placement of anchors.

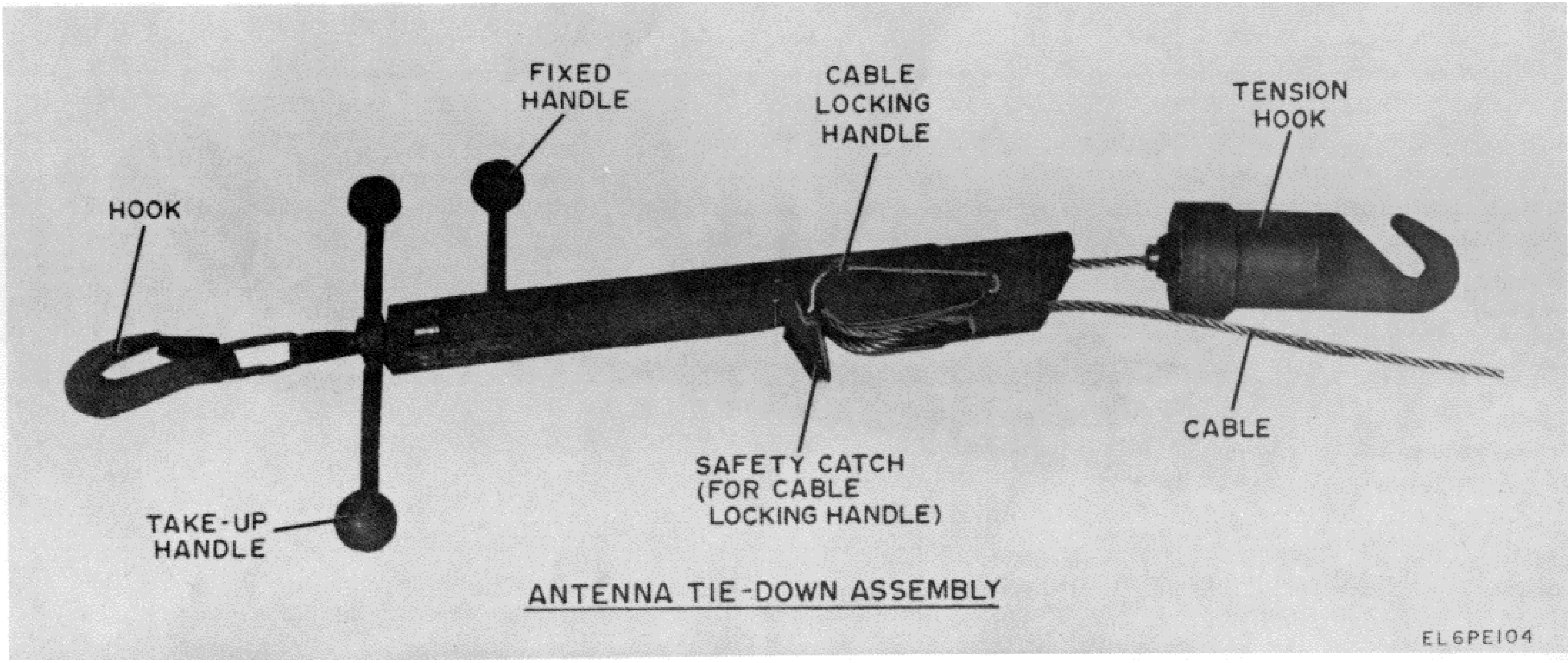


Figure 2-15. Tie-Down Cable and Take-Up Device (Sheet 1 of 2).

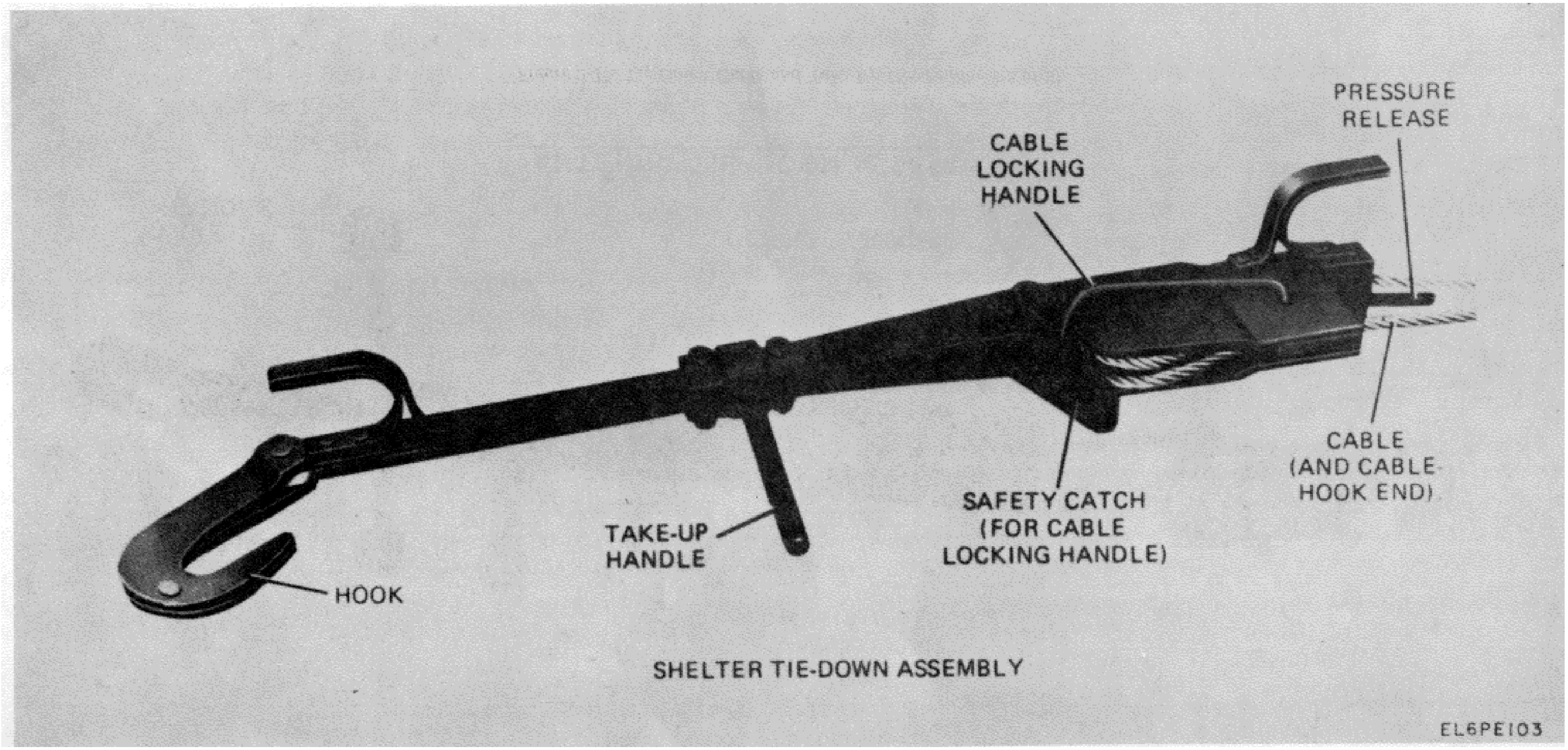


Figure 2-15. Tie-Down Cable and Take-Up Device (Sheet 2 of 2).

WARNING

Wear work gloves while performing any of the anchoring and tie-down procedures to protect the hands.

(1) Remove storage bags SM-C-937355-1, -2 and - 3 (fig. 2-4). Remove the following items from the bag:

(a) Two antenna tie-down assemblies (take-up devise with cable) (fig. 2-15, sheet 1).

(b) Drive bar head.

(c) Drive bar holding aid.

(d) Two 8-inch anchor (fig. 2-4).

(e) An arrowhead drive bar (fig. 2-4).

(2) Locate an anchor point approximately 36 inches (0.9m) behind the center of a 16-inch side ground pad and in line with its outer edge (fig. 2-14).

(3) Repeat step (2) above for the other side.

(4) lace an arrowhead ground anchor at one of the anchor points. Place the recessed end of the ground anchor drive bar rod over the shaft of the arrowhead ground anchor.

(5) Using the holding aid and drive bar head over the arrowhead drive bar, drive the arrowhead ground anchor (with attached cable) straight down to a depth of approximately 31/2 feet (1.07m).

(6) Attach the tension hook of the take-up device to the guy ring on the antenna pillow block (same side).

(7) On the take-up device rotate the take-up handle to fully extend the screw-bolt-end hook from the take-up device.

(8) Lift the safety catch and unlock the cable locking handle. Extend the cable through the take-up device until the screw-bolt-end hook reaches the ground anchor cable.

(9) Attach the screw-bolt-end hook to the O-ring of the ground anchor cable.

(10) Pull slack cable through the take-up device until the cable is tight. Lock the cable locking handle.

(11) Repeat steps (4) through (10) above to install the ground anchor and tie-down assembly on the other side.

(12) Tug inward (toward the antenna structure) on each tie-down cable to stabilize the ground anchor and to pull the below-ground anchor cable more in line with the actual tie-down slope angle.

(13) Unlock the cable locking handle on each take-up device and tighten-up any slack cable. Lock the cable locking handle.

(14) Repeat steps (12) and (13) above.

(15) Observe the level on the rear leg assembly. Rotate the take up handle on each take-up device to tighten the tie-down cables. Alternately tighten each side to maintain a level condition.

CAUTION

When tightening, observe the cable at the tension hook. Do NOT over-tighten such that the green band indicator on the cable inside the hook becomes exposed.

c. Anchoring the Shelter on the Ground (fig. 2-14).

NOTE

The following procedure applies for anchoring the shelter directly on the ground.

(1) The selected site should be on level ground.

(2) Locate the anchoring points not more than 5 feet from the shelter corners.

(3) At each anchor point drive an arrowhead ground anchor (with attached cable) straight down to a depth of approximately 31/2 feet (1.07m).

(4) Attach the cable-end hook of a tie-down assembly to a shelter guy ring.

(5) On the take-up device rotate the take-up handle to fully extend the screw-bolt-end hook from the take-up device.

(6) Lift the safety catch and unlock the cable locking handle. Extend the cable through the take-up device until the screw-bolt-end hook reaches the ground anchor cable.

(7) Attach the screw-bolt-end hook to the O-ring of the ground anchor cable.

(8) Pull slack cable through the take-up device until the cable is tight. Lock the cable locking handle.

(9) Repeat steps (4) through (8) above to install the tie-down assemblies on the remaining three corners of the shelter.

(10) Tug inward (toward the shelter corners) on each tie-down cable to stabilize the ground anchor and to pull the below-ground anchor cable more in line with the actual tie-down slope angle.

(11) On each take-up device, unlock the cable locking handle and tighten-up any slack cable. Lock the cable locking handle.

Section V. PRELIMINARY ADJUST OF EQUIPMENT

2-20. Checking Cable and Ground Connections

Check antenna and ground cables as follows (fig. 2-10):

a. Check antenna cables for proper termination at the antenna mounted electronics units and at the shelter antenna entry panel.

b. Check the transmit waveguide flange connections for proper fit and tightness at the antenna or the mode transducer and shelter antenna entry panel. Improper connections at these points will activate the proximity switches (waveguide interlocks) and inhibit the transmitter.

c. Check that antenna cables are dressed properly and that antenna movement will not be inhibited nor cause any stress or damage to the cables themselves.

d. Check that all ground cables are terminated properly and are tight at their respective equipment and ground connections.

e. Check that the power cable is terminated properly and is tightly connected at the generator distribution box and power entry panel.

2-21. Adjusting the Shelter Vents

Adjust the shelter vents according to the outside temperature. Proceed as follows:

a. Temperature Above 32°F (0° C). When the temperature is above 32°F (0°C), open all external intake and exhaust vents (four roadside). Close all internal recirculating vents (on the roadside).

b. Temperature Below 32°F (0° C). When the temperature is below 32°F (0°C), close all external intake and exhaust vents. Open all internal recirculating vents.

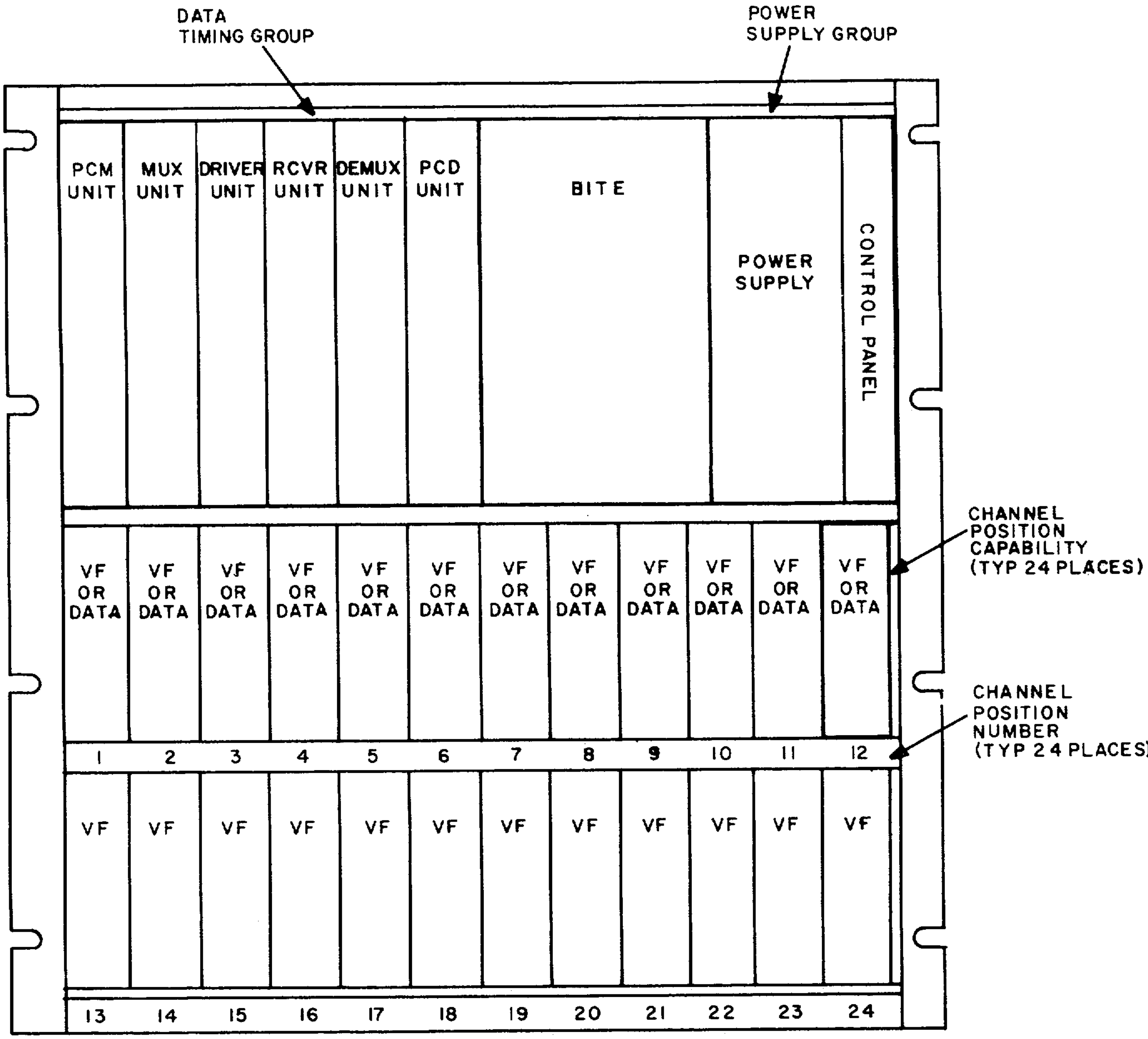
c. Air Conditioner Cover and Drain Plug.

CAUTION

Prior to operating the air conditioner always uncover it and remove the drain plug; otherwise, damage to the unit could result. Unsnap, roll up, and secure the rolled-up cover with the straps provided. Remove the condenser drain plug.

2-22. Adjustment of AN/FCC-98

On the initial installation, it is assumed that the configuration of the multiplexer (fig. 2-16) is built up or rearranged to meet specific site/system requirements. Refer to the appendix A references, if necessary, for the applicable operator and maintenance manuals to configure the multiplexer.



NOTES

1. VF CHANNEL ANNOTATION ON CHART MEAN THAT VF (VOICE FREQUENCY) MODULES CAN BE USED IN THESE POSITIONS.
2. DATA CHANNEL ANNOTATIONS MEAN THAT 0-20 KB/S, 50KB/S, OR MULTIRATE DATA MODULES CAN BE USED IN THOSE POSITIONS.
3. ACTUAL CHANNELS USED TO CONTAIN DATA MODULES DEPEND UPON THE DATA HANDLING RATE OF THE MODULE.

EL6PE107

Figure 2-16. Multiplexer Set Module/Group Configuration.

Section VI. INSTALLATION AND CIRCUIT LINEUP

2-23. External Circuit Connections (fig. 2-17)

a. For the terminal to accomplish its assigned tactical mission, certain external circuits must be connected to the entry panels. The entry panels providing cable interface are as follows:

(1) IF/frequency standard/telephone entry panel.

(2) Data signal entry panel.

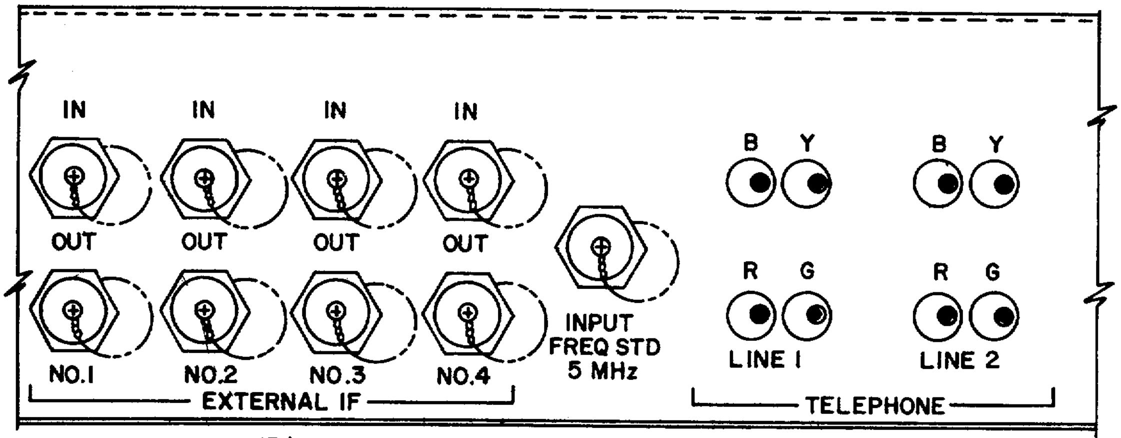
(3) TTY/VF entry panel.

(4) Antenna entry panel.

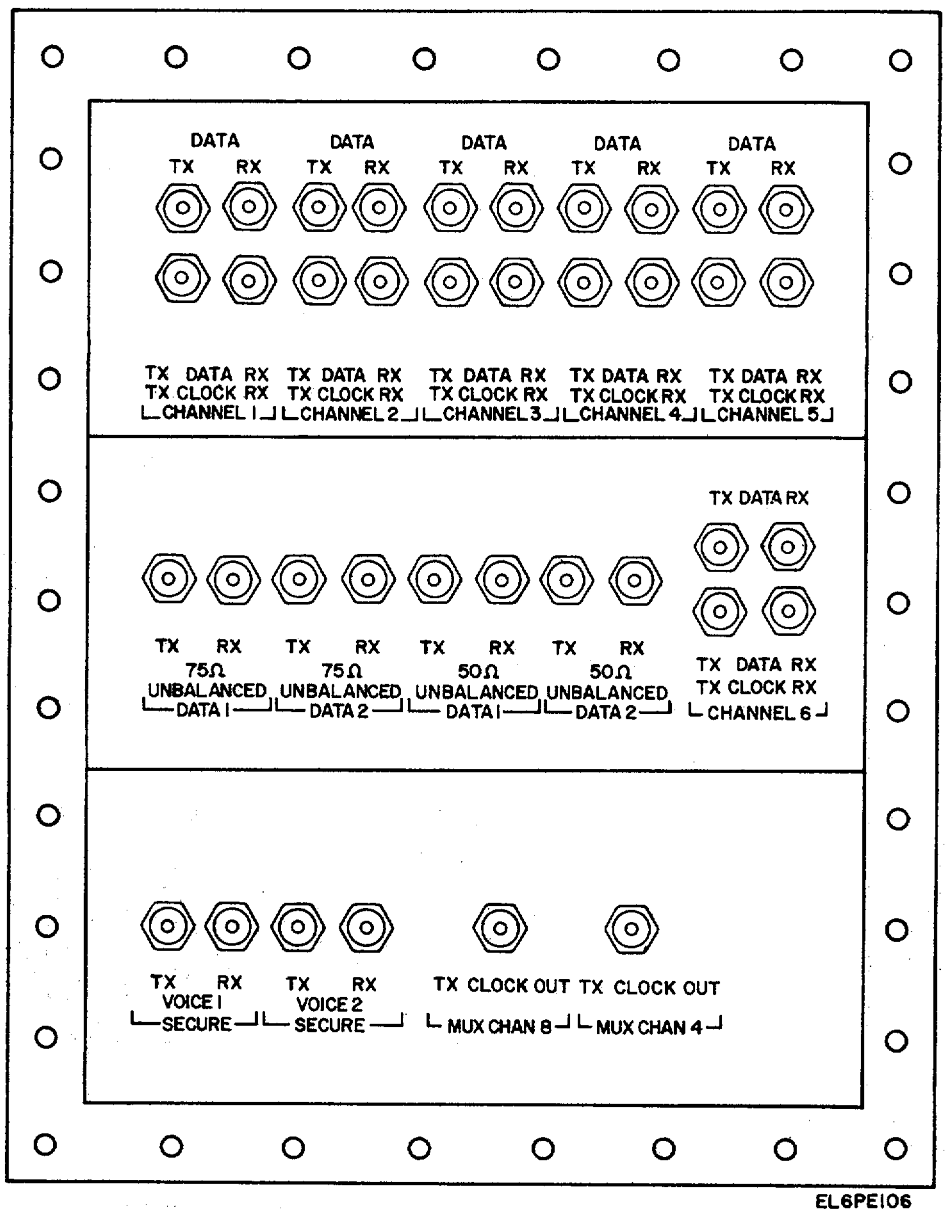
(5) SHF input entry panel.

(6) EMI power entry panel.

b. Connect external circuit cables and wires to the appropriate connectors and binding posts on the entry panels as shown in figure 2-17.



IF/FREQUENCY STANDARD/TELEPHONE ENTRY



DATA SIGNAL ENTRY

Figure 2-17. External Circuit Connection Entry Panels (Sheet 1 of 2)

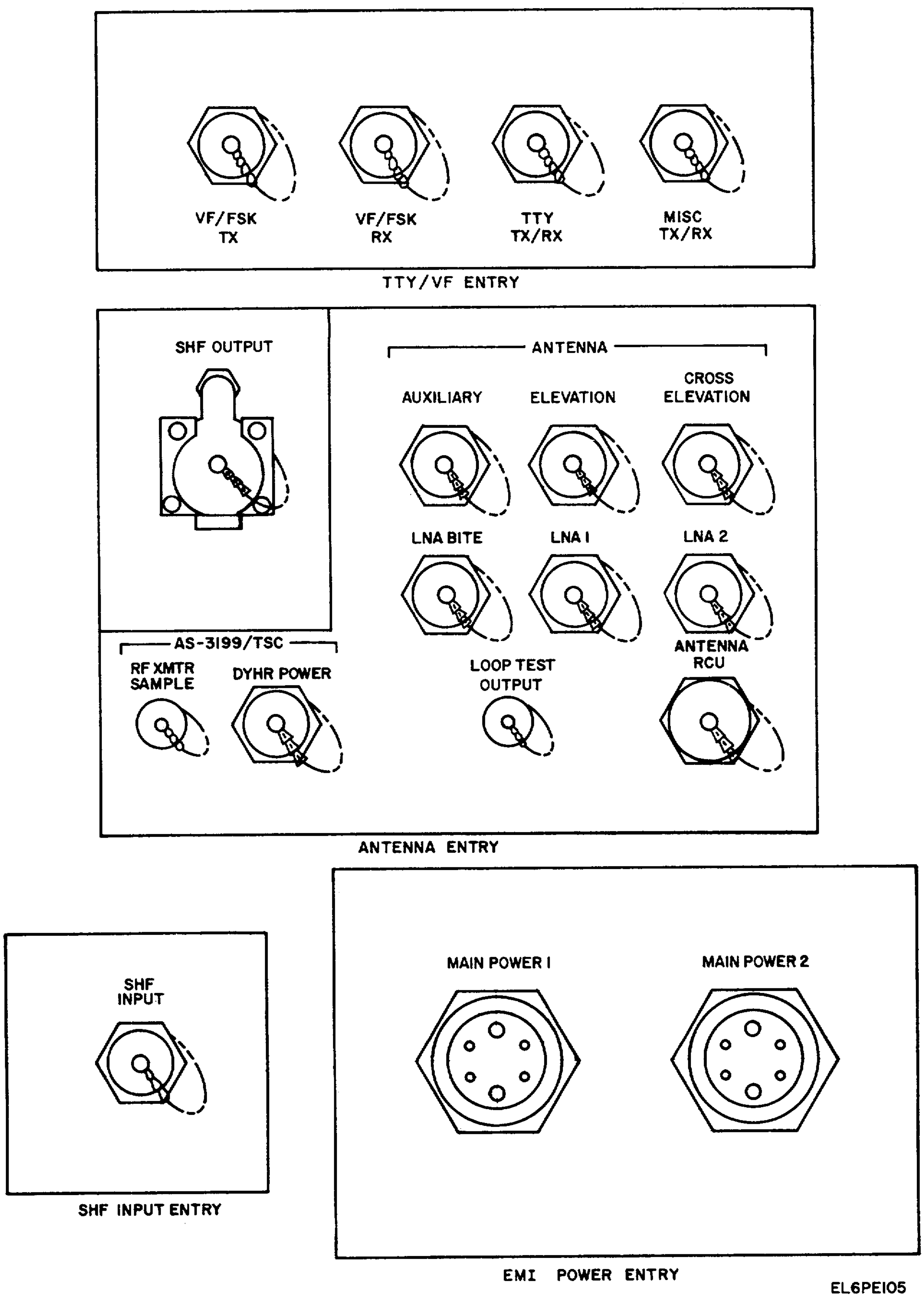


Figure 2-17. External Circuit Connection Entry Panels (Sheet 2 of 2).

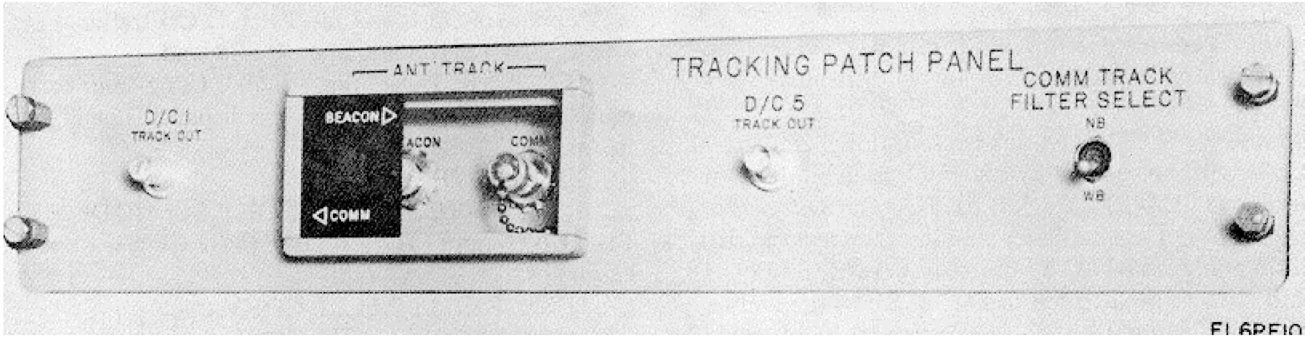


Figure 2-18. Track Patch Panel, Patch Connector Locations.

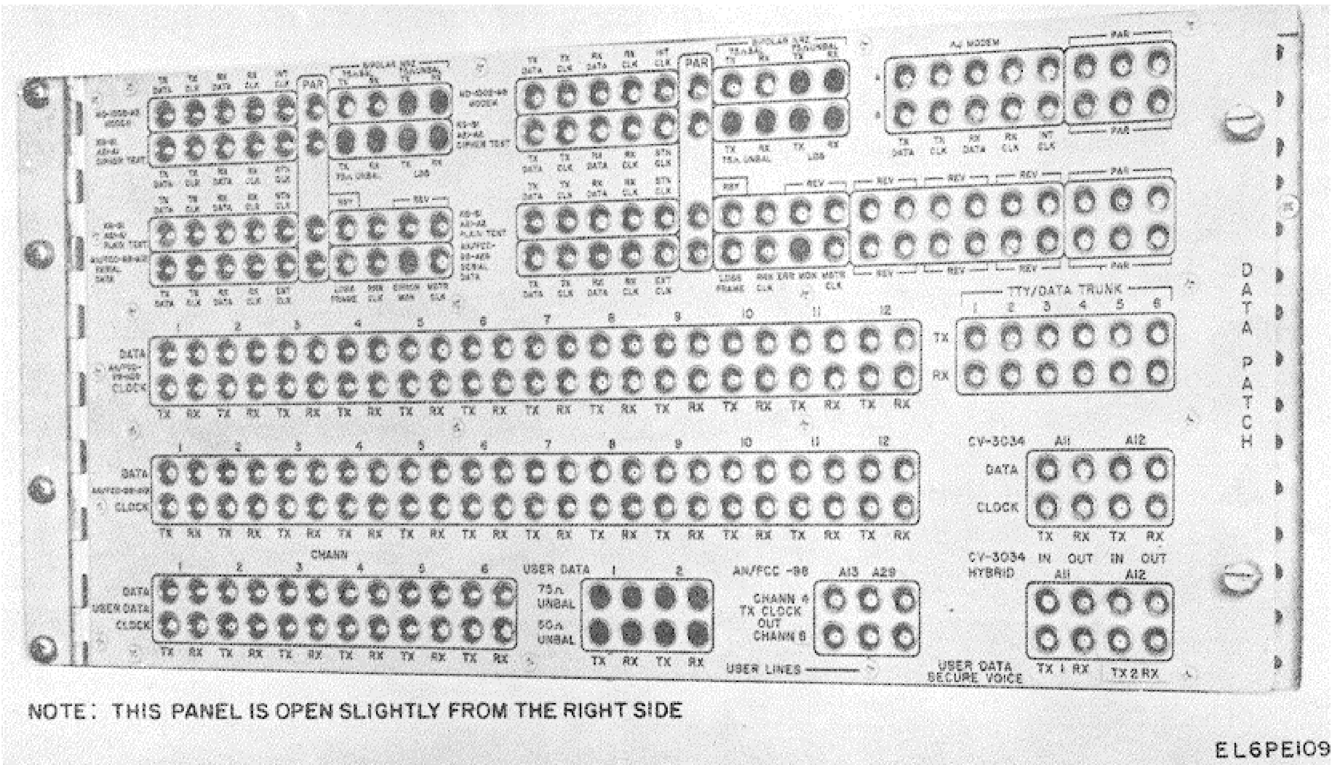


Figure 2-19. Data Patch Panel, Patch Connector Locations.

2-24. Shelter Interior Patch Panel Connections

a. Signal flow routing varies with mission requirements and must be coordinated with all other terminals in that node. The following paragraphs will cover patch panel connections to meet these mission requirements.

b. To reduce the use of patch cables to the maximum extent possible, the AN/TSC-86 uses normal-through jack field wiring in the VF, TTY/Low Level, and the TTY/FSK patch panels. Signals from the user VF and TTY lines are routed through the CDF matrix patch board which allows flexibility in signal routing of each user through any available signal processing thread and multiplexer channel port.

These routing considerations will be covered for each signal traffic mode.

c. Patch panel connections for the various signal modes and traffic types are covered as follows:

(1) Tracking patch panel (fig. 2-18).

(2) IF patch panel (fig. 2-21).

(3) Central distribution frame (CDF, Matrix patch board).

(4) Data patch panel (fig. 2-19).

(5) VF patch panel.

(6) TTY/low level patch panel.
(7) TTY/FSK patch panel.
(8) Transmit patch panel (fig. 2-21).

d. Tracking Patch Panel (fig. 2-18). Mission control will determine whether BEACON or COMM track will be used. If COMM track is used, down converter D/C 1 will be on-line with D/C 5 available for standby. If BEACON track is used, D/C 5 will be on- line with D/C 1 available for standby. However in this latter mode with a D/C 5 failure, any traffic on D/C 1 would have to be directed to D/C 2, 3 or 4 depending upon total terminal traffic requirements. Patch cable connections for these two tracking modes are as follows:

Tracking Mode	Down Converter On-Line	Standby	Patch Cable Connection
COMM	D/C 1	D/C 5	D/C 1 TRACK OUT to ANT. TRACK, COMM
COMM*	D/C 5	D/C 1 Failure	D/C TRACK OUT to ANT. TRACK, COMM
BEACON	D/C 5	D/C 1	D/C TRACK OUT to ANT. TRACK BEACON
BEACON**	D/C 1 Failure	D/C5	D/C 1 TRACK OUT to ANT. TRACK, BEACON

*Failure of On-Line Unit

**Failure of On-Line Unit, Patch D/C 1 traffic to D/C 2, 3 or 4 depending upon traffic load.

e. IF Patch Panel (fig. 2-20). Using four-carrier multichannel operation the IF patch panel is patched as follows:

(1) *XMT IF Patch.*

(a) MODEM 1 to UP CONV 1 or MODEM 1 to FILTER IN and FILTER OUT to UP CONV 1 if filter is used.

(b) EXT IF 2 to UP CONV 2.

(c) EXT IF 3 to UP CONV 3.

(d) EXT IF 4 to UP CONV 4.

(2) *RECEIVE IF PATCH.*

(a) MODEM 1 to DOWN CONV 1 or DOWN CONV 1 to FILTER 2 IN and FILTER 2 OUT to MODEM 1 if filter is used.

(b) EXT IF 2 to DOWN CONV 2.

(c) EXT IF 3 to DOWN CONV 3.

(d) EXT IF 4 to DOWN CONV 4.

Mission control may require other signal routing between internal modem, external IF users and the up and down converters. Coaxial patch cables are supplied for meeting these needs and for cross-patching in the event of equipment failures.

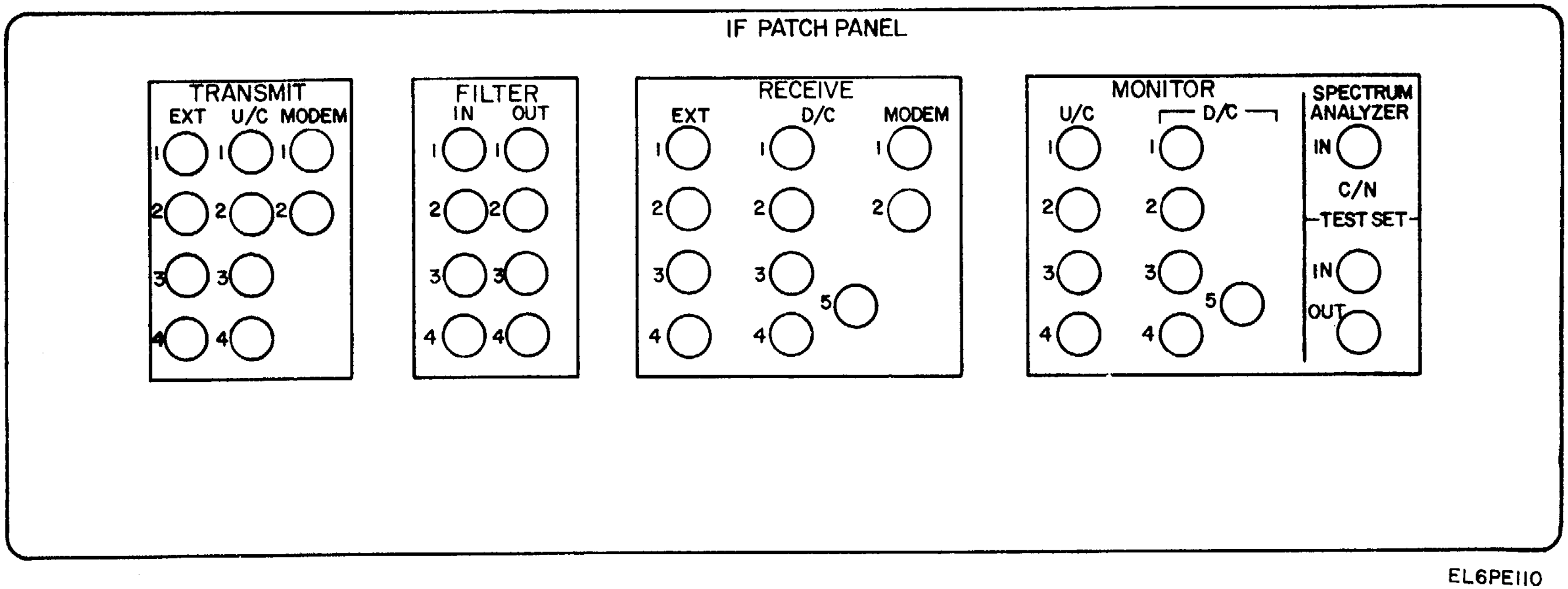


Figure 2-20. IF Patch Panel, Patch Connector Locations.

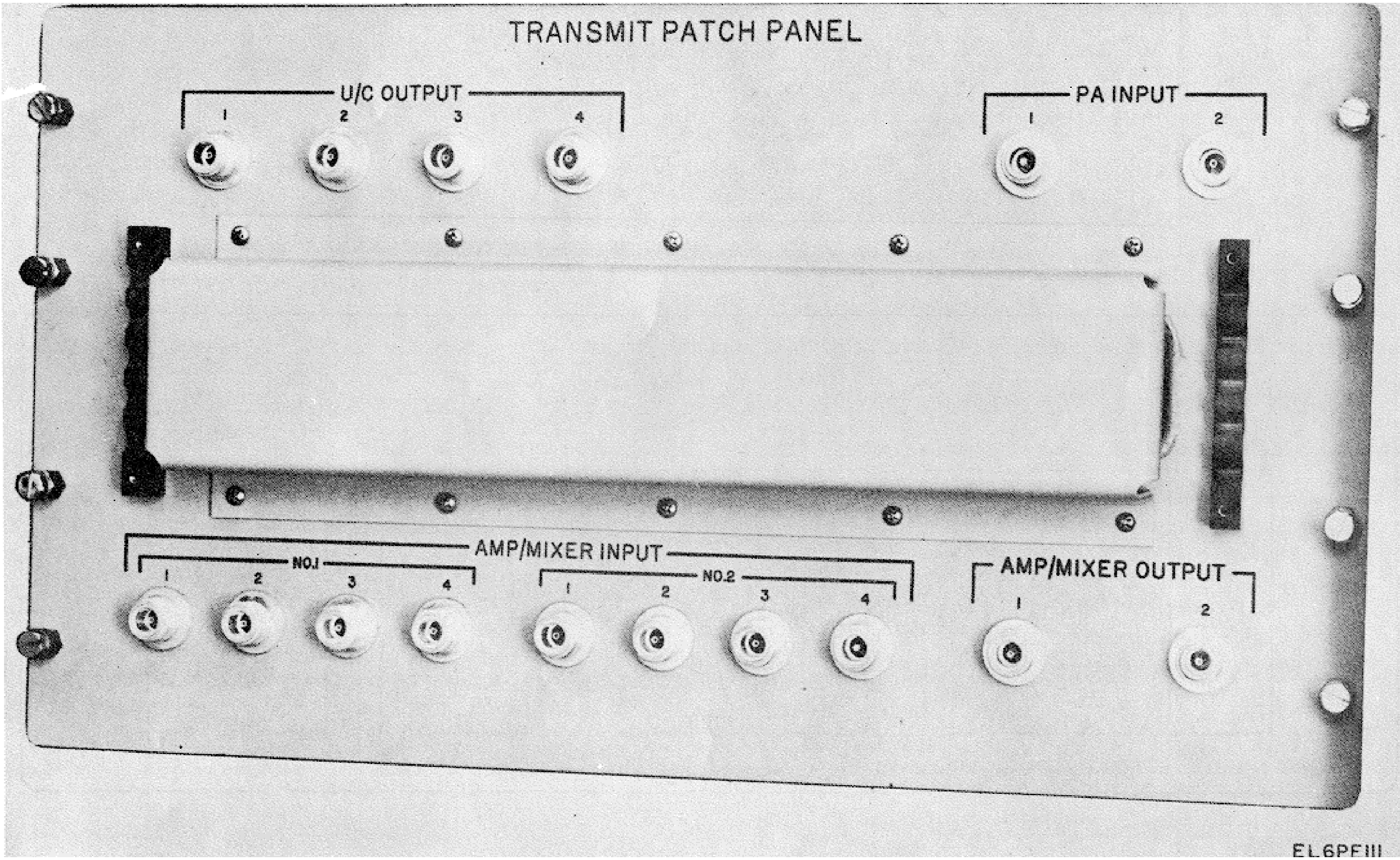


Figure 2-21. Transmit Patch Panel, Patch Connector Locations.

f. Central Distribution Frame. Signal routing of user VF, TTY/FSK and TTY/low level circuits to the CSS is done at the CDF matrix patch board using the red (four wire circuit) programming pins. When inserted into the board, these pins connect a user four wire circuit, available at the external J-Box, to a specific CSS equipment processing thread.

(1) *VF circuits.*

(*a*) The normal configuration is to connect user line side VF channels 1 through 12 to VF patch panel, VF EQPT channels 1 through 12, respectively. The programming pins form a diagonal line 1 to 1 through 12 to 12.

(*b*) User line side, channels 13 through 19 are connected to VF patch panel. CDF spares 1 through 7, respectively making J-Box spare four wire circuits available directly at the VF Patch Panel.

(*c*) VF circuits, data bypass mode. For users employing voice band data modems exclusively, the echo suppressor can be disabled (on a channel by channel basis) using spare terminal pairs at the VF XMT J-Box. This is done using a programming pin at the matrix board to connect the data user channel ES disable line to the TX J-Box and shorting the chosen spare terminal pair. This function could be extended to the user location for control of that circuit for data or voice. It should be noted that voice band data modem user having the tone disabling feature does not require the metallic ES disable function.

(2) *TTY/FSK users.* The CSS can accept up to five user TTY/FSK channels. These are usually connected to VS/FSK TX and RX J-Box terminal pairs 20 through 24. Programming pins then route these user circuits to TTY/FSK patch, channels 1 through 5, respectively.

(3) *TTY/low level users (fig. 3-13).* The CSS can accept up to four user TTY/low level channels. These are connected from the TTY, TX/RX J-Box, terminal pairs 11, 13, 15 and 17 transmit, terminal pairs 12, 14, 16 and 18 receive to the CDF Matrix Patch LO LEV 1, 2, 3 and 4, respectively. Programming pins then route these user circuits to TTY LO PATCH 1, 2, 3 and 4.

(4) *TTY/high level users*. TTY high level users are connected at the TTY, TX/RX- J-Box, terminal pairs 19, 21 and 23 transmit and 20, 22 and 24 receive. These user circuits do not appear on the matrix patch but are routed through the CDF fuse panel. These user lines terminate at the high level side of the line isolator units, LIU-1, 2 and 3, respectively. Patching of the LIU is on the low level side only.

g. Data Patch Panel (fig. 2-19).

(1) *Serial data stream patching*. Using blue triaxial looping plugs (LPTWM-78), patch the following circuits:

(*a*) MD-1002-A3 Modern to KG81-A21A1 Cipher Text:

TX Data to TX Data
TX Clk to TX Clk
RX Data to RX Data
RX Clk to RX Clk
Modem INT CLK to Par bus

(b) KG81-A21-A1 Plain Text to AN/FCC98-A13 Serial Data:

TX Data to TX Data
TX Clk to TX Clk
RX Data to RX Data
RX Clk to RX Clk
FCC98 EXT Clk to Par bus
FCC-98 Lose Frame to RSY

(*c*) Repeat *(a)* above for MD1002-A6 modem to KG81-A21-A2 cipher text.

(d) Repeat *(b)* above for KG81-A21-A2 plain text to AN/FCC-98-A29 serial data.

(*e*) Patching of the standby modem and MUX in (*c*) and (*d*) above allows monitoring these units on an active basis with the modem looped at the IF patch.

(2) *User data rate patching*.

(*a*) Patching of the multiplexer user data rate ports depends upon the mission requirements and must be coordinated with all other terminals in the node.

(*b*) User data from any of the data entrance panel ports must correspond to the multiplexer data module rate to which it is patched. These rates are limited by the multiplexer to 0-20, 50, 56/64/128/256/ 512 kB/s. Reference must be made to the multiplexer TM for data module programming and allowable location within the multiplexer main frame. In the AN/TSC-86 the data modules will be restricted to the first 12 multiplexer slots with VF traffic occupying the rest of the multiplexer slots in a fully loaded, 1544 kB/s MBS, system.

(*c*) Twinaxial patch cords are used to patch each data user to the on-line multiplexer:

TX DATA to TX DATA
TX CLOCK to TX CLOCK
RX DATA to RX DATA
RX CLOCK to RX CLOCK

(*d*) For synchronous data operation at 56, 64, 128, 256 and 512 kB/s the user transmit data must be phase locked to the multiplexer and such operation limited to multiplexer slot 4 and 8. Triaxial looping plugs are then used at the data patch to connect the AN/FCC-98-A13 or A29, channel 4 and/or channel 8 TX CLOCK OUT to the user lines. These looping plugs are oriented horizontally for this patch function.

(*e*) The 50 kB/s data channels are for user encrypted secure voice and are processed through the CV-3034 A/D converters. Patching of these circuits is done with triaxial looping plug as follows:

User Data, Secure Voice	CV-3034 Hybrid
TX 1	A11 TX
RX 1	A11 RX
TX 2	A12 TX
RX 2	A12 RX

CV-3034 interface to the multiplexer 50 kB/s channel is done with twinaxial patch cords to the proper 50 kB/s channel slot of the on-line multiplexer:

TX DATA to TX DATA
TX CLOCK to TX CLOCK
RX DATA to RX DATA
RX CLOCK to RX CLOCK

h. VF Patch Panel (fig. 3-15).

(1) With the exception of the order wire and TTY group accesses, the VF patch panel uses normal-through jack field wiring requiring no patch cords for routing the 12 user VF channels through the signal processing stages to the VF ports of the on-line multiplexer.

(2) For 1544 kB/s MBS operation the 12 user VF channels are routed to the on-line multiplexer channel slots 1 through 24 not used for data. This is done with the three position lever switches of the VF patch panel. These switches allow the following routing of the user VF channel group:

(*a*)	Switches 1 through 12 Up Switches 13 through 24 Neutral (Center)	User VF group to MUX A29 channel slots 1 through 12. For 772 kB/s or less MBS operation.
(*b*)	Switches 1 through 12 Neutral Switches 13 through 24 UP	User VF group to MUX A29 channel slots 13 through 24. For 1544 kB/s MBS operation.
(*c*)	Switches 1 through 12 Down Switches 13 through 25 Neutral	User VF group to MUX A13 channel slots 1 through 12. For 772 kB/s, or less, MBS operation.
(*d*)	Switches 1 through 12 Neutral Switches 13 through 24 Down	User group to MUX A13 channel slots 13 through 24. For 1544 kB/s MBS operation.

(3) Orderwire group.

(*a*) Three ports of the orderwire bridge appear on the VF Patch Panel, of which only one is used for normal link orderwire use. These circuits are not wired through and must be patched to an available VF channel port (slot), equipped with an EM4 module of the on-line multiplexer.

(*b*) Typical operation for a fully loaded 1544 kB/s, MBS system, with 12 user VF channels, would assign one of the multiplexer slots 1 through 12 for link orderwire (since slots 13 through 24 carry the user 12 channel VF group). Patching for this service would then be: OW BRIDGE, LINE, TX, 1, RX to MUX A29 (or A13) LINE using a Bantam dual patch cord.

(4) TTY group. This four wire circuit from the TTY/FSK filter bridge appears on the VF patch panel and is patched in similar manner to that of the orderwire group to an assigned multiplexer slot equipped with an EM4 VF module.

(5) VF/TTY trunk. These three 4-wire circuits appear on the TTY/FSK patch panel and allow routing high priority TTY traffic to the available multiplexer VF circuits. Patch considerations are identical to that of the TTY or orderwire groups.

i. TTY/Low Level Patch Panel (fig. 3-13).

(1) The TTY/low levelpatch panel is wired normal- through from the four user low level circuits to the low level side of the four keyer/converters.

(2) The low level side of the three line isolator units (LIU) must be patched 'to the keyer/converters to bring them on-line. This patching will preempt a low level user. This patching would be: LIU LOW LEVEL, 1, 2 or 3, LINE TO KEY/ CONV, EQPT 1, 2, 3 or 4, assignment.

(3) The local TTY machine must also be patched to come on-line. Patching and frequency coordination is identical to that of the LIU.

(4) TTY/data trunk. Six, 4-wire circuits between the TTY/low level patch and the data patch panel allow routing of high priority TTY traffic to any available low rate 20 kB/s data channels. This patching would be from any LINE side low level user to the EQPT jacks of the TTY/data trunk using twin bantam patch cords.

j. TTY/FSK Patch.

(1) The TTY/FSK patch panel is wired normal- through from the FSK side of the four keyer/converters and the five user remote FSK circuits to the nine channel TTY filter bridge. No patch cords are required for this configuration.

(2) Three, 4-wire trunk circuits are provided for patching high priority FSK traffic to available VF channels. Patching would be from the line jacks to EQPT jack row of the VF/TTY trunk using twin bantam patch cords.

CHAPTER 3
OPERATING INSTRUCTIONS

Section I. CONTROLS AND INDICATORS

3-1. Damage from Improper Control Settings

A very real possibility of degraded performance of the satellite transponder could occur if the terminal transmitter power output was inadvertently set too high. A wrong setting on the power amplifier monitor scale switch could set the power output to 10 times or even 100 times the desired output level. An excessively strong transmit signal may overload or capture the transponder thereby causing other terminal downlink signals to operate at a reduced power level. Therefore, when adjusting transmitter power, be careful not to exceed the assigned output level.

3-2. Operator Controls and Indicators

This section includes illustrations (fig. 3-1 through 3-16) which show all operating controls and indicators for major units of the terminal. The function of each control and indicator is described in table 3-1 through 3-16 for the associated major unit. Each table also contains a reference to an applicable figure and an index number for the item in that figure.

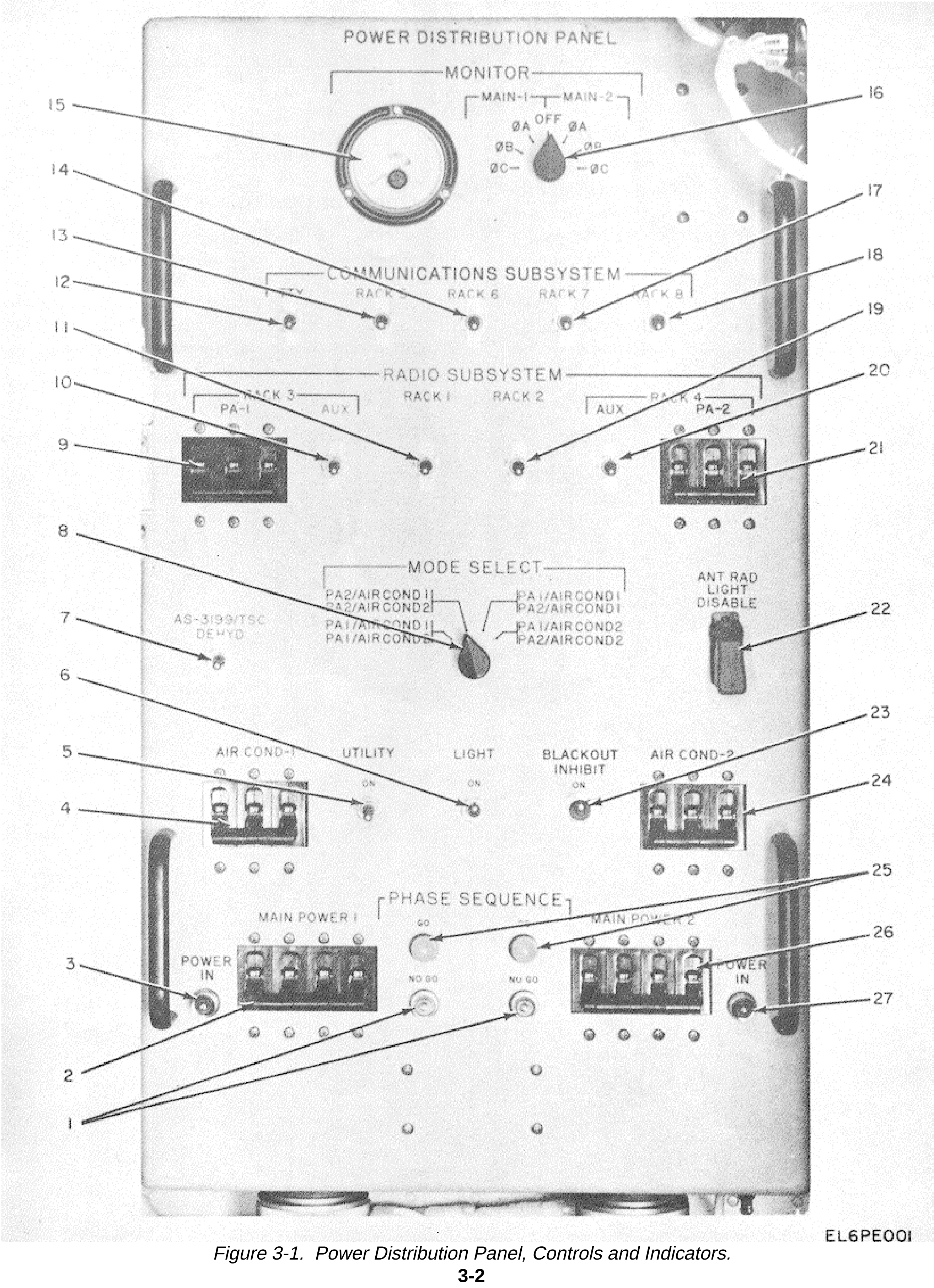


Figure 3-1. Power Distribution Panel, Controls and Indicators.

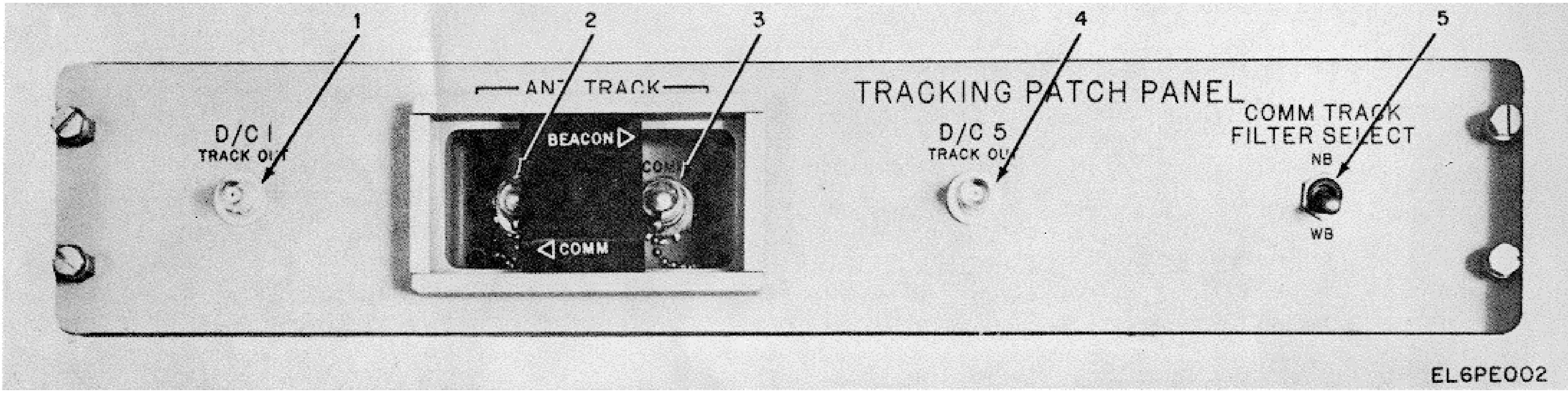


Figure 3-2. Track Patch Panel, Controls and Indicators.

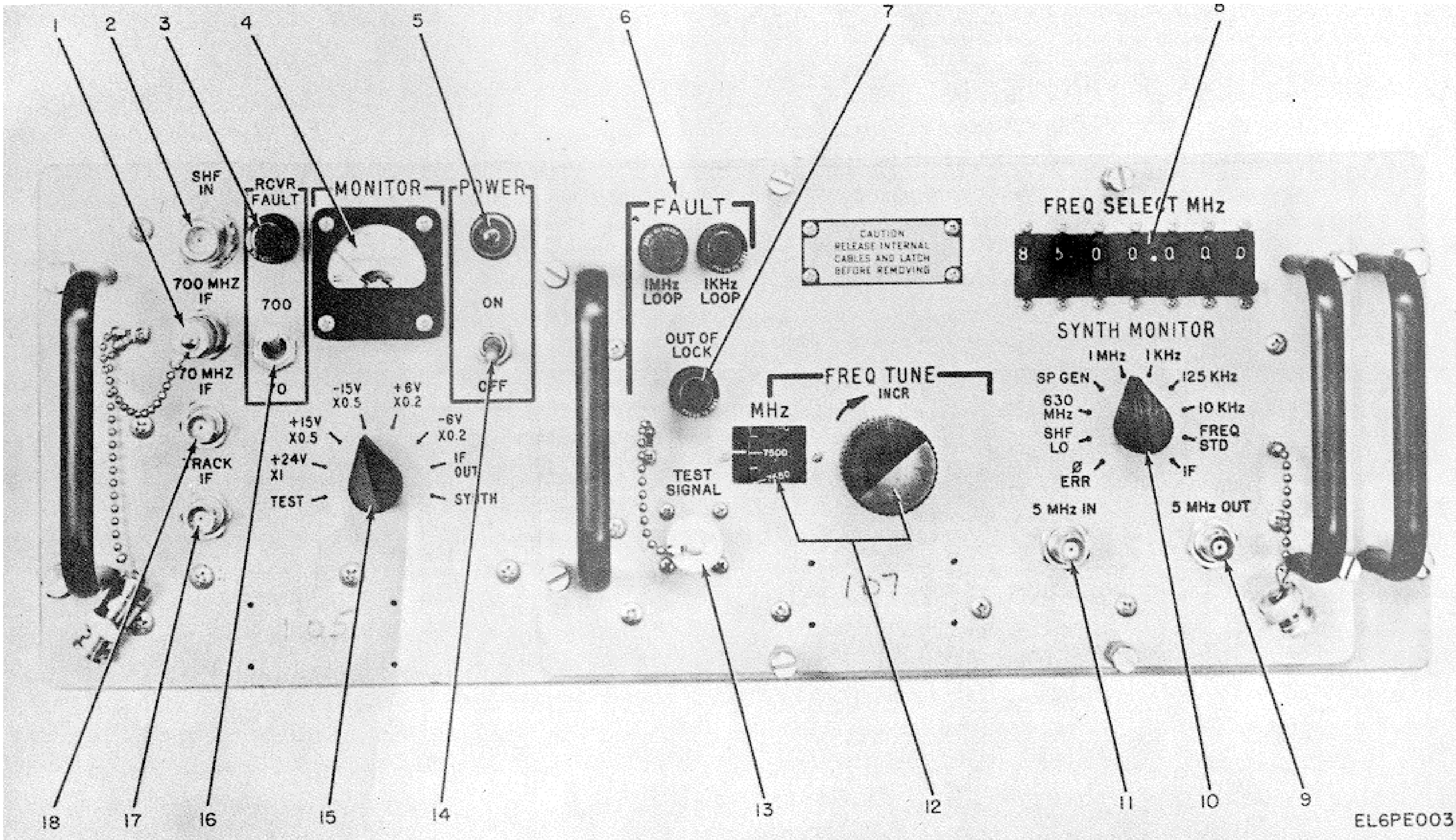


Figure 3-3. Downconverter, Controls and Indicators.

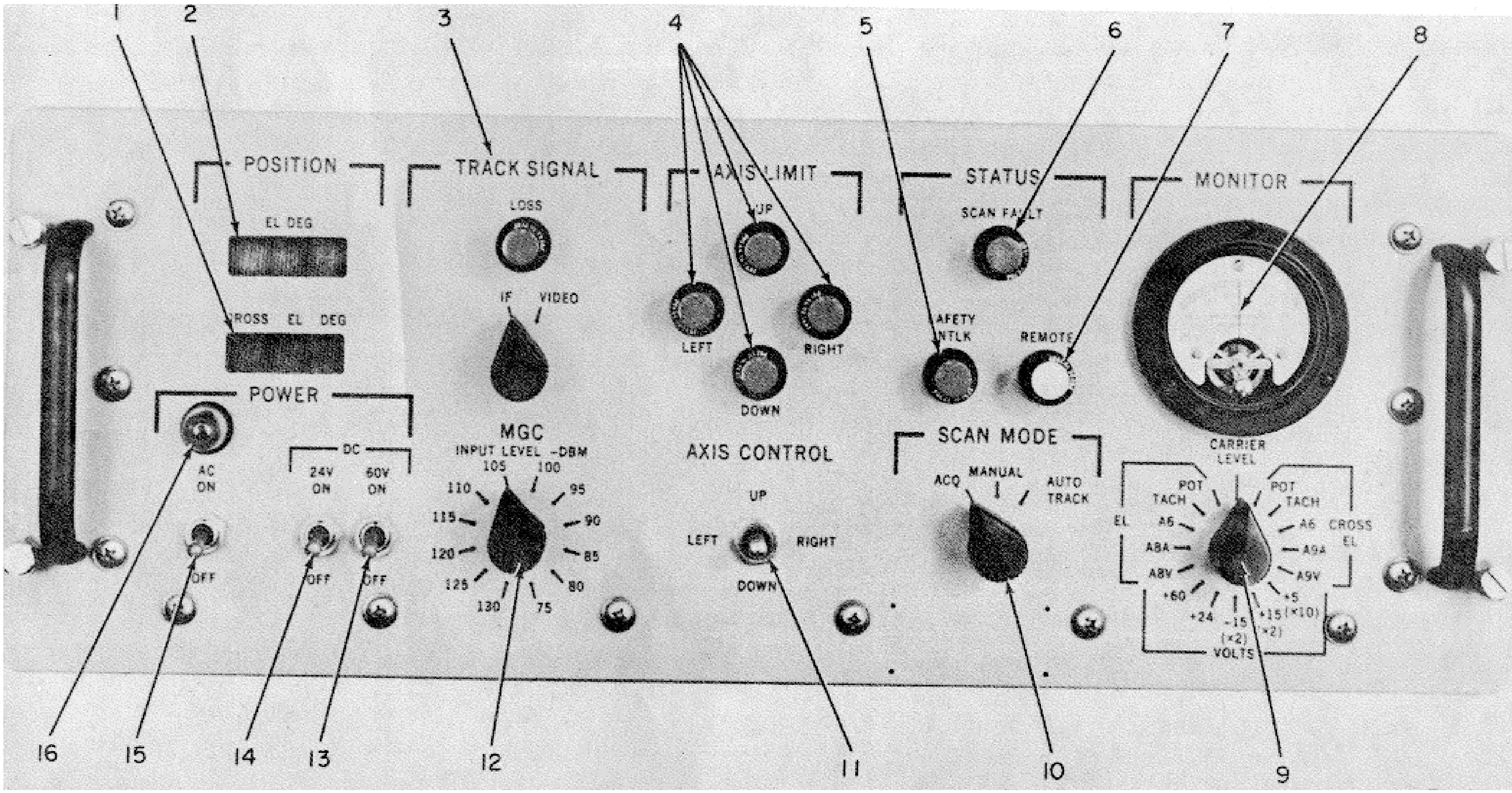


Figure 3-4. Antenna Control, Controls and Indicators.

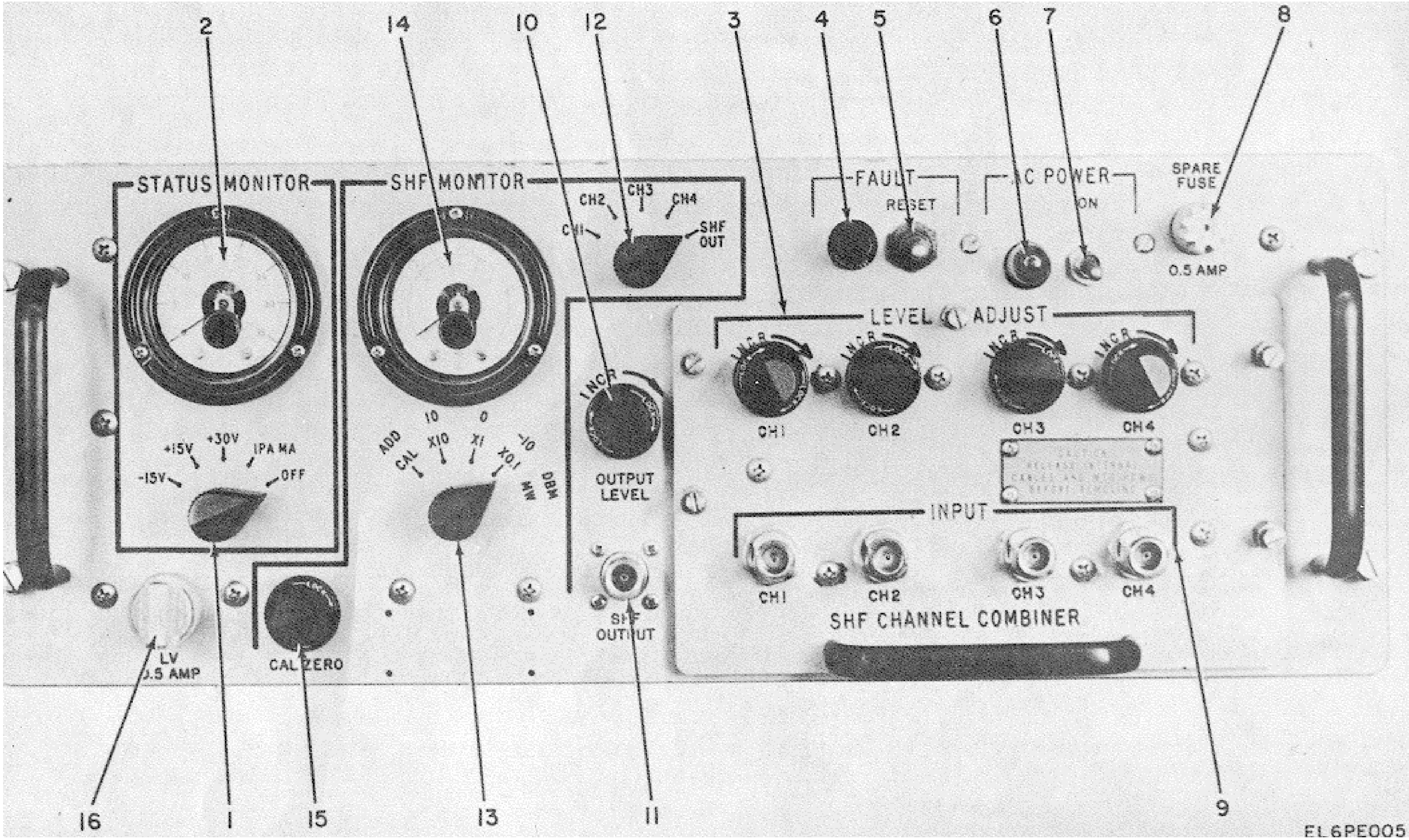


Figure 3-5. Amplifier/Mixer, Controls and Indicators.

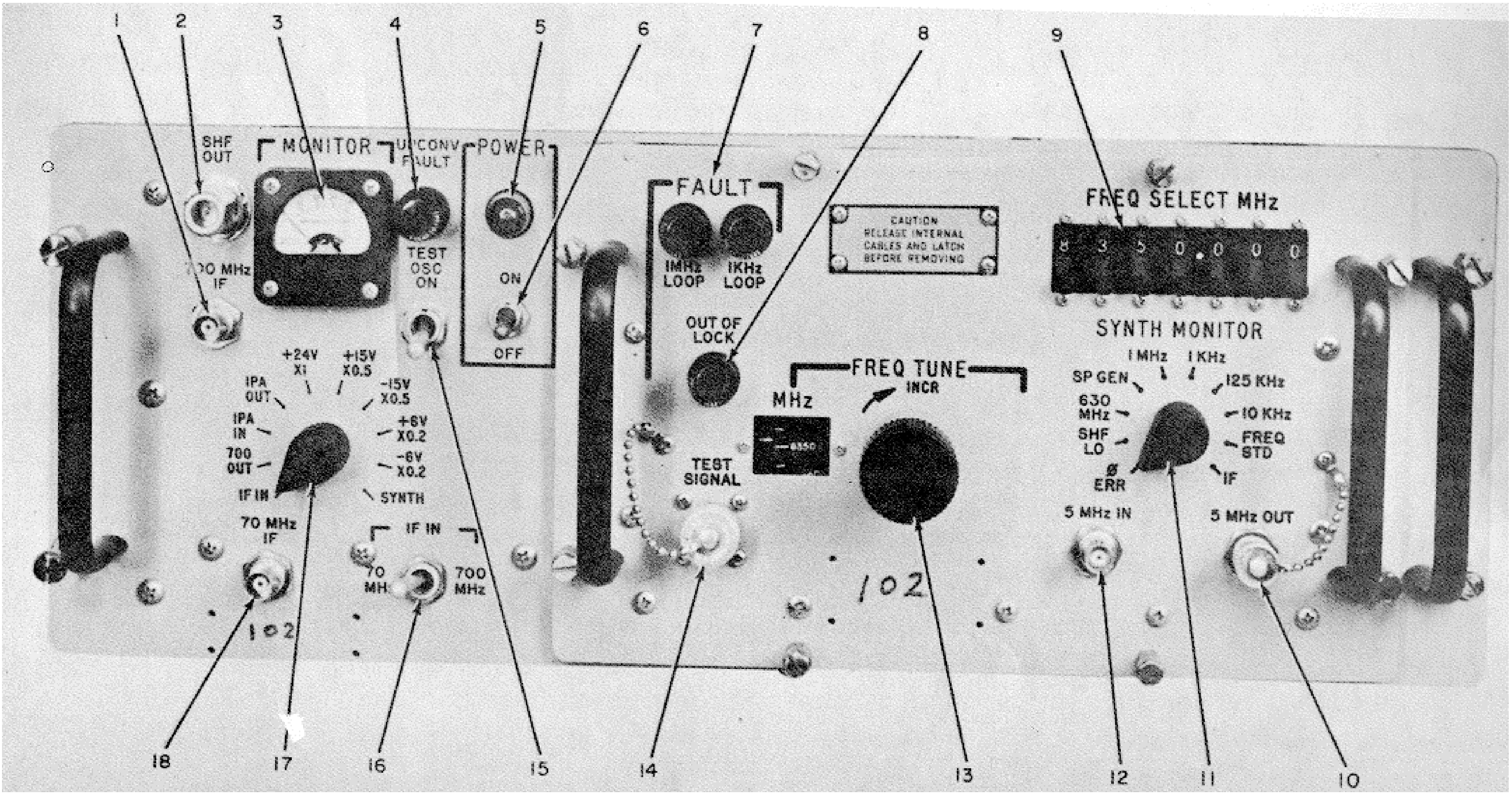


Figure 3-6. Upconverter, Controls and Indicators.

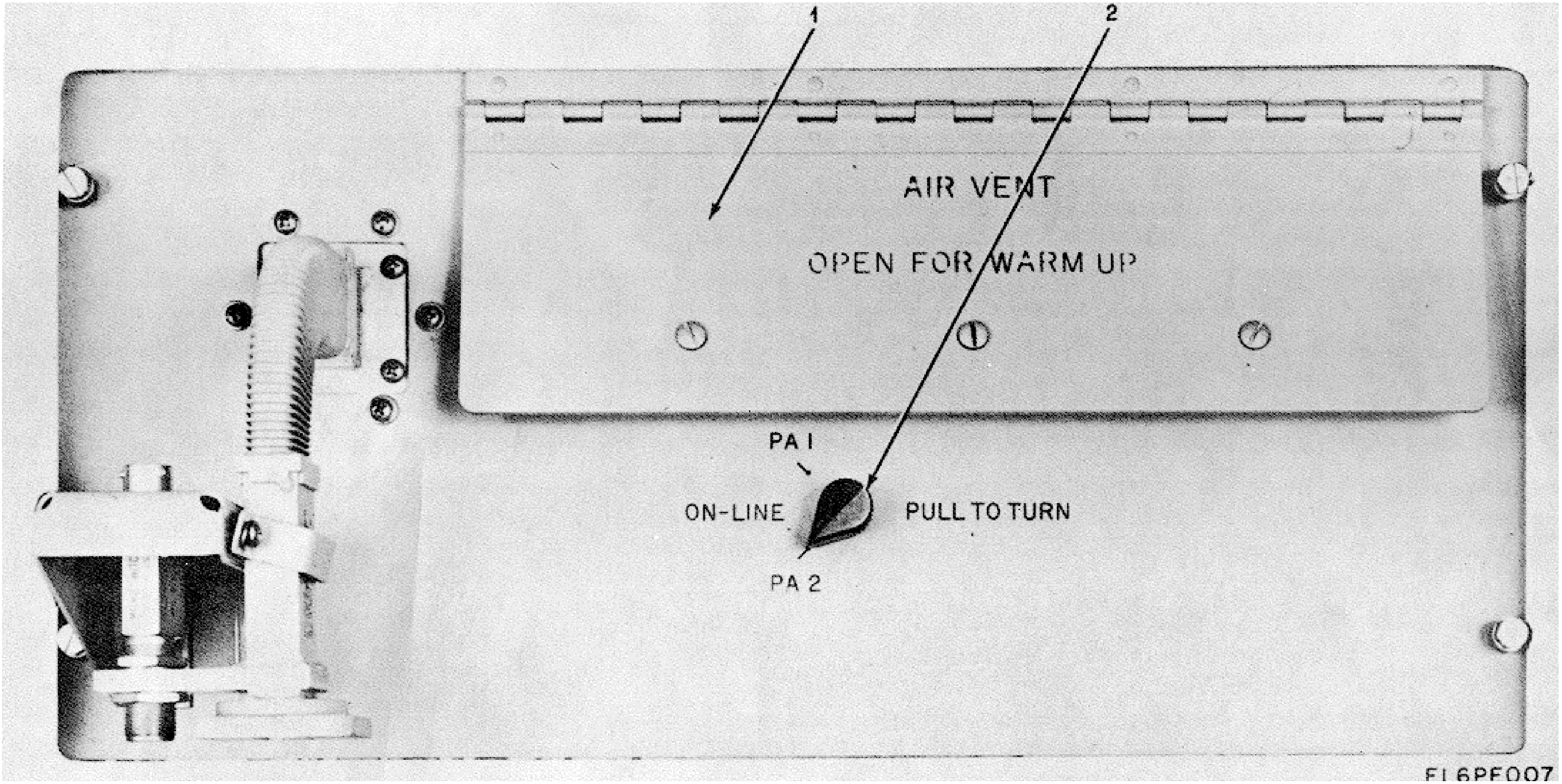


Figure 3-7. Waveguide Switch w/Air Vent, Controls.

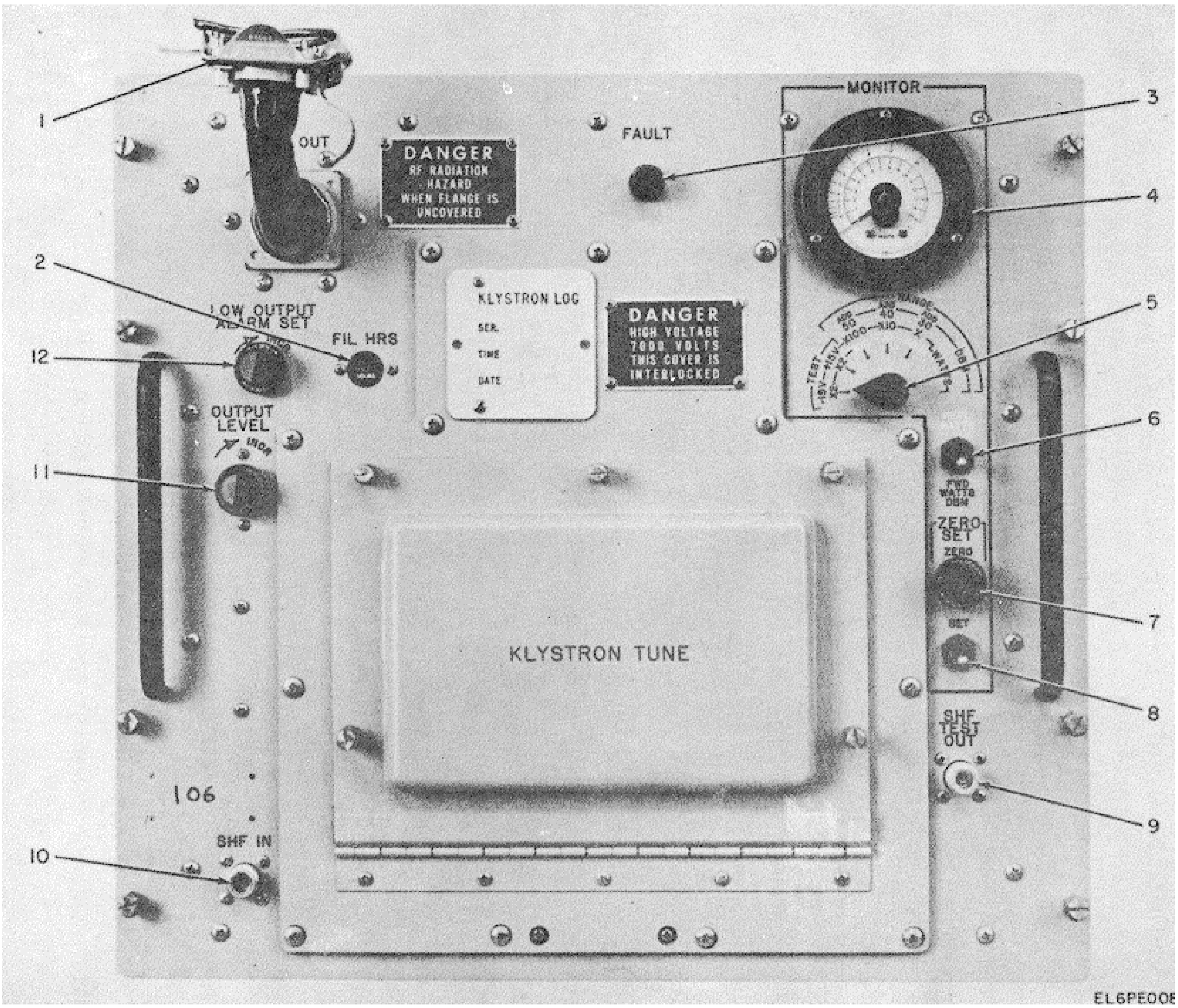
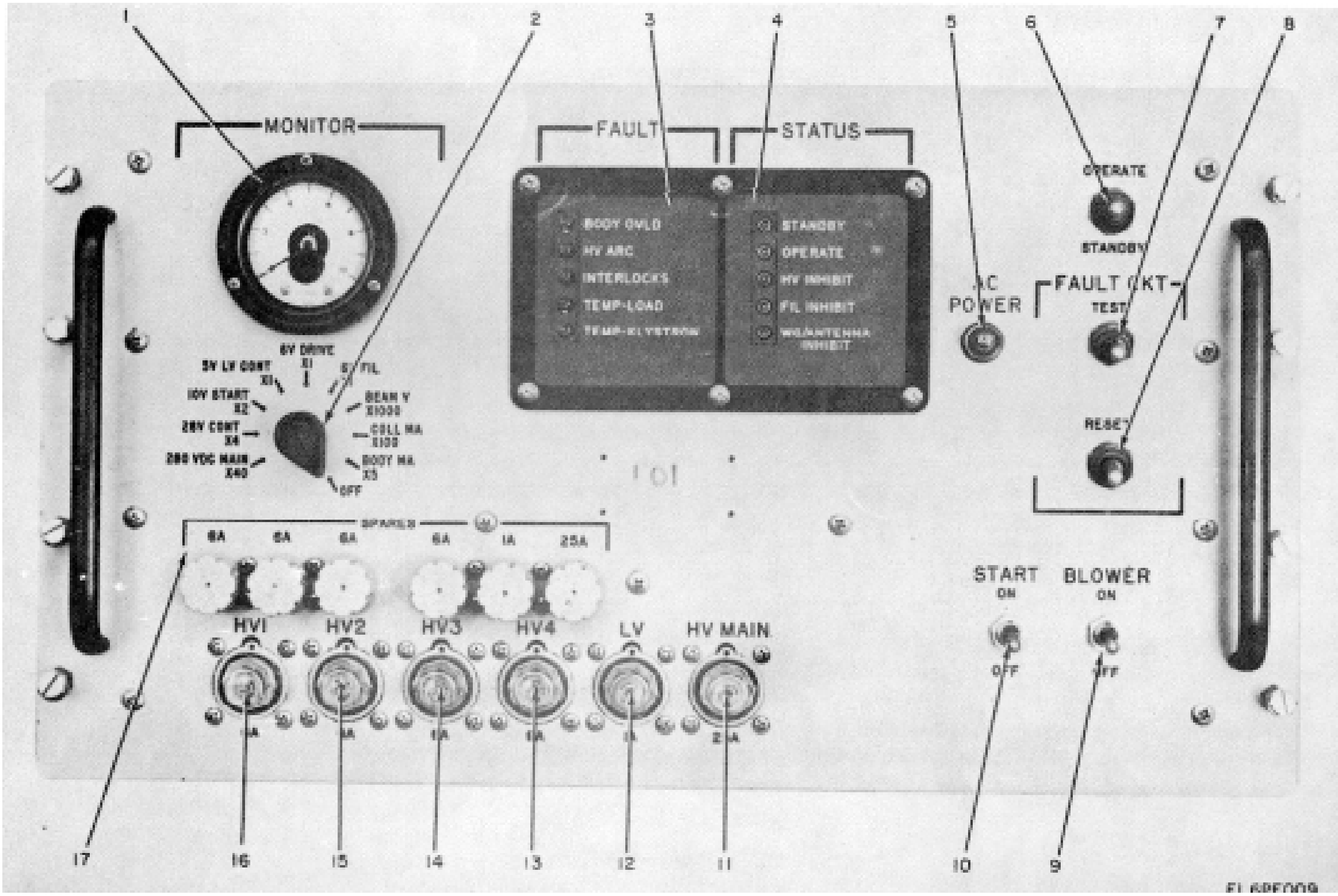


Figure 3-8. Power Amplifier, Controls and Indicators



EL6PE009

Figure 3-9. Power Supply PP-7087, Controls and Indicators.

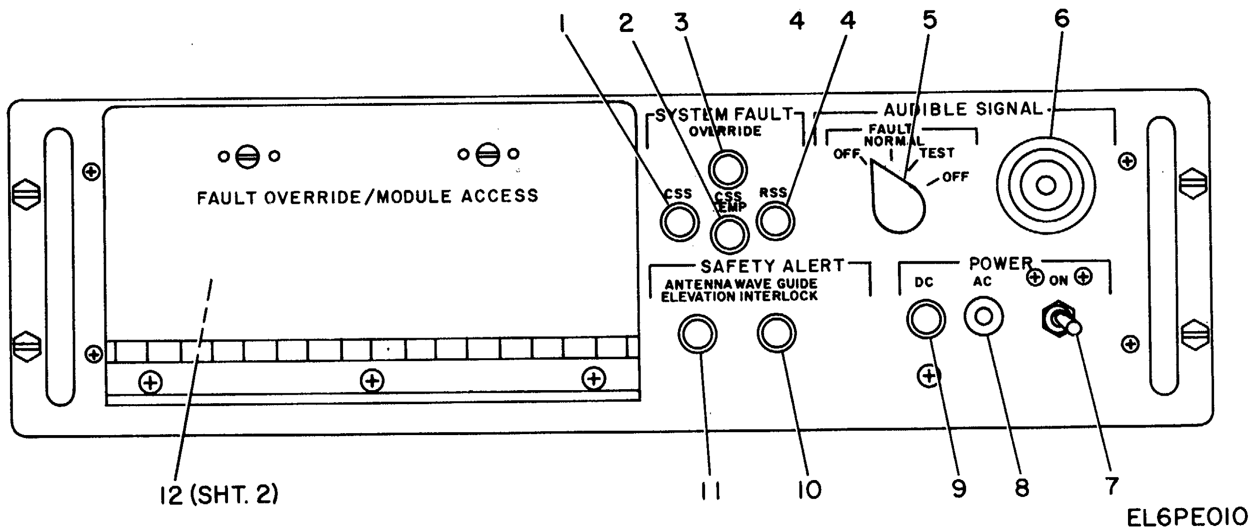


Figure 3-10. Alarm Monitor, Controls and Indicators (Sheet 1 of 2).

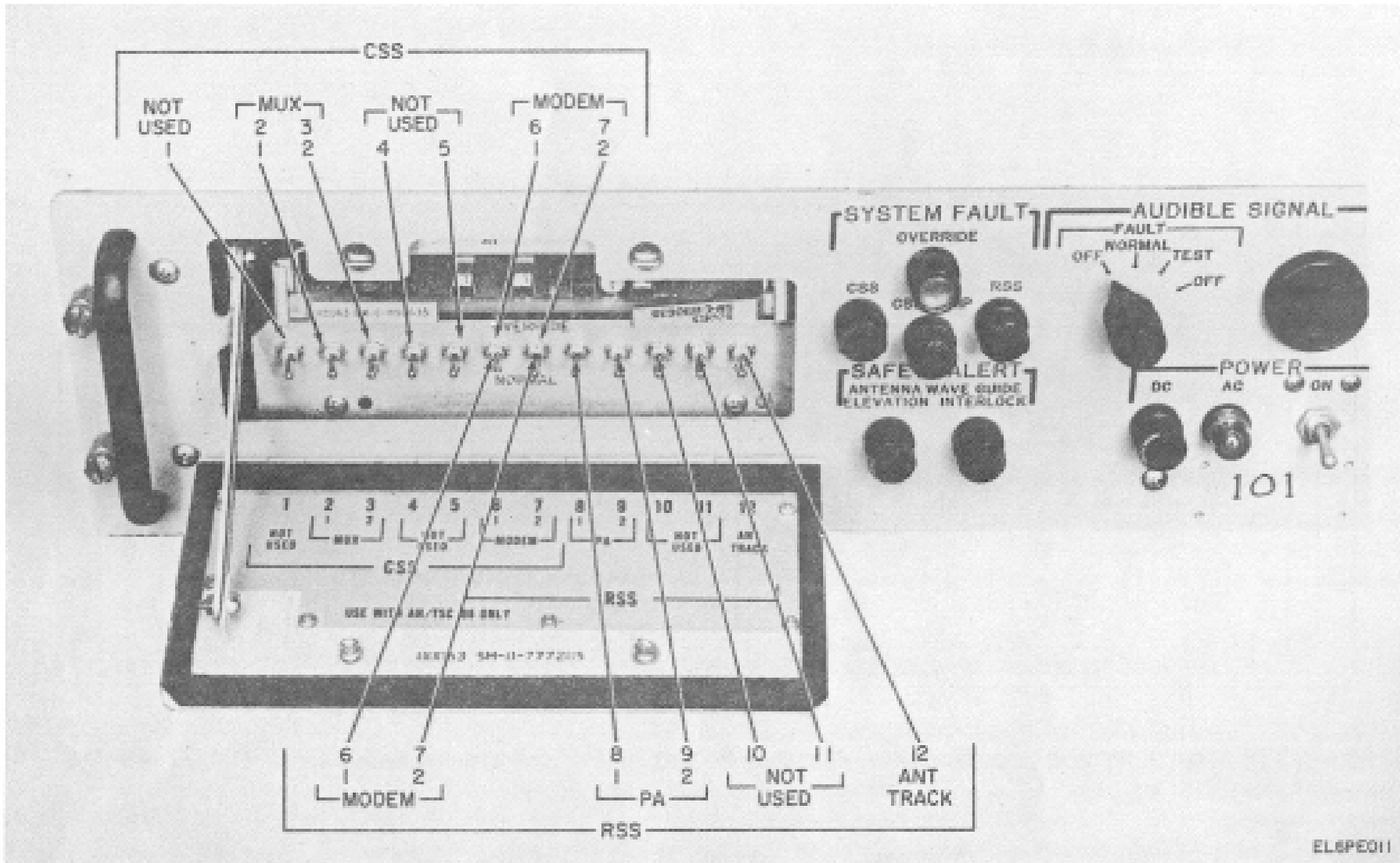


Figure 3-10. Alarm Monitor, Controls and Indicators (Sheet 2 of 2).

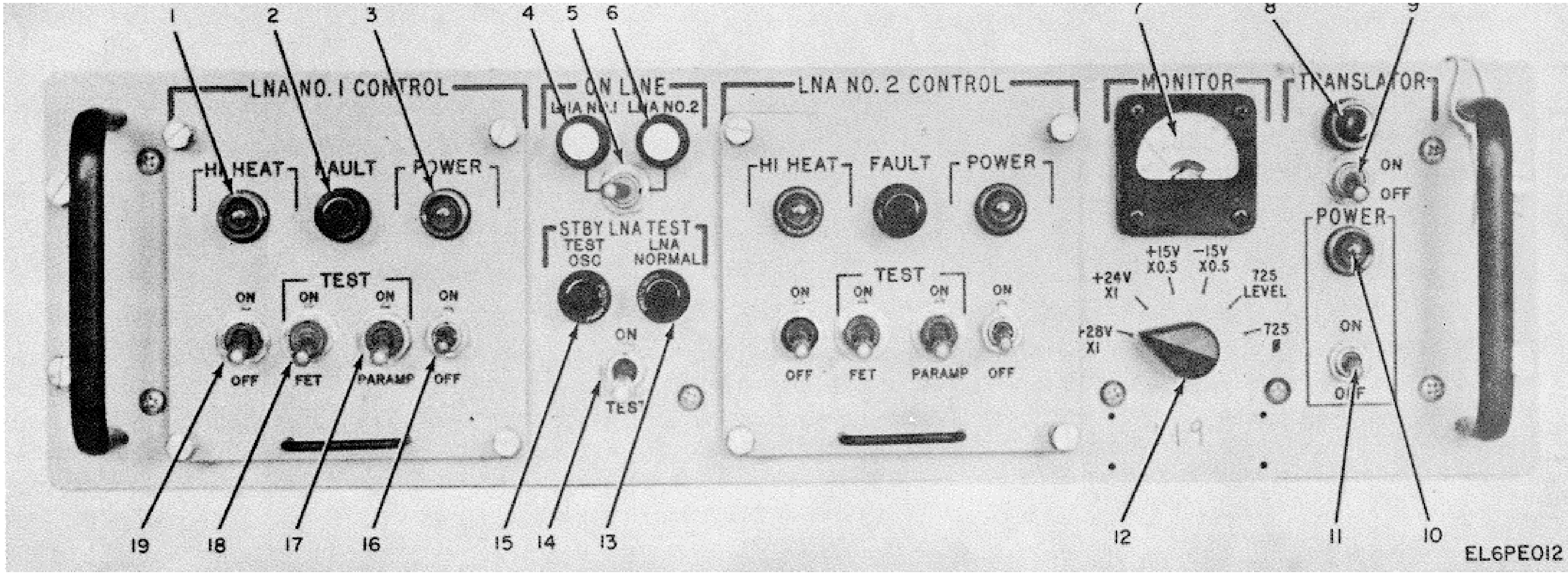
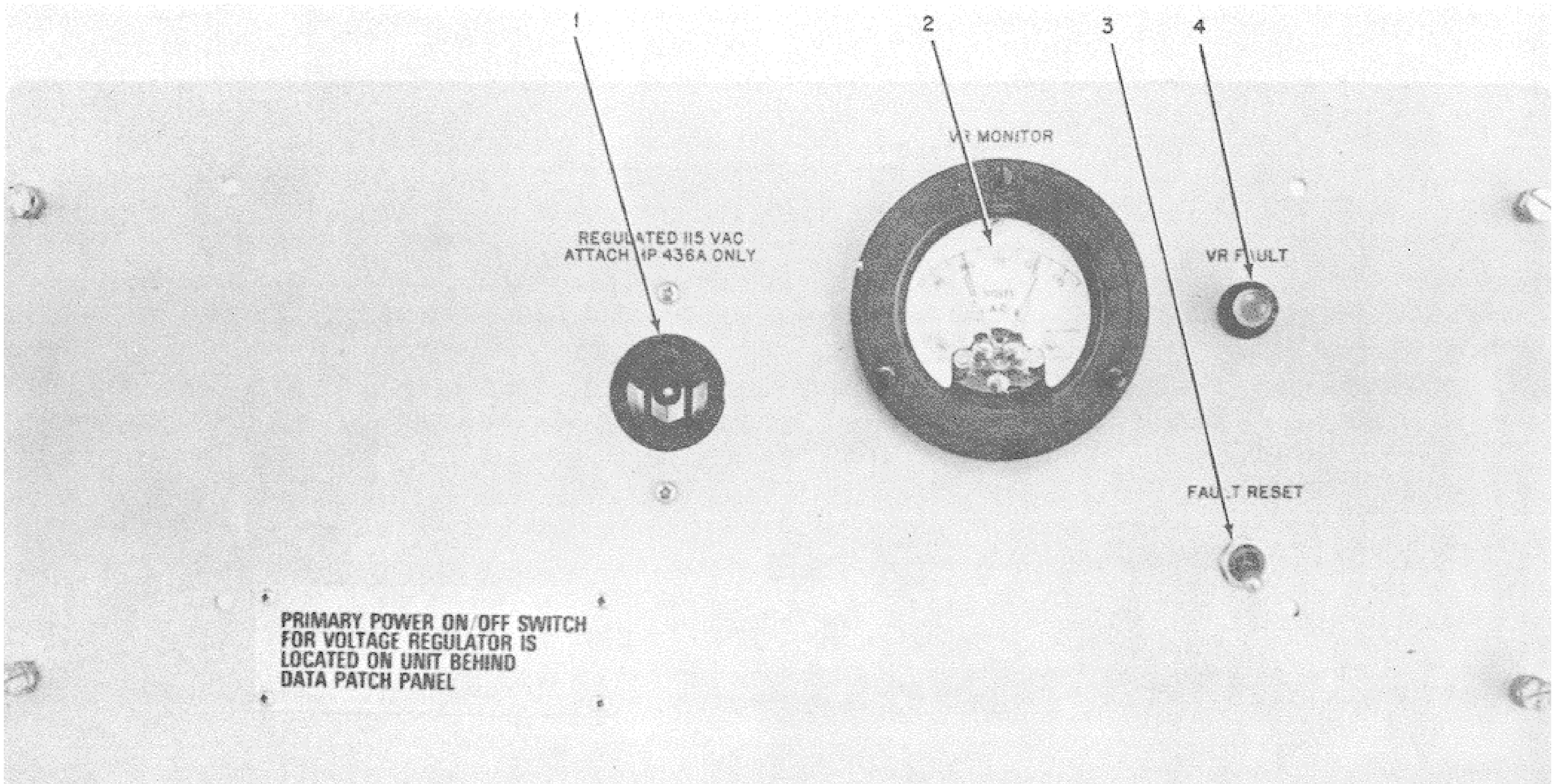


Figure 3-11. Control/Translator, Controls and Indicators.



EL6PE013

Figure 3-12. AC Regulator Monitor Panel, Controls and Indicators.

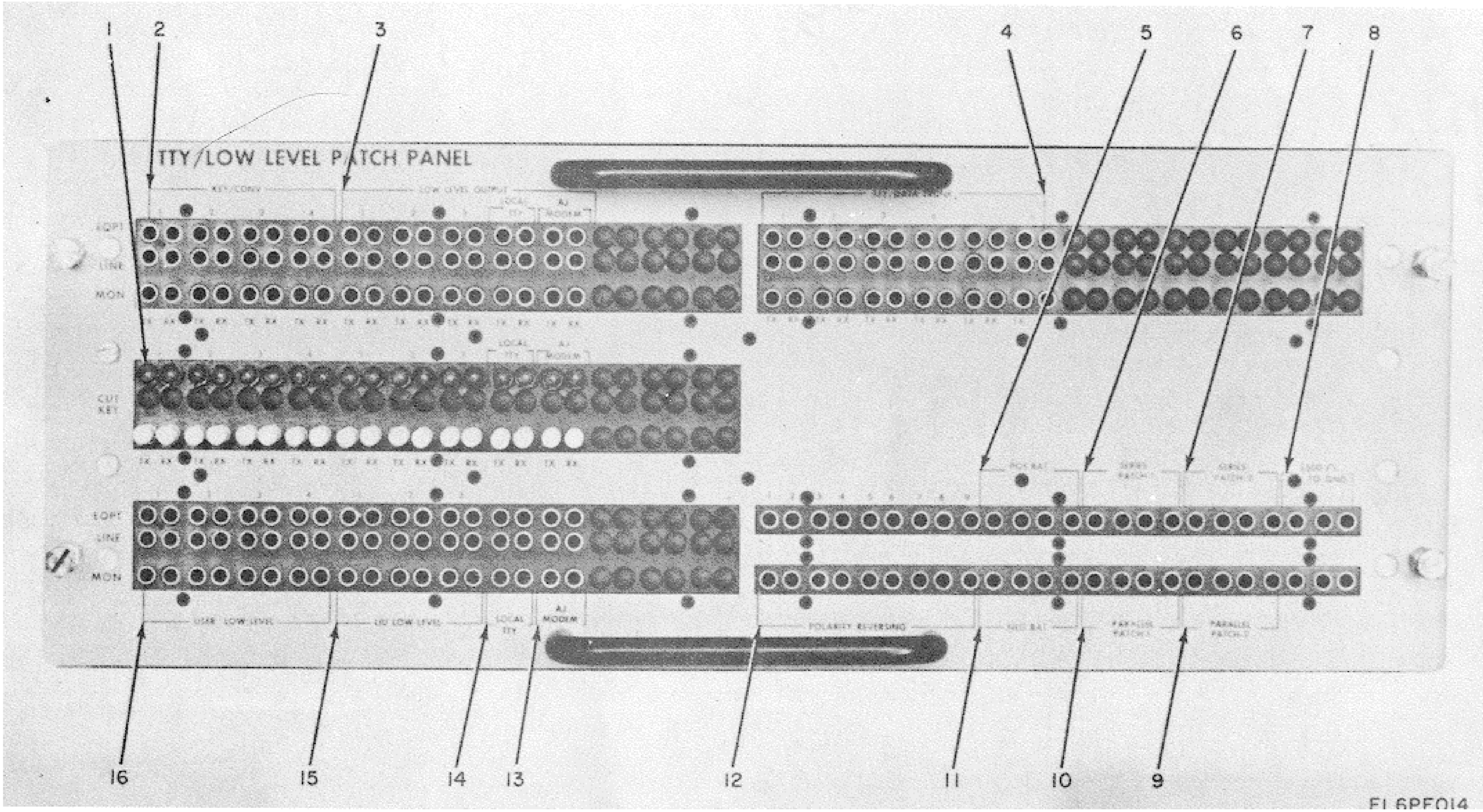
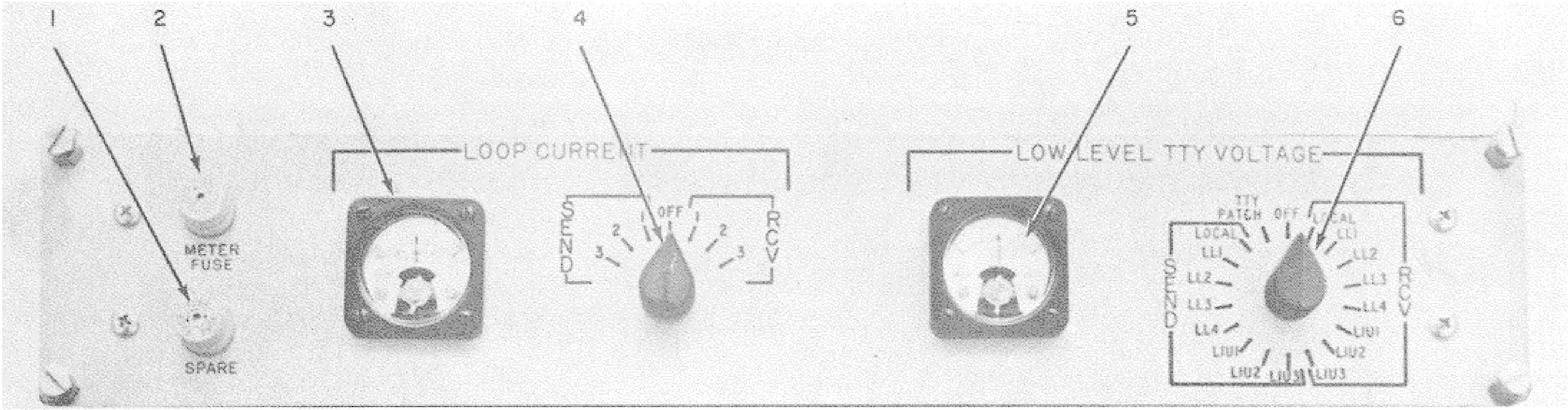


Figure 3-13. TTY/Low Level Patch Panel, Controls and Indicators.



EL6PE015

Figure 3-14. TTY Loop Monitor, Control and Indicators

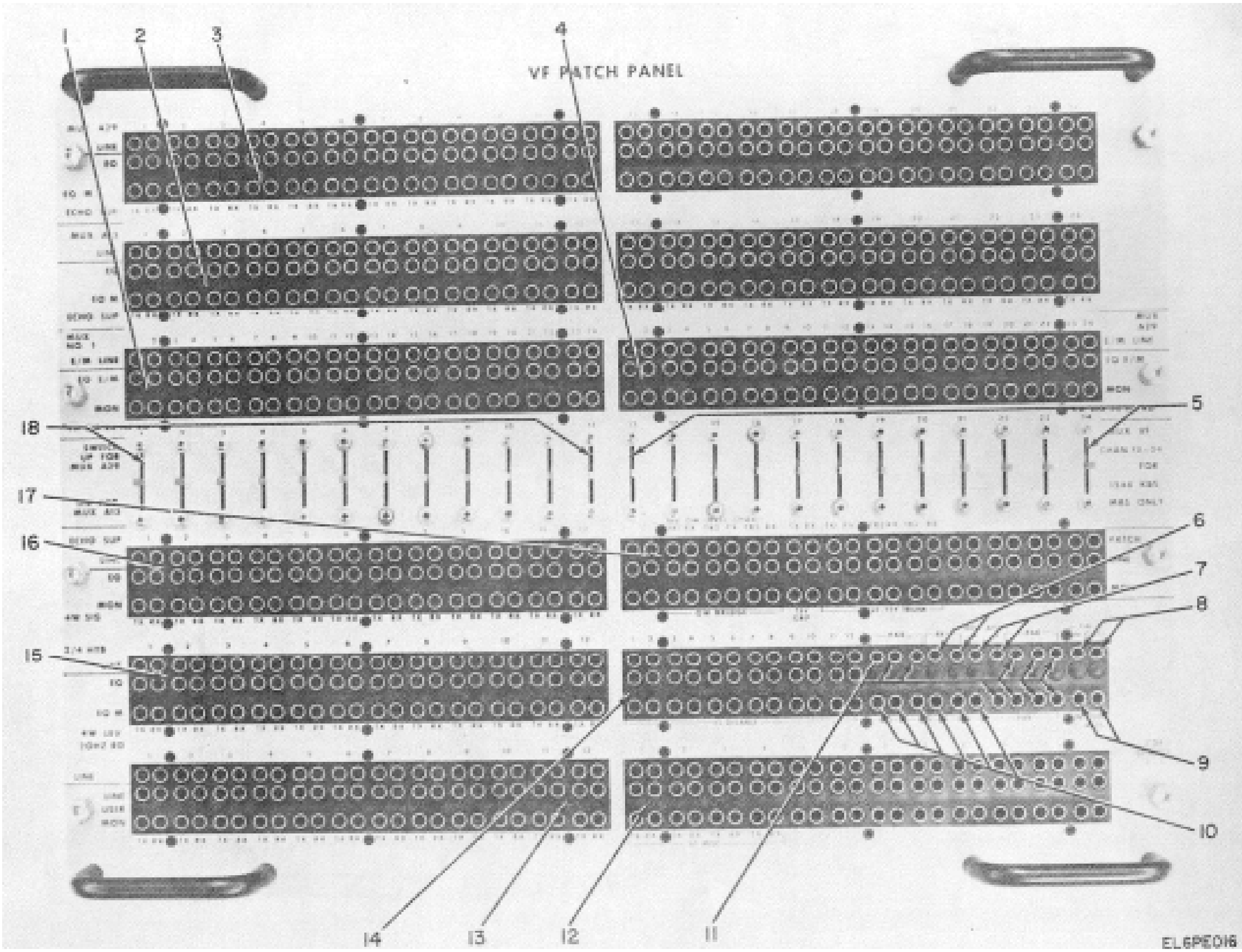


Figure 3-15. VF Patch Panel, Controls and Indicators.

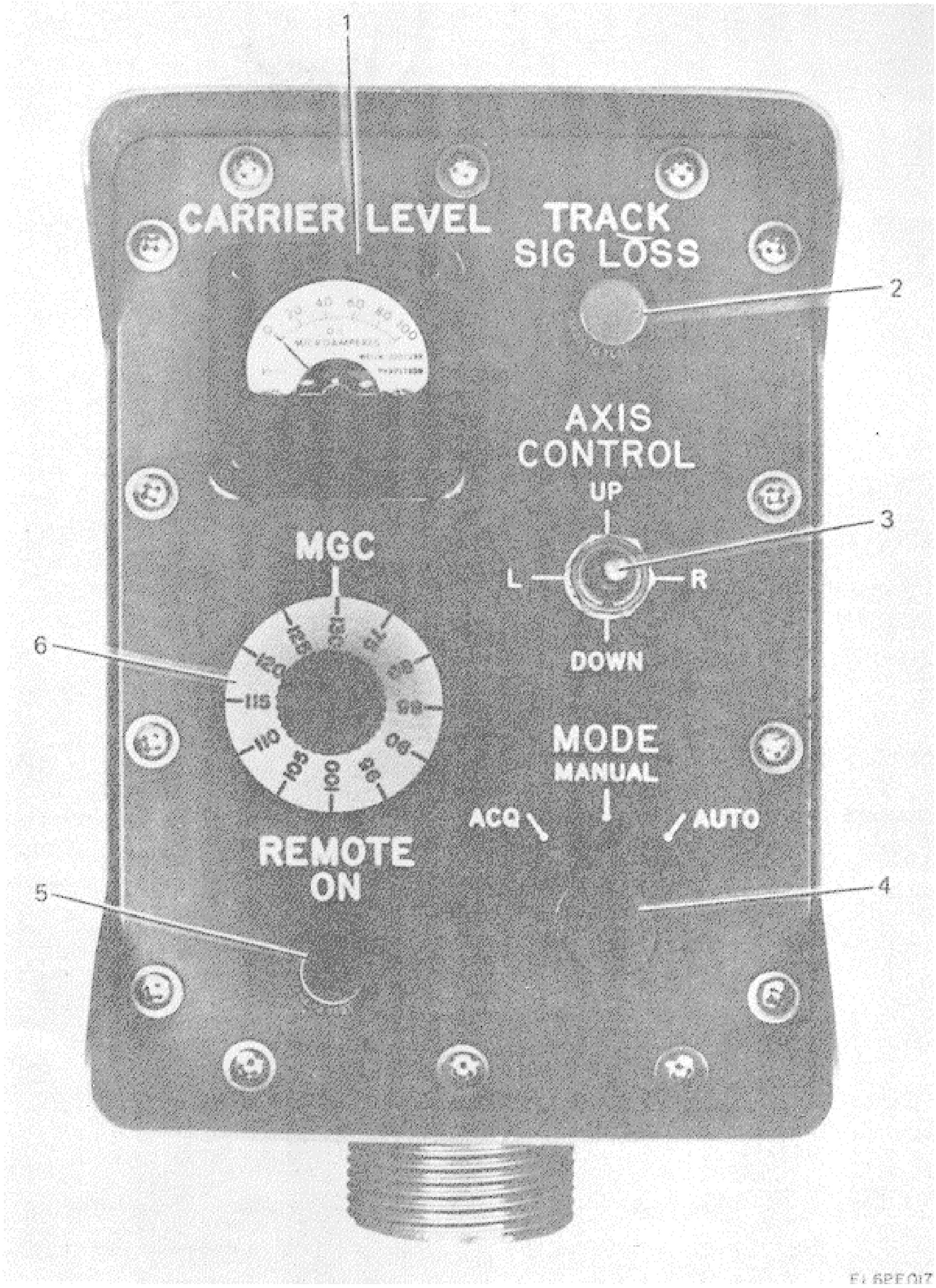


Figure 3-16. Remote Control, Controls and Indicators.

Table 3-1. Power Distribution Panel, Operator's Control and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference.
	PANEL, POWER DISTRIBUTION SM-F-935007 (POWER DISTRIBUTION PANEL)		
1	NO GO Indicator	When illuminated, indicates fault between the power distribution panel and the applicable generator.	3-1
2	MAIN POWER-1 Circuit Breaker	When in the ON position, applies power from the NO. 1 primary power source to the panel breakers and switches.	
3	POWER IN Indicator (left side)	When illuminated, indicates that primary power is available at the MAIN POWER-1 circuit breaker.	
4	AIR COND-1 Circuit Breaker	When in the ON position, applies power to the NO. 1 air conditioner when MODE SELECT is in any of the first three CW positions.	
5	UTILITY Circuit Breaker	When in the ON position, applies power to the shelter utility outlets.	
6	LIGHTS Circuit Breaker	When in the ON position, applies power to the shelter lights.	
7	AS-3199/TSC DEHYD Circuit Breaker	When in the ON position, applies power to the alternate antenna dehydrator.	
8	MODE SELECT switch	Provides selection of the required power amplifier and air COND combination.	
9	RACK 3 PA-1	When in the ON position, applies power to the rack 3 power amplifier.	
10	AUX	When in the ON position, applied power to the rack 3 upconverter.	
11	RACK 1 Circuit Breaker	When in the ON position, applies power to rack 1.	
12	TTY Circuit Breaker	When in the ON position, applies power to the TTY.	
13	RACK 5 Circuit Breaker	When in the ON position, applies power to rack 5.	
14	RACK 6 Circuit Breaker	When in the ON position, applies power to rack 6.	
15	MONITOR AC Volt Meter	Provides for measuring terminal voltages from the AC power generators.	
16	Selector switch	Provides for switching meter to the six AC lines from the power generator.	
17	RACK 7 Circuit Breaker	When in the ON position, applies power to rack 7.	
18	RACK 8 Circuit Breaker	When in the ON position, applies power to rack 8.	
19	RACK 2 Circuit Breaker	When in the ON position, applies power to rack 2.	
20	RACK 4 AUX Circuit Breaker	When in the ON position, applies power to the blower and all equipment except the power amplifier.	
21	PA-2 Circuit Breaker	When in the ON position, applies power to the blower and power amplifier.	
22	ANT RAD LIGHT DISABLE switch	Provides for switching off of power to radiation light on antenna.	
23	BLACKOUT INHIBIT Circuit Breaker	When in the ON position, prevents the blackout circuit from functioning when the shelter door is opened.	
24	AIR COND-2 Circuit Breaker	When in the ON position, applies power to the NO. 2 air conditioner when the MODE SELECT is in any position except the third CW position.	
25	GO Indicator	When illuminated, indicates power is available for distribution from applicable circuit breakers.	
26	MAIN POWER-2 Circuit Breaker	When in the ON position, applies power from the NO. 2 primary power source to the panel breakers and switches.	
27	POWER IN indicator (right side)	When illuminated, indicates that primary power is available at the MAIN POWER-2 circuit breaker.	

Table 3-2. Track Patch Panel, Operator's Controls and Indicators

Item No.	Control, indicator or connector	function	Fig. reference.
	PANEL, COMMUNICATIONS TRACK PATCH SM-D-935073 (TRACK PATCH PANEL)		
1	D/C1 TRACK OUT connector	Provides tracking output termination from downconverter 1.	3-2
2	BEACON connector (behind sliding door)	Provides termination for the beacon signal.	
3	COMM connector (behind sliding door)		
4	D/C5 TRACK OUT) connector	Provides tracking output termination from downconverter 5.	
5	COMM TRACK FILTER SELECT Switch.	Provides for selection of narrow or wide band filter.	

Table 3-3. Downconverter, Operator's Control and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference.
	CONVERTER, FREQUENCY, ELECTRONIC CV-3201/TSC (DOWNCONVERTER)		
1 ,	700 MHz IF Connector	Provides 700 MHz receive IF signal out to the modem.	3-3
2	SHF IN Connector	Input connector for received SHF signals.	
3	RCVR FAULT Indicator	Illuminates when fault occurs in downconverter, or the LNA or BITE (antenna mounted electronics).	
4	MONITOR Meter	Provides an indication of applicable voltage and signal levels as selected by MONITOR switch.	
5	POWER Indicator	Illuminates when AC power is applied to the unit.	
6	FAULT Indicator	When illuminated.	
	1 MHz LOOP	Indicates a fault in the 1 MHz loop circuit	
	1 kHz LOOP	Indicates a fault in the 1 KHz loop circuit	
7	OUT OF LOCK Indicator	Illuminates when the frequency synthesizer is not operating on the selected frequency.	
8	FREQ SELECT MHz Switches	Five thumbwheel switches for selecting assigned receive operating frequency in 1 kHz increments.	
9	5 MHz OUT Connector	Provides 5 MHz standard output signal (for test purposes only.)	
10	SYNTH MON Switch	Provides for switching of signals to MONITOR meter for fault isolation of synthesizer. This switch is enabled when MONITOR switch is placed in SYNTH position.	
11	5 MHz IN	Input connector for 5 MHz external standard signal.	
12	FREQ TUNE/MHz Dial	Adjusts internal oscillator to receive operating frequency a indicated on MHz dial.	
13	TEST SIGNAL Connector	Provides SHF spectrum output test signal from synthesizer.	
14	Power Switch	Applies AC power to the unit when in the ON position.	
15	MONITOR Switch	Provides for switching of signals to MONITOR meter for fault isolation purposes.	
16	700/70 Switch Provides	700 MHz or 70 MHz operation.	
17	TRACK IF Connector	Provides 70 MHz IF antenna tracking signal out to the antenna control.	
18	70 MHz Connector	Provides 70 MHz receive IF signal out to the modem.	

Table 3-4. Antenna Control, Operator's Control and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference.
	CONTROL, ANTENNA C-10273/TSC (ANTENNA CONTROL)		
1	POSITION Digital Display	Provides a digital display of cross EL degrees.	3-4
2	EL DEG Digital Display	Provides a digital display of EL degrees.	
3	TRACK SIGNAL		
	o LOSS	Illum. when ant. tracking signal has been lost.	
	o IF/VIDEO	Switches type of track signal	
4	AXIS LIMIT Indicators	One of the indicators (UP, RIGHT, DOWN, LEFT) will be illuminated when antenna travel has reached its limit in that direction.	
5	SAFETY INTLK Indicator	Illuminates when a safety interlock is open.	
6	SCAN FAULT Indicator	Illuminates when a scan fault occurs in the unit.	
7	REMOTE Indicator	Illuminates when remote control is connected to antenna entry panel. Items 10, 11 and 12 are disabled; remote control is enabled.	
8	MONITOR Meter	Provides an indication of applicable signal levels as selected by MONITOR switch.	
9	MONITOR Switch	Provides for switching of signals to MONITOR meter for fault isolation purposes.	
10	MODE Switch	Provides for placing unit in selected (ACQUISITION, MANUAL ,or AUTO TRACK) operating mode.	
11	AXIS CONTROL Switch	When in MANUAL mode and moved to selected position (UP, RIGHT, DOWN, LEFT) will cause antenna to travel in selected direction.	
12	MGC Control	Adjusts gain of communications tracking module in unit.	
	POWER:		
13	60 V Switch	Applies 60 Vdc to unit when in the ON position.	
14	24 V Switch	Applies 24 V Vdc to unit when in the ON. position.	
15	Power Switch	Applies ac power to unit when in the ON position.	
16	Power Indicator	Illuminates when ac power is applied to unit.	

Table 3-5. Amplifier/Mixer, Operator's Control and Indicators

Item No.	Control, indicator or connector	function	Fig. reference.
	AMPLIFIER/MIXER AM-6704/TSC (AMPLIFIER/MIXER)		
	STATUS MONITOR:		
1	Selector Switch	Provides for switching of meter to dc lines for fault isolation	3-5
2	Meter	Provides an indicator for voltage/current measurements of applicable circuits selected by the STATUS MONITOR selector switch.	
3	LEVEL ADJUST Controls (CH1-CH4)	Adjusts the input power level of the selected channel.	
4	FAULT Indicator	Illuminates when a fault occurs in the IPA.	
5	RESET Switch	In the RESET position it clears the fault sensing circuits.	
6	AC POWER Indicator		
	Indicator	Illuminates when the AC POWER switch is in the ON position.	
7	Switch	Applies power to the unit when in the ON position.	
8	SPARE FUSE Fuseholder	Provides storage for a 0.5 AMP fuse.	
9	INPUT SHF CH1-CH4 COMBINER Connectors	Provides input connections for up to four channels.	
10	OUTPUT LEVEL Control	Provides adjustment of the SHF output level.	
11	SHF OUTPUT Connector	Provides SHF output from the unit.	
12	CH1 CH4 SHF Selector Switch	Provides for output reading of four channels or reading for adjustment of SHF OUTPUT.	
13	SHF MONITOR Selector Switch	Provides for switching of selected meter range.	
14	SHF MONITOR Meter	Provides an indication of applicable values as selected by the SHF MONITOR selector switch.	
15	CAL ZERO Control	Adjust meter's indicator for zero indication when SHF MONITOR selector switch is in SHF OUT.	
16	LV 0.5 AMP	Provides protection for the LV circuit.	

Table 3-6. Upconverter, Operator's Control and Indicators

Item No.	Control, indicator or connector	function	Fig. reference.
	CONVERTER, FREQUENCY, ELECTRONIC CV-3199 ()/TSC-86 (UPCONVERTER)		
1	700 MHz IF Connector	Provides 700 MHz receive IF input	3-6
2	SHF OUT Connector	Provides for SHF output.	
3	MONITOR Meter	Provides an indication of applicable values as selected by the MONITOR selector switch.	
4	UPCONV FAULT Indicator	Illuminates when a fault exists in the upconverter.	
5	POWER Indicator	Illuminates when POWER switch is placed on ON position.	
6	POWER Switch	When in the ON position, applies power to the unit.	
7	FAULT Indicator	When illuminated,	
	1 MHz Loop	Indicates a fault in the 1 MHz loop circuit.	
	1 kHz Loop	Indicates a fault in the I kHz loop circuit.	
8	OUT OF LOCK Indicator	Illuminates when the frequency synthesizer is not operating on the selected frequency.	
9	FREQ SELECT MHz Switch	Thumb wheel switches for selecting the assigned operating frequency.	
10	5 MHz OUT Connector	Provides an output from the synthesizer 5 MHz standard.	
11	SYNTH MONITOR Selector Switch	Provides for switching of signals to the meter for fault isolation purposes. This switch is enabled when the MONITOR Selector switch is placed in the SYNTH position.	
12	5 MHz IN Connector	Provides an input for an external 5 MHz standard.	
13	FREQ TUNE Dial	Adjusts the synthesizer Gunn oscillator to the operating frequency.	
14	TEST SIGNAL jack	Output signal for test purposes.	
15	TEST OSC ON Switch	Activates the test oscillator circuits when placed in the ON position.	
16	IF IN Switch	Provides for selection of 70 MHz or 700 MHz IF for monitoring.	
17	MONITOR Selector Switch	Provides for switching of signals to the meter for fault isolation purposes.	
18	70 MHz IF Connector	Provides for 70 MHz IF input.	

Table 3-7. Waveguide Switch w/Air Vent, Operator's Controls

Item No.	Control, indicator or connector	function	Fig. reference.
	WAVEGUIDE SWITCH W/AIR VENT SM-D-936346 (WAVEGUIDE SWITCH W/AIR VENT)		
1	AIR VENT	Provides for adequate air circulation during the warm up period.	3-7
2	PA1, ON LINE, PA2 Control	Provides for switching of the waveguide system outputs from power amplifiers and inputs to antennas and the dummy load.	
3	Proximity Switch	Opens when waveguide connection is not tight and inhibits power amplifier.	

Table 3-8. Power Amplifier, Operator's Controls and Indicators

Item No.	Control, indicator or connector	function	Fig. reference.
	AMPLIFIER, RADIO FREQUENCY AM-6703/TSC (POWER AMPLIFIER)		
1	SHF OUT Connector	Provides waveguide connection for output of power amplifier.	3-8
2	FIL HRS Indicator	Indicates total hours that power is applied to filaments of klystron.	
3	FAULT Indicator	Illuminates when the output power falls below the alarm setting.	
4	MONITOR Meter	Provides indication of applicable values as selected by MONITOR switch.	
5	MONITOR Switch	Provides for switching of voltages and power levels to MONITOR meter.	
6	REFL WATTS/FWD WATTS DBM Switch	Selects either reflected (white markings) or forward power levels for measurements on MONITOR meter.	
7	ZERO SET Control	Provides for zeroing MONITOR meter when ZERO SET switch is placed in SET position.	
8	ZERO SET Switch (Spring-loaded)	Allows MONITOR meter zero adjustment when held in SET position.	
9	SHF TEST OUT Connector	Supplies sample of PA transmit output to test translator in LNA control/translator.	
10	SHF IN Connector	RF input for transmit operating frequency signal from upconverter.	
11	OUTPUT LEVEL Control	Adjusts power output level of power amplifier.	
12	LOW OUTPUT ALARM SET Control	Adjusts level at which low output will activate alarm system.	

Table 3-9. Power Supply PP-7087, Operator's Controls and Indicators

Item No.	Control, indicator or connector	function	Fig. reference.
	POWER SUPPLY PP-7087/TSC (PWR SPLY PP-7087)		
1	MONITOR Meter	Provides indication of applicable voltage and current levels as selected by MONITOR switch.	3-9
2	MONITOR Switch	Provides for switching of signals to MONITOR meter for fault isolation purposes.	
3	FAULT Display Indicators	One or more indicators will illuminate to indicate type of fault occurring in power supply or power amplifiers.	
4	STATUS Display Indicators	One or more indicators will illuminate to indicate operating status of power amplifier.	
5	AC POWER Indicator	Illuminates when AC power is applied to the unit from the power distribution panel.	
6	OPERATOR-STANDBY Switch	Places transmit function in an operating or standby condition, as desired.	
7	FAULT CKT/TEST Switch	In TEST position, tests operation of all fault and status circuits. The FAULT and STATUS displays will be illuminated.	
8	FAULT CKT/RESET	In RESET position, resets BODY OVLD, HV ARC, and primary crow-bar circuits.	
9	BLOWER Circuit Breaker	In ON position applies AC power to power amplifier kystron blower.	
10	START Circuit Breaker	In ON position applies AC power to start module in the unit and to power supply fan.	
11	HV MAIN Fuse	Protects high voltage circuits from overload or short circuit.	
12	LV Fuse	Protects low voltage circuits from overload or short circuit.	
13 Through 16	HV1 through HV4 Fuses	Protects each of the HV rectifier circuits.	
17	SPARE Fuse Holders	Provide storage space for fuses used in HV1 through HV4, LV, and HV MAIN fuse sockets.	

Table 3-10. Alarm Monitor, Operator's Control and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference.
	ALARM MONITOR SM-D-936383(ALARM MONITOR)		
1	SYSTEM FAULT Group CSS Indicator	Illuminates when fault occurs in CSS portion of system. A unit fault indicator may also be illuminated and AUDIBLE SIGNAL alarm will sound.	3-10
2	CSS TEMP Indicator	Illuminates when normal CSS temperature is exceeded.	
3	OVERRIDE Indicator	Illuminates when any fault override switch (under access cover) is placed in OVERRIDE position. Used to determine the unit source of a CSS or RSS fault. The CSS or RSS indicator will be extinguished thereby indicating a valid fault.	
4	RSS Indicator	Illuminates when fault occurs in RSS portion of system. A unit fault indicator may also be illuminated and AUDIBLE SIGNAL alarm will sound.	
5	AUDIBLE SIGNAL Group FAULT Switch	Selects operating or test mode for AUDIBLE SIGNAL alarm. Normally set to the NORMAL position.	
6	Audible Alarm	Sounds a tone when SYSTEM FAULT/CSS or RSS indicator or SAFETY ALERT indicator illuminates. This fault/alert sound can be disabled (turned off) when FAULT switch is set to OFF.	
7	POWER Group ON Circuit Breaker	Applies ac power to the unit when placed in the ON position.	
8	AC Indicator	Illuminates when ac power is applied to the unit.	
9	DC Indicator	Illuminates to indicate internal power supply is operational. Illuminates simultaneously with ac indicator.	
	SAFETY ALERT Group		
10	WAVEGUIDE INTERLOCK Indicator	Illuminates when waveguide connection opens at antenna orthomode transducer, shelter antenna entry panel, or SHF output flange of either power amplifier. The power supply unit STATUS/WG/ANTENNA INHIBIT and HV INHIBIT display indicators will be illuminated. The alarm monitor RSS indicator will be illuminated and the audible alarm will sound.	
11	ANTENNA ELEVATION Indicator	Illuminates when antenna drops below a preset elevation angle. Otherwise, functions same as WAVEGUIDE INTERLOCK indicator above.	
12	Fault Switches (under access cover)	Used for fault isolation purposes when a SYSTEM FAULT/CSS or RSS indicator illuminates. In turn, each switch is placed in the OVERRIDE position and then returned to NORMAL (the OVERRIDE indicator will be turned on and off). A valid fault is indicated if the CSS or RSS indicator is turned off when a switch is in the OVERRIDE position. The switch marking indicates the area of the fault. To enable the alarm monitor to receive other faults, let the OVERRIDE condition stand and return the AUDIBLE SIGNAL/FAULT switch to the NORMAL position.	

Table 3-11. LNA Control/Translator, Operator's Controls and Indicators

Item No.	Control, indicator or connector	function	Fig. reference.
	CONTROL/TRANSLATOR, LNA SM-D-775327 (LNA CONTROL/TRANSLATOR)		
1	HI HEAT Indicator	Illuminates to indicate high heat operation of the low noise amplifier(LNA) (on the antenna mounted electronics).	3-11
2	FAULT Indicator	Illuminates when fault occurs in LNA.	
3	POWER Indicator	Illuminates when ac power is applied to the LNA.	
4	ON LINE/LNA No. 1 Indicator	Illuminates to indicate that LNA No. 1 on-line (No. 2 is in standby).	
5	ON LINE Switch	Selects either of LNAs for on-line operation.	
6	ON LINE/LNA No. 2 Indicator	Illuminates to indicate that LNA No. 2 is on-line (No. 1 is in standby).	
7	MONITOR Meter	Provides indication of applicable signal levels as selected by MONITOR switch.	
8	TRANSLATOR Indicator	Illuminates to indicate the translator 725 MHz source is operational.	
9	TRANSLATOR Switch	Places translator in operation when in the ON position.	
10	POWER Indicator	Illuminates when ac power is applied in the unit.	
11	POWER Switch	Applies ac power to the unit when in the ON Position.	

Table 3-11 LNA Control/Translator, Operator's Control and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference.
12	MONITOR Selector Switch	Provides for switching of signals to MONITOR meter for fault isolation purposes.	
13	STBY LNA TESTILNA NORMAL Indicator	Illuminates to indicate that LNA under test is normal when TEST switch is in ON position.	
14	STBY LNA TEST/TEST Switch	Places antenna BITE box test oscillator in operation when in ON position.	
15	STBY LNA TEST/TEST OSC Indicator	Illuminates to indicate the above test oscillator is in operation.	
16	POWER Switch	Applies ac power to the LNA when in the ON position.	
17	TEST/PARAMP Switch (spring-loaded)	When held in ON position, disables paramp section of LNA to test fault circuits. If test is ok, FAULT indicator will be illuminated.	
18	TEST/FET Switch (spring-loaded)	Disables FET section otherwise same as paramp section above.	
19	HI HEAT Switch	Places high heat circuit of LNA in operation when in ON position.	

Table 3-12. AC Regulator Monitor Panel, Operator's Controls and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference.
	AC REGULATOR MONITOR PANEL SM-D-936692 (AC RGLTR MON PANEL)		
1	REGULATED 115 VAC ATTACH HP 436A ONLY outlet	Provides 115 Vac for the HP 436A power meter.	3-12
2	VR MONITOR meter	Provide ac voltage regulator monitoring.	
3	FAULT RESET Switch	Provides regulator reset for drop-out caused by a temporary, minor fault.	
4	VR FAULT Indicator	When illuminated, indicates a voltage regulator fault.	

Table 3-13. TTY/Low Level COMM Patch Panel, Operator's Controls and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference.
	PATCH PANEL, TTY/LOW LEVEL COMM SM-A-935861 (TTY/LL COMM PATCH PANEL)		
1	CUT KEY Indicator and Switch Group	Provides for detecting and switching transmit and receive circuits of the FSK and low level output circuits.	3-13.
2	KEY/CONV Jacks	Provides patching for four pairs of FSK transmit and receive channels for EQPT, LINE, and MON circuits.	
3	LOW LEVEL OUTPUT Jacks	Provides patching for five pairs of low level output transmit and receive channels for EQPT LINE, and MON circuits.	
4	TTY/DATA TRUNK Group	Provides patching for six pairs of TTY/data trunk transmit and receive channels for EQPT,LINE, and MON circuits.	
5	POS BAT Jacks	Provides jacks for four positive battery voltage outputs.	
6	SERIES PATCH-1 jacks	Provides two pairs of jacks for series patch-i.	
7	SERIES PATCH-2 jacks	Provides two pairs of jacks for series patch-2.	
8	2500 Ohm TO GND jacks	Provides four jacks for 2.5K ohm ground terminations.	
9	PARALLEL PATCH-2 jacks	Provides four jacks for parallel patch-2.	
10	PARALLEL PATCH-1 jacks	Provides four jacks for parallel patch-i.	
11	NEG BAT jacks	Provides jacks for four negative battery voltage outputs.	
12	POLARITY REVERSING jacks	Provides nine outputs for polarity reversing.	
13	AJ MODEM Jacks	Provides patching for AJ modem functions.	
14	LOCAL TTY Jacks	Provides patching for local TTY functions.	
15	LIU LOW LEVEL jacks	Provides patching for input/output connections and monitoring.	
16	USER LOW LEVEL jacks	Provides patching for input/output connection and monitoring.	

Table 3-14. TTY Loop Monitor, Operator's Control and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference
		MONITOR, TELETYPE LOOP SM-D-936640 (TTY LOOP MON)	
1	SPARE	Provides stowage space for spare METER FUSE.	3-14
2	METER FUSE Loop Current	Provides protection of LOOP current meter.	
3	Loop Meter	Provides indication of loop current.	
4	SEND/OFF/RCV Switch	Controls function and sensitivity of LOOP Current Meter	
5	LOW LEVEL TTY VOLTAGE Meter	Provides indication of low-level TTY voltage.	
6	Function Selector Switch	Provides selective monitoring of various low level TTY voltages.	

Table 3-15. COMM/VF Patch Panel, Operator's Controls and -Connectors

Item No.	Control, indicator or connector	Function	Fig. reference
		PATCH PANEL, COMM/VF SM-A-935851 (COMM/VF PATCH PANEL)	
1	MUX NO 1 Jack Group	Provides 24 patch jacks each for the MUX NO 1 E&M LINE, EQ, and MON channels.	3-15
2	MUX A13 Jack Group	Provides 24 pairs (48 jacks) transmit/receive patch jacks each for the LINE, EQ and MON channels.	
3	MUX A29 Jack Group	Provide 24 pairs (48 jacks) of patch jacks each for the MUX A29 LINE, EQ and MON transmit/receive channels.	
4	MUX A29 Jack Group	Provides 24 patch jacks each for the MUX A29 E&M LINE, EQ and MON channels.	
5	4W SIG 20 HZ RD 13-24 Group	Provides switching of MUX VF channels 13-24 (for 1544 kBS MBS only) for MUX A29 when placed in the up position and MUX A13 when placed in the down position.	
	2/4 HYB Jack Group		
	LINE Row		
6	REV Jacks	Provides one pair (2 jacks) of jacks for REV patching.	
7	600 Jacks	Provides two jacks for 600-ohm patching.	
8	FIA IN OUT Jacks	Provides one pair (2 jacks) of FIA input and output patching.	
	EQM Row		
9	C-MESS IN OUT Jacks	Provides one pair (2 jacks) of C-Mess input and output jacks for patching.	
10	REV Jacks	Provides three pairs (6 jacks) of EQ M REV patch jacks.	
11	LINE and EQ M Rows	Provides two 3-set jack groups on the LINE row for PAR patching and one 4-set jack group on the EQM row for PAR patching.	
	4W LEV 20 HZ RD Group		
12	VF MISC Section	Provides four pairs (8 jacks) of MISC patch jacks each for the INE, LINE USER, and MON transmit/receive channels.	3-15
13	LINE, LINE USER, and MON rows	Provides twelve pairs (24 jacks) of patch jacks each for LINE, LINE USER, and MON transmit/receive channels.	
	2/4 HYB Jack Group		
14	ES DISABLE	Provides twelve jacks for ES DISABLE patching.	
15	LINE EQ, and EQ M rows	Provides twelve pairs (24 jacks) of patch jacks each for LINE, EQ, and MON patching.	
16	ECHO SUP LINE, EQ, and MON 4 W SIG Jacks	Provides twelve pairs (24 jacks) of patch jacks each for LINE, EQ, and MON 4 W SIG patching.	
17	OW BRIDGE, TTY GRP, and VF/TTY TRUNK Jacks	Provides three pairs (6 Jacks) of patch jacks each for transmit/receive patching of the OW BRIDGE, one pair (2 jacks) of patch jacks each for transmit/receive patching of the TTY, and three pairs (6 Jacks) of patch jacks each for transmit/receive patching of the VF/TTY TRUNK channels.	
18	MUX A29 and MUX A13 Switches	Provides for switching channels 1 to 12 to MUX A29 and MUX A13 as required for terminal configuration.	

Table 3-16. Remote Control, Operator's Control and Indicators

Item No.	Control, indicator or connector	Function	Fig. reference
		CONTROL, ANTENNA SM-D-936104 (REMOTE CONTROL)	
1	CARRIER LEVEL Meter	Measures received signal strength of 70 MHz tracking signal.	3-2
2	TRACK SIG LOSS Indicator	Illuminates when antenna tracking signal has been lost.	
3	AXIS CONTROL Switch	When in MANUAL mode and moved to selected position (UP, R, DOWN, L) will cause antenna to travel in selected direction.	
4	MODE Switch	Provides for placing unit in selected (ACQ, MANUAL, or AUTO) operating mode.	
5	REMOTE ON Indicator	Illuminates when remote control is connected to the antenna entry panel. Remote control now assumes acquisition control of the antenna.	
6	MGC Control	Adjusts gain of communications tracking module in antenna control.	

Section II. OPERATION UNDER USUAL CONDITIONS

3-3. Scope

a. This section contains instructions and procedures for applying power to the equipment, placing it into operation, and shutting down the equipment. The procedures assume that the installation procedures described in chapter 2 have been accomplished.

b. If the terminal is being started up from a complete power shutdown, paragraphs 3-4 through 3-20 must be performed in sequence.

c. If the terminal is being started up following a short-interval shutdown, proceed to the applicable text in the following paragraphs as required to place the equipment into the system.

NOTE

Ensure that all external and internal roadside ventilation ports are adjusted as required.

3-4. Initial Control Settings

Set all controls to the positions indicated on all the units listed in table 3-17. These control positions are intended merely to represent a cold-start initial setup and not a total shutdown of fully operational condition. Where noted, do not disturb any mode assignment control positions from the last operational deployment.

Table 3-17. Preliminary Control Settings

Unit and control	Position
Power Distribution Panel (fig. 3-1)	
All OFF-ON Switches except MAIN Power 1&2, and BLACKOUT INHIBIT	OFF (down)
MODE SELECT Switch	PA1/AIR COND 2,
MONITOR Switch	PA2/AIR COND 1
	Any
Track Patch Panel (fig. 3-2)	
FILTER SELECT Switch	WB
Downconverter (fig. 3-3) (five)	
POWER Switch	OFF
Other Switches	ANY
Antenna Control (fig. 3-4)	
POWER:	
All OFF-ON Switches (three)	OFF
Amplifier/Mixer (fig.3-5) (two)	
AC POWER ON Switch	OFF (down)
Other Switches	Any
Waveguide Switch w/Air Vent (fig. 3-7)	
AIR VENT (See para 2-21)	
PA1-ONLINE-PA2 Switch	As Required for Terminal configuration
Power Amplifier (fig. 3-8)	As Required for
All switches	Terminal configuration
Power Supply PP-7086 (fig. 3-9)	
BLOWER Switch	OFF
START Switch	OFF
Other Switches	As Required for terminal configuration
Alarm Monitor (fig. 3-10)	
POWER ON Switch	Down (off)
Other switches	As required for terminal configuration
LNA Control/Translator (fig. 3-11)	
POWER OFF-ON Switch	OFF
Other Switches	As required for terminal configuration
AC RGTR MON Panel (fig. 3-12)	
REGULATED 115 VAC ATTACH HP 436A ONLY Outlet	NOTE Turn off power of any equipment plugged into this outlet.
TTY Low/Level Patch Panel (fig. 3-13)	As required for
CUT KEY Switches	configuration
TTY Loop MON (fig. 3-14)	
LOOP CURRENT Switch	OFF
LOW LEVEL TTY VOLTAGE Switch	OFF
COMM/VF Patch Panel (fig. 3-15)	
Multiplexer Selection and Channel Selection switches	As required for technical configuration
Remote Control (fig. 3-16)	As required
Multiplexer AN/FCC-98	Check that E/F strapping is in F position refer to applicable technical manuals.

3-5 Turn-On of External Power

WARNING

Ensure that all power circuit breakers in the shelter (all unit drawers and the power distribution panel) and on the pallet power unit are in their off or down position except main pwr 1 and 2 and blackout inhibit circuit breakers.

a. On the power unit, assure that the output of both generators is set for 120 volts.

b. On the distribution box check that the generator output selector switch is in the OFF position.

c. Start the engine-generators and allow a minimum of 15 minutes for warm-up.

d. When the output voltage and frequency are stabilized, proceed to paragraph 3-6.

3-6. Lighting the Shelter

a. Refer to the procedures described in paragraph 3-4.

b. On the power distribution panel check for or perform the following:

(1) Check that both POWER IN indicators are illuminated.

(2) The MAIN POWER 1 GO/NO GO PHASE SEQUENCE light is on in the GO position when the MAIN POWER 1 circuit is on.

WARNING

Applying power to the terminal with the PHASE SEQUENCE lights on in the NO GO position will cause damage to the terminal equipment, the generator, or both.

(3) If the NO GO lights appear, place the applicable generator POWER circuit breaker to the OFF position and check the terminal power cables for the proper connection to the power selector box on the power pallet.

(4) In order, place the MAIN-2 and MAIN-1 circuit breakers to the ON position, unless already placed to ON.

(5) Place the UTILITY and LIGHTS circuit breakers to the ON position.

c. Place the BLACKOUT INHIBIT switch to the ON position, unless already placed on ON. Close the shelter doors.

d. The shelter should now be illuminated and ac power applied to the utility receptacles.

NOTE

As a minimum, the incandescent lamp should be lighted if the temperature is below approximately freezing (32°F, 0°C); the fluorescent lamps will be lighted but at a reduced output. Full light output from the fluorescent lamps will be attained after the TM11-5895-846-14 shelter temperature rises above approximately 40°F (5°C); the incandescent lamp will not be lighted.

3-7. Checking Blackout Switch Operation

Check the operation of the door and blackout switches as follows:

a. Close the shelter doors and place the BLACKOUT switch to the ON position; that is, the door switches are operational, lights are on.

b. Open and close the shelter door; the lights should turn off and on, respectively.

c. Open and close the small door (within the shelter door); the lights turn "off" and on, respectively.

d. Place the BLACKOUT switch to the OFF position, that is, door switches are bypassed and inoperative; lights remain on.

e. Open, then close, each door in turn; lights remain on.

f. Position the BLACKOUT switch for the desired mode of operation.

3-8. Adjusting the Environmental Control System

Adjust the environmental control system as described below. Consider this as a two-part procedure being performed, in part, before and after turn-on (para 3-9 below). Some of the initial adjustments may have to be changed after the warm-up period.
Proceed as follows:

a. Adjust the shelter vents as described in paragraph 2-21.

b. On the power distribution panel, place the UTILITY circuit breaker to the ON .position, unless already placed to ON.

c. Refer to TM 5-4120-239-14 for operating instructions on the air conditioner. Place the air conditioner in the desired mode of operation; cooling, heating or venting.

d. Perform the appropriate step below depending on the temperature:

(1) Temperature above 32°F (0°C). Open all external intake and exhaust vents (four roadside).
Close all internal recirculating vents.

(2) Temperature below 32°F (0*C). Close all external vents and open all internal vents...

e. Depending on the temperature, place the air conditioner in the cooling or heating mode (or venting, if desired). Adjust the thermostat to turn off the unit at the desired temperature.

3-9. Applying Power and Tuning the Equipment

WARNING

An RF radiation hazard exists if the rack 3 or rack 4 RF output, is not properly terminated into the waveguide inside or outside of the shelter. Check all waveguide connections before applying power.

NOTE

This procedure contains general follow-up instructions applicable to the preliminary control settings in table 3-17.

a. Power Distribution Panel. Operate controls and observe indicators as follows:

(1) RACK 1 switch to ON and observe that rack 1 blower starts.

(2) RACK 2 switch to ON and observe that rack 2 blower starts.

(3) RACK 3 AUX switch to ON and observe that rack 3 blower starts.

(4) PA1 switch to ON and observe that power supply (rack 3, A14) AC POWER indicator illuminates.

(5) RACK 4 AUX switch to ON and Observe that rack 4 blower starts.

(6) PA2 switch to ON and observe that power supply (A18) AC POWER indicator illuminates.

(7) AIR COND 2 switch to ON.

(8) TTY switch to ON.

CAUTION

Check that the communication subsystem air conditioner is operating before applying ac power to racks 5 through 8. Damage caused by inadequate cooling of equipment can result in loss of performance.

NOTE

AC power in the communication subsystem SCOPE/TTY rack may be checked by observing any electrical function of the oscilloscope or TTY unit.

(9) RACK 5 switch to ON and observe that rack 5 blower starts.

(10) RACK 6 switch to ON and observe that rack 6 blower starts and the orderwire (A10) PWR ON indicator illuminates.

(11) RACK 7 switch to ON and observe that rack 7 blower starts.

(12) RACK 8 switch to ON and observe that rack 8 blower starts.

b. Rack 5, modems (A3 or A6). Place the POWER switch on the selected modems and KY-801S to ON; operate, and observe the following:

(1) POWER indicator illuminates.

(2) Check the modem for malfunctions via the SELF TEST controls and indicators.

NOTE

If a malfunction occurs, switch over to the back-up modem and repeat this step.

c. Racks 6 and 8, Multiplexes (A13 and A29). Check the multiplexers as follows:

(1) Remove front cover.

(2) Check the voice and data modules for proper position.

(3) Check the transmit interface and receiver input modules for the proper clock frequency operation.

(4) Place the POWER switches to ON and observe that the POWER indicators illuminate.

d. Rack 6, A/D Converter (A11 and A12). Place the POWER switches to ON and observe that the POWER indicators illuminate.

e. Rack 7, TLG Line Isolator (A14).

(1) Set up the controls on the three isolator units for the proper mode of operation.

(2) Place the POWER switches to ON and observe that the PWR indicator illuminates.

f. Rack 7, Tone Keyer (A19).

(1) Check the jumper straps for proper operation on the selected unit.

(2) Place FUNCTION switches to LINE.

g. Rack 8, Echo Suppressor (A24) and 48 Volt Power Supply. Place the POWER switches to ON.

h. CSS cabinet, SCOPE (A31). Gently pull the POWER switch to the stop position and adjust the functional controls as required.

i. Rack 5, C/N Test Set (A1). Place the microwattmeter power switch to PWR, push the modem test set POWER switch in (to illuminate indicator), and adjust the functional controls as required.

j. Rack 6, Digital Communications Test Set (A9) and Spectrum Analyzer (A7).

(1) On the digital communications test set (A9), push in and release the POWER switch/indicator pushbutton and observe that the indicator remains illuminated when the pushbutton is released.

(2) On 'the spectrum analyzer (A7), place the LINE switch to ON and adjust the functional control as required.

k. Rack 1, Downconverters (A2, A3, A4, A5, and A6). Operate and observe the selected downconverters as required.

(1) Place the applicable POWER switches to ON and observe that POWER indicators illuminate.

(2) Tune the units to the selected frequency.

l. Racks 2 and 3; Antenna Control (A7), Amplifier/Mixers (A8 and A10), XMT Patch (A9) and Upconverters (All, A12, A15, and A16).

(1) *Antenna control (A7).* Place the AC switch to ON and observe that the POWER indicator is illuminated.

(2) *Amplifier/mixers (A8 and A10).* Operate and observe the selected amplifier/mixer as follows:

(a) Rotate each STATUS MONITOR switch to IPA MA.

(*b*) Rotate each SHF MONITOR switch to 10, X10.

(*c*) Place each AC POWER switch to ON.

(*d*) Observe that each AC POWER indicator illuminates.

(*e*) Hold each FAULT switch in the RESET position and observe a reading of 10 to 30 on the status monitor meter.

(3) *XMT patch (A9).* Patch the selected upconverter and amplifier/mixer to the selected power amplifier.

(4) *Upconverters (A11, A12, A15, A16).* Operate and observe the selected upconverters as follows:

(*a*) Place the POWER switches to ON.

(*b*) Observe that the POWER indicators illuminates.

(*c)* Tune the applicable units to the selected frequency.

m. Rack 4, Alarm Monitor (A19) and LNA Control/ Translator (A20).

(1) *Alarm monitor* (A19). Place the POWER, AC, and DC switches to ON and observe the following:

(a) AC indicator illuminates.

(b) DC indicator illuminates.

NOTE

The audible alarm indicator may be activated at turn-on. Set the AUDIBLE SIGNAL/FAULT switch to OFF.

(2) *LNA control/translator (A20*). Place the TRANSLATOR POWER switch to ON: operate and observe as follows:

(a) Observe that the selected ON LINE indicator (LNA No. 1 or LNA No. 2) is illuminated.

(b) Place the selected LNA CONTROL POWER switch to ON and observe that the applicable POWER indicator illuminates.

(c) Place the selected LNA CONTROL HI HEAT switch to ON.

NOTE

THE FAULT indicator illuminates during warmup and will extinguish after approximately 5 to 8 minutes, depending upon the outside temperature. If desired, an applicable HI HEAT switch may be placed to the ON position to speed up the warmup cycle; the associated HI HEAT indicator illuminates in response.

n. Racks 3 and 4; On-Line Switch and On-Line Power Supply PP-7087 (A14 or A18).

(1) ON-LINE *switch (top of rack 3*). Place the ON-LINE (waveguide) switch to the selected PA position (PA1 and PA2).

NOTE

When the ON-LINE switch is in the PA1 position, the power supply A14 and power amplifier A13 group (located in rack 3) is terminated into the antenna and power supply A18 and power amplifier A17 group (located in rack 4) is terminated into the dummy load. When the ON-LINE switch is in the PA2 position, the status is reversed.

(2) *On-Line PWR SPLY PP-7087 (A14 or A18).*
Place the selected on-line power supply START and BLOWER switches to ON and place the selected power supply OPERATE/STANDBY switch to OPERATE. Allow a warm-up time of 5 to 8 minutes.

(3) *Power amplifier (A13 or A17*). On the selected power amplifier, operate as follows:

(*a*) Open the KLYSTRON TUNE door.

(*b*) Tune the klystron to the selected frequency (c) Close the KLYSTRON TUNE door.

o. Rack 2, Amplifier/Mixers (A18 and A10). Operate and observe the selected amplifier/mixer as follows:

(1) Set up the SHF MONITOR meter to read selected channel inputs (CH1, CH2, CH3, and CH4) for 70 mw as adjusted by the LEVEL ADJUST control.

(2) Set up the SHF MONITOR meter to read approximately 160 mw of SHF OUT as adjusted by the OUTPUT LEVEL control.

NOTE

Readjustment of the selected LEVEL ADJUST controls might be necessary. Any adjustment will cause a change in the step (1) input readings.

p. Racks 3 and 4, Power Amplifiers (A13 and A17). On the selected power amplifier, operate as follows:

(1) Hold the ZERO/SET switch in the SET position while performing the next step.

(2) Adjust the ZERO SET control for 0.0 watts reading on the MONITOR meter with the MONITOR select switch in the x0.1 position and release the ZERO/SET switch.

(3) Adjust the OUTPUT LEVEL control for approximately 10 watts on the MONITOR meter.

(4) Connect the SHF TEST OUT to the applicable RF patch panel input (upper section of rack 4).

q. Rack 1, Downconverter (A2, A3, A4, A5 or A6).

NOTE

In step *k* above, one or more of the five downconverters was designated as spare. Select a spare unit to be tuned below the transmitted frequency as outlined in the following steps.

(1) Place the POWER switch of the selected spare downconverters to ON and observe that the POWER indicators are illuminated.

(2) Tune the spare downconverters 725 MHz below the transmitter frequency.

r. Rack 2 or 3, Upconverter (A11 A12, A15 or A16). Operate the selected spare upconverter and observe as follows:

(1) Place the POWER switch to ON.

(2) Observe that the POWER indicator is illuminated.

(3) Place the TEST OSC switch to ON.

s. Rack 1, Downconverter (A2, A3, A4, A5, and/or A6). Place the MONITOR selector switch to IF OUT and observe meter reading of 35 to 45.

NOTE

Ventilation ports (internal and external). Adjust the ventilation ports as required to provide proper ventilation of the equipment (para. 3-8).

t. Rack 5, Modems and IF Patch Panel (A2).

(1) Modem (A3 or A6). Set up the controls on the selected modem as follows:

NOTE

FAULT lamps will extinguish after a delay.

(a) Place the ALARM/RESET-OFF-ON switch to the ON position.

(b) Place the MODE switch to the OPERATE position.

(c) TRANSMIT/INPUT DATA RATE thumb dials set to 1.5440 MB/S X. XXXX.

(d) Place the TRANSMIT/QPSK-BPSK switch to the QPSK position.

(e) Place the RANSMIT/ENCODER/DIFF-OFF switch to the DIFF position.

(f) Place the TRANSMIT/ENCODER/EXT- OFF switch to the EXT position.

(g) RECEIVE/CHANNELSYMBOLRATE thumb dials set to 1.5440 MB/S X.XXXX.

(h) Place the RECEIVE/QPSK-BPSK switch to the QPSK position.

(i) Place the RECEIVE/DIFF-OFF switch to the DIFF position.

(j) Place the RECEIVE/EXT-OFF switch to the EXT position.

(2) *Alternate modem.* Set up the controls on the alternate modem (the modem not used in the on-line status) as follows:

(a) Place the MODE switch to the TEST position.

(b) Place all other switches as (1)*(a)* (1)*(c)* through (1)*(j)* above.

(3) *IF patch panel (A2).* Set up the panel for the selected modem filter and upconverter to be used in the mode of operation.

u. Rack 6, Data Patch Panel (A8). Set up the panel to process the selected data circuits.

v. Rack 8, COMM/VF Patch Panel (A25). Operate and check as follows:

(1) Set up the VF SELECTOR switches for the selected multiplexer (A13 or A29).

(2) Check the CHANNEL SELECTION switches for the orderwire and teletype circuits.

w. Rack 7, TTY/LL COMM Patch Panel (A15). Set up the panel to patch through the selected circuits.

3-10. Alarm Monitor Safety Alert Check

On the alarm monitor ignore any SYSTEM FAULT CSS and RSS fault indications. Check that the audible alarm FAULT switch is in the OFF position. There should be no SAFETY ALERT indications.

WARNING

If any SAFETY ALERT indicators are illuminated the conditions must be cleared. Check the conditions as follows:

a. At the antenna the elevation safety switch should be set for minimum (0°) elevation angle. (Refer to paragraph 3-17 below and see figure 3-22).

b. Check waveguide connections at the power amplifier SHF output port and both ends of the flexible transmit waveguide at the antenna and shelter entry ports.

3-11. Tuning the Transmitter

Assume transmitter group 1 or 2 is assigned to on-line status and operating on a different frequency than set up in paragraph 3-9. Tune the associated power amplifier klystron and upconverter to the assigned transmit frequency. Proceed as follows:

a. On the associated power supply place the OPERATE-STANDBY switch to the STANDBY position.

b. Position the transmit waveguide switch so that this transmitter group is terminated into the dummy load.

c. On the associated power amplifier open the hinged KLYSTRON TUNE cover by loosening the five captive screws.

d. Rotate the FREQ calibration chart knob until the assigned transmit frequency is registered along the window line (see fig. 3-17). For example, if the assigned transmit frequency is 8225.0 MHz rotate the knob until FREQ 8225 is alined on the window's crossline.

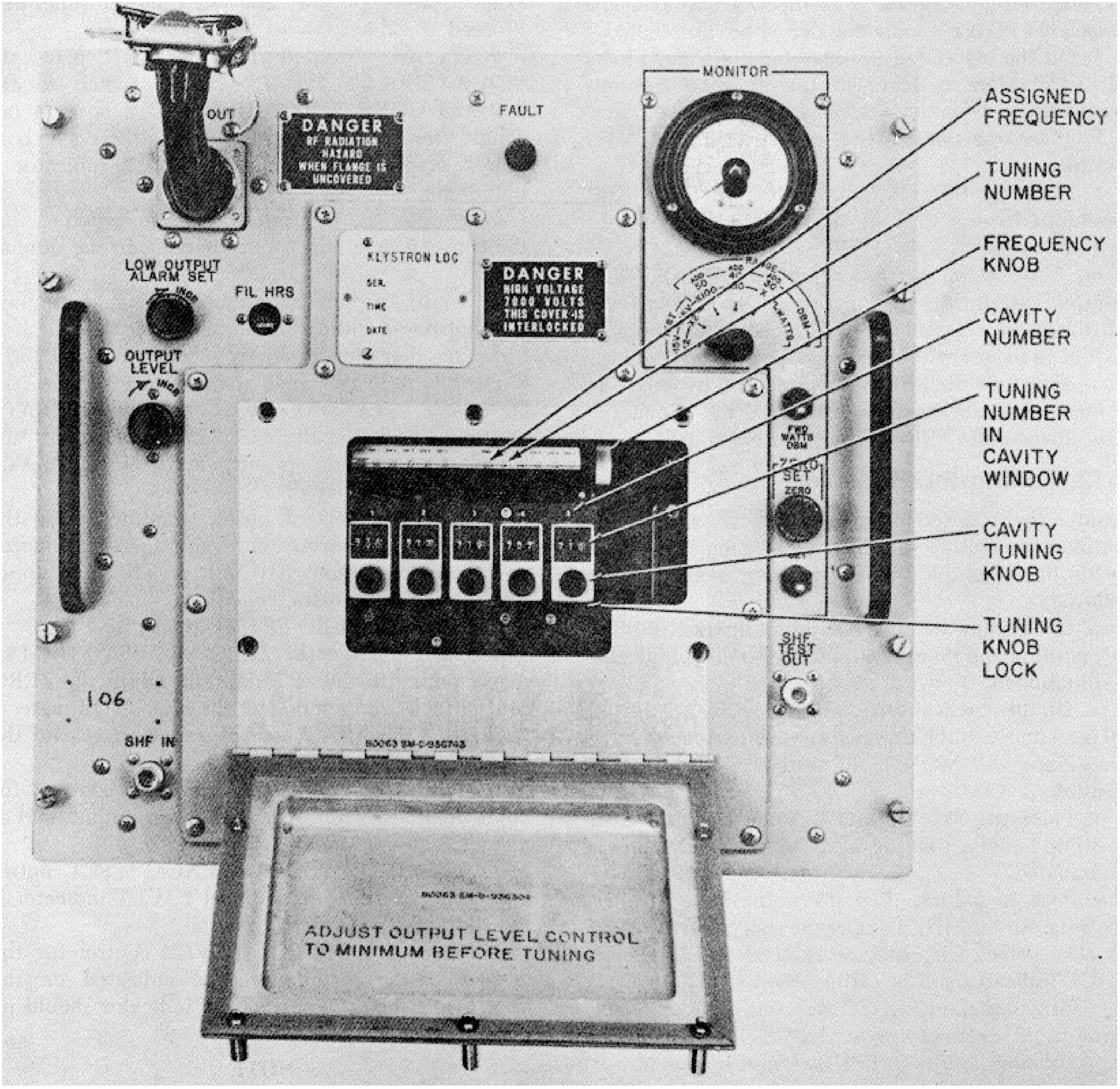


Figure 3-17. Klystron Frequency Chart and tuning Cavities.

e. Listed alongside each frequency entry are five columns of 3-digit numbers which are related to the five cavity tuning knobs and windows below the chart. The cavity tuning numbers (in this example) for 8225 MHz are as follows:
(each klystron has an applicable chart).

Cavity no. (column)	3-digit tuning no.
1	715
2	736
3	755
4	736
5	766

f. See figure 3-17. Unlock the tuning knob for cavity 1 by pushing the tuning knob lock to the left.
Rotate the cavity tuning knob to the assigned tuning number (715). Always approach this number from a clockwise direction and starting about 100 digits below it. For example, rotate the cavity tuning knob to 615 (from either direction) then rotate the knob clockwise up to 715. Lock the tuning knob for cavity 1.

g. Repeat step *f* above for cavities 2, 3, 4 and 5. The klystron is now tuned to the assigned transmit frequency.

h. Close and secure the KLYSTRON TUNE cover.

i. On the associated upconverter check that the POWER circuit breaker is in the ON position.

The associated POWER indicator should be illuminated.

j. On the associated upconverter place the FREQ SELECT MHz switches to the assigned transmit frequency.

k. Place the MONITOR switch to the SYNTH position.

l. Place the SYNTH MON switch to the 0 ERR position. Observe that the OUT OF LOCK indicator is illuminated.

m. Push to unlock then rotate the FREQ TUNE control until the MHz dial is at the assigned frequency. As the correct frequency is reached, the OUT OF LOCK indicator will be extinguished.

n. Fine tune the FREQ TUNE control by adjusting it for a mid-scale reading on the MONITOR meter.

o. Release the FREQ TUNE control to lock it.

3-12. Tuning the Receiver

Assume that a different receiver is assigned to on-line status and operating on a different frequency than that set up in paragraph 3-9. Tune the downconverter as follows:

a. Check that the POWER circuit breaker is in the ON position and that the associated POWER indicator is illuminated.

b. On the downconverter place the FREQ SELECT MHz switches to the assigned receive frequency.

c. Place the MONITOR switch to the SYNTH position.

d. Place the SYNTH MON switch to the 0 ERR position. Observe that the OUT OF LOCK indicator is illuminated.

e. Push to unlock, then rotate the FREQ TUNE control until the MHz dial is at the assigned frequency. As the correct frequency is reached the OUT OF LOCK indicator will be extinguished.

f. Fine tune the FREQ TUNE control by adjusting it for a mid-scale reading on the MONITOR meter.

g. Release the FREQ TUNE control to lock it.

3-13. Setting the Transmitter Power Output

Assume that a different transmitter group (1 of 2) is assigned on-line status. Set the power output to assigned level on the associated power amplifier. Proceed as follows:

a. On the power distribution panel place the MODE SELECT PA/AIR COND switch to the PA/AIR COND 2 PA2/AIR COND 2 position (air conditioner No. 2 will be turned on). Observe on both power supplies that the AC POWER indicator is illuminated.

b. Position the transmit waveguide switch so that the transmitter group is terminated into the dummy load.

c. On the associated transmit-receive modem, place the controls as outlined in paragraph 3-9t.

d. On the power supply check that the FIL INHIBIT indicator has turned off. Place the OPERATE STANDBY switch to the OPERATE position. Check that all FAULT indicators are off, the STANDBY indicator is off, and the OPERATE indicator is illuminated.

e. On the associated power amplifier place the MONITOR range switch to the appropriate (assigned) power range position, X1, X10, or X100 (use upper watts range scale, black stencil).

f. Unlock the ZERO SET/ZERO control.

g. While holding the ZERO SET/SET-NORMAL toggle switch in the SET position, adjust the ZERO control for a zero reading on the MONITOR meter.

h. Lock the ZERO control and then release the SET-NORMAL toggle switch.

i. Adjust the OUTPUT LEVEL control for approximately 1/2 of the desired power output level as indicated on the MONITOR meter.

j. Unlock the LOW OUTPUT ALARM SET control and adjust until the front panel FAULT indicator is just illuminated. Lock the control.

k. Adjust the OUTPUT LEVEL control for the desired power output level as indicated on the MONITOR meter. The FAULT indicator should be extinguished.

NOTE

The power amplifier low output level alarm is now set.

l. On the power supply place the OPERATE-STANDBY switch to the STANDBY position.

3-14. Receive Field Alinement.

For field alinement of the receive group the following test equipment and cables are required:

Limiter, SM-A-934943
Cable Assembly, SM-C-935488-1
6 dB Attenuator, SM-A-937237-3
14 dB Attenuator, SM-A-937237-1
RF Power Meter, HP-436A with HP-848A Power Sensor and HP-8481A Power Sensor

a. LNA Low Noise Gain/Slope Adjustment

NOTE

The LNA low noise gain/slope is adjusted using signal sources within the terminal in conjunction with precision attenuators and a low level SHF hard limiter as shown in figure 3-18. A signal at the local receiver frequency is obtained from the SHF local oscillator output (A1A1J2) of the frequency synthesizer in the upconverter drawer. The output level of signal is between the limits of + 6 and + 12 dBm. The signal is passed through the SHF hard limiter and attenuators to provide a - 66 dBm signal at the low noise amplifier (LNA 1 or LNA 2) test port of the waveguide switch on the antenna mounted electronic subassembly and at the LNA input.

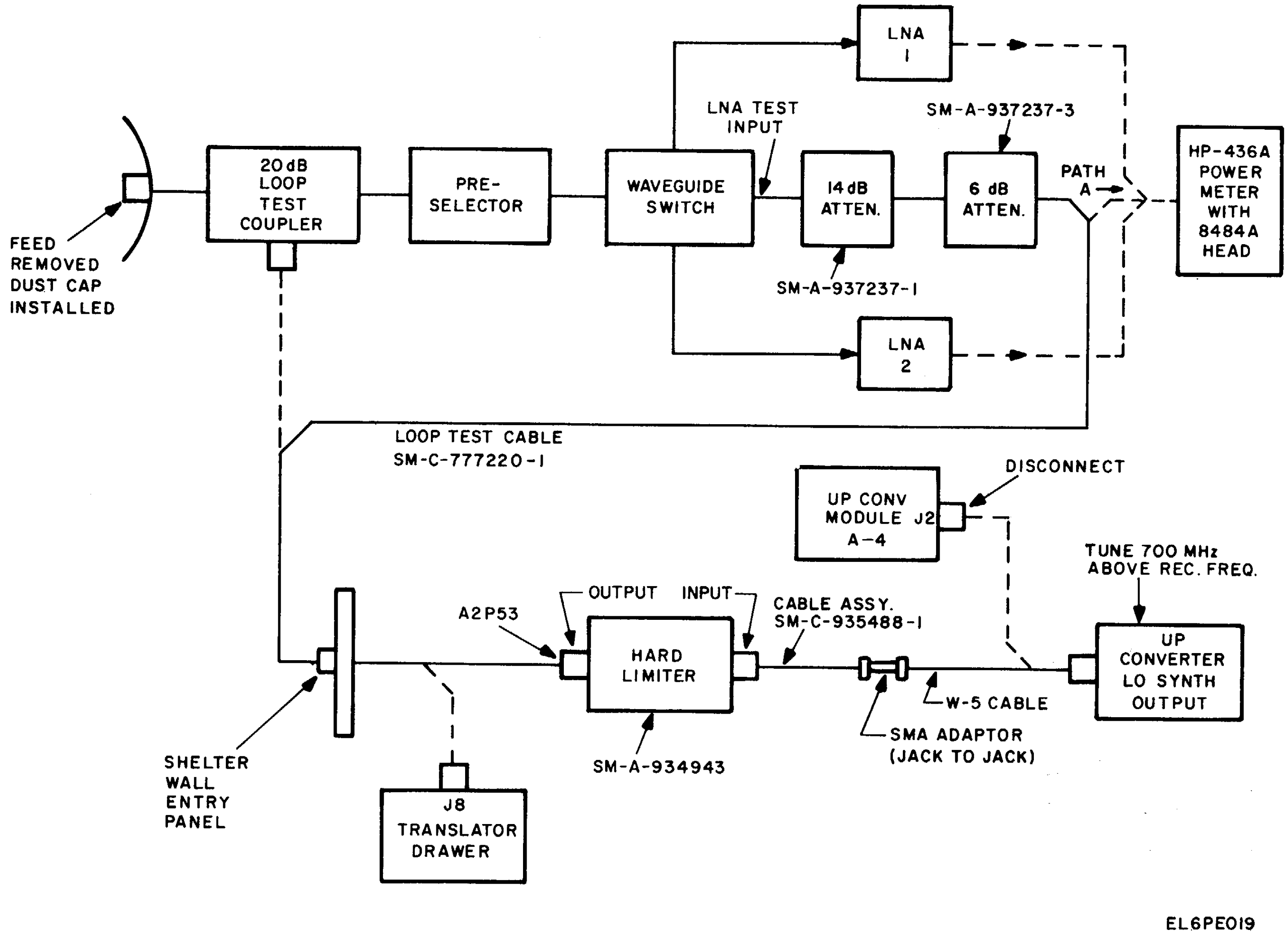


Figure 3-18. Low Noise Amplifier, Gain/Slope Adjustment Diagram.

(1) Turn off power to the upconverter and turn on power to the LNA. Allow one hour for warmup.

(2) Loosen the captive screws fasteners on the front panel of an upconverter drawer and pull the drawer forward on its slides.

(3) Disconnect cable W-5 going from the synthesizer of the upconverter at J2 on module A4 and connect the same to the hard limiter test assembly (SM-A-934943) through test cable assembly SM- C-935488-1 and the SMA adapter provided.

(4) Loosen the captive screws on the front panel of the LNA control/translator drawer and pull the drawer forward on its slides.

(5) Disconnect connector A2P53 going to receptacle J8 (SHF OUT) at the rear of the LNA control/translator drawer, and connect it to the output of the limiter SM-A-934943.

(6) At the AME assembly, disconnect the terminal loop test cable (30A1W10) from the loop test coupler input and connect the cable to the RF power meter with low power head (HP-8484A) using a UG-29B/U adapter.

(7) Configure the shelter for normal operation and turn the power ON except that the power amplifiers are left on STBY.

(8) Tune the upconverter synthesizer test signal source to 8399.000 MHz and measure and record the signal level.

(9) Repeat step 8 above at 8300.00Mhz.

(10) Repeat step 8 above at 8200.00 MHz.

(11) Repeat step 8 above at 7950.00 MHz.

(12) Disconnect the loop test cable from the RF power meter and connect the cable to the waveguide switch test input through the 14 dB and 6dB series attenuators provided (Sm-A-937237-1, and -3).

(13) Disconnect the output cable from the LNA to be tested and connect the HP436A Power Meter with HP 8484A power head (using a UG-298/U adapter) to the LNA-1 or LNA-2 output port as the case may be, as selected at the LNA control/translator.

NOTE

With the test signal applied to the LNA test port of the W/G switch, LNA #2 is being tested with selector switch to the LNA #1 on the LNA control/translator.

(14) Tune the synthesizer in the upconverter drawer to 7950.00 MHz. Read and record the output level on the HP436A Power Meter.

(15) Repeat step 14 above at 8200.000 MHz.

(16) Repeat step 14 above at 8300.000 MHz.

(17) Repeat step 14 above at 8399.000 MHz.

(18) Calculate and record the LNA input level for each frequency by decreasing the measured levels of steps 8 through 11 above by 20 dB.

(19) Calculate and record the LNA gain by taking the algebraic difference between the levels of step 18 above and LNA output levels of steps 14 thru 17 above.

(20) The gain should be within the limits of 39 ± 2.0 dB at each measured frequency. If such is the case, proceed to the downconverter gain calibration step 3-14*b*. If not, proceed to step 21 below.

(21) Plot the power output reading vs. frequency on a graph. It is desirable to have a flat or slightly positive slope of the LNA gain characteristic (fig. 3-20).

(22) The LNA gain/slope may be adjusted by removing the access covers and weatherproofing plugs on the side of the LNA as shown in figure 3-19. A special thin wall socket nut driver is required to loosen the lock nut on the screwdriver adjustment for the LNA pump power and bias controls which affect the gain/slope of the LNA. A CW rotation of the adjustment screw produces a negative slope and vice versa; the adjustment sensitivity is approximately 5 dB/quarter turn. The bias control mainly affects the low frequency gain; however, both controls interact and therefore may require alternate repeated adjustments.

NOTE

Access to LNA No. 1 adjustment may be improved by temporary removal of the W/G switch cable.

(23) If the gain of the LNA at the four frequencies is not within ±2 dB of 39 dB, adjust the bias control until such is achieved. It also may be necessary to adjust the pump control slightly. To expedite the adjustment procedure, calculate and record the output level range limits in dBm for each frequency by adding 37 and 41 dB to the input levels calculated in step 18. For example an input level of - 64 dBm will have an LNA output range of - 27 to - 23 dBm.

(24) The adjustment should be performed in accordance with conditions and procedures shown in table 3-18.

NOTE

It may be necessary to perform the adjustment procedures several times to obtain the correct limits. It is better to make several slight adjustments to the controls instead of attempting one large adjustment.

(25) After the gain is correctly adjusted, lock the controls in accordance with the following:

(a) Set the synthesizer at 8399 MHz and note the reading on the power meter. This reading must be maintained when locking the controls.

(*b*) Insert the screwdriver into the handle of the nut driver such that the screwdriver can be applied to the pump power adjustment screw while the nut driver is engaging the lock nut.

(*c*) While observing the power meter gently move the adjustment screws back and forth very lightly and slowly tighten the lock nut. Keep the gain at the desired level while performing this step.

(*d*) After the lock nut has been tightened, gently tap the adjustment screw with the tip of the screw driver to relieve internal stress in the locking mechanism.

(*e*) Tighten the BIAS voltage control in a similar manner.

(*f*) Replace the weatherproof access caps, remove all test cables and attenuators, restore all drawers to normal and return the terminal to normal operation.

Table 3-18. LNA Response Adjustment

Condition	Corrective Action
1. a. Gain relatively flat for all frequencies. b. Gain below minimum for all frequencies	a. Set the synthesizer to 8399 MHz. b. Adjust the gain upward by rotating pump power control slightly CCW until the gain is within the required level (39 ±2 dB) c. Set the synthesizer to 7950 MHz. d. Using the BIAS voltage control adjust the gain up (CW) or down (CCW) to the same level as that in step b above. e. Repeat steps a through d as necessary to obtain the desired level. f. Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
2. a. Low frequency gain b. High frequency gain below limits.	a. Set the synthesizer to within limits. 8399 MHz. b. Slightly adjust the pump power control CCW so that the gain equals that previously measured with the synthesizer set at 7950 MHz. c. Remeasure the gain with the synthesizer set at 7950 MHz; if necessary adjust the bias voltage and pump power controls to obtain the desired gain. d. Repeat steps a, b and c as necessary. e. Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
3. a. Response has a negative tilt. b. Gain is low for all readings.	a. Set the synthesizer to 8399MHz. b. Adjust the gain by rotating the pump power control CCW to reach the desired level. c. Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
4. a. Response is relatively flat b. Gain is high at all frequencies.	a. Set the synthesizer to 8399MHz. b. Reduce the gain by slightly rotating the pump power control CW until the correct level is reached. c. Set the synthesizer to 7950 MHz. d. Use the bias voltage control to set the gain at the same level measured in step b above. e. Repeat steps a and b above and adjust the gain to the same level as first time. f. Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
5. a. Low frequency gain is within limits b. High frequency gain	a. Set the synthesizer to 8399MHz. b. Adjust the pump power control in a CW direction is higher than limits to reduce the gain to that measured for the low frequency (synthesizer at 7950 MHz) c. Measure the gain with the synthesizer set at 7950, 8200, 8300, and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.

Table 3-18. LNA Response Adjustment-Continued

Condition	Corrective Action
6. *a.* Response has a positive tilt. *b.* Gain is higher at all frequencies.	a. Set the synthesizer at 8399 MHz. *b.* Adjust the pump power control in a CW direction to decrease the gain to the desired level. *c.* Set the synthesizer at 7950 MHz and adjust pump power and bias voltage controls to obtain the same gain as obtained in step b. above. d. Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe the conditions and compare with this table. Proceed accordingly.

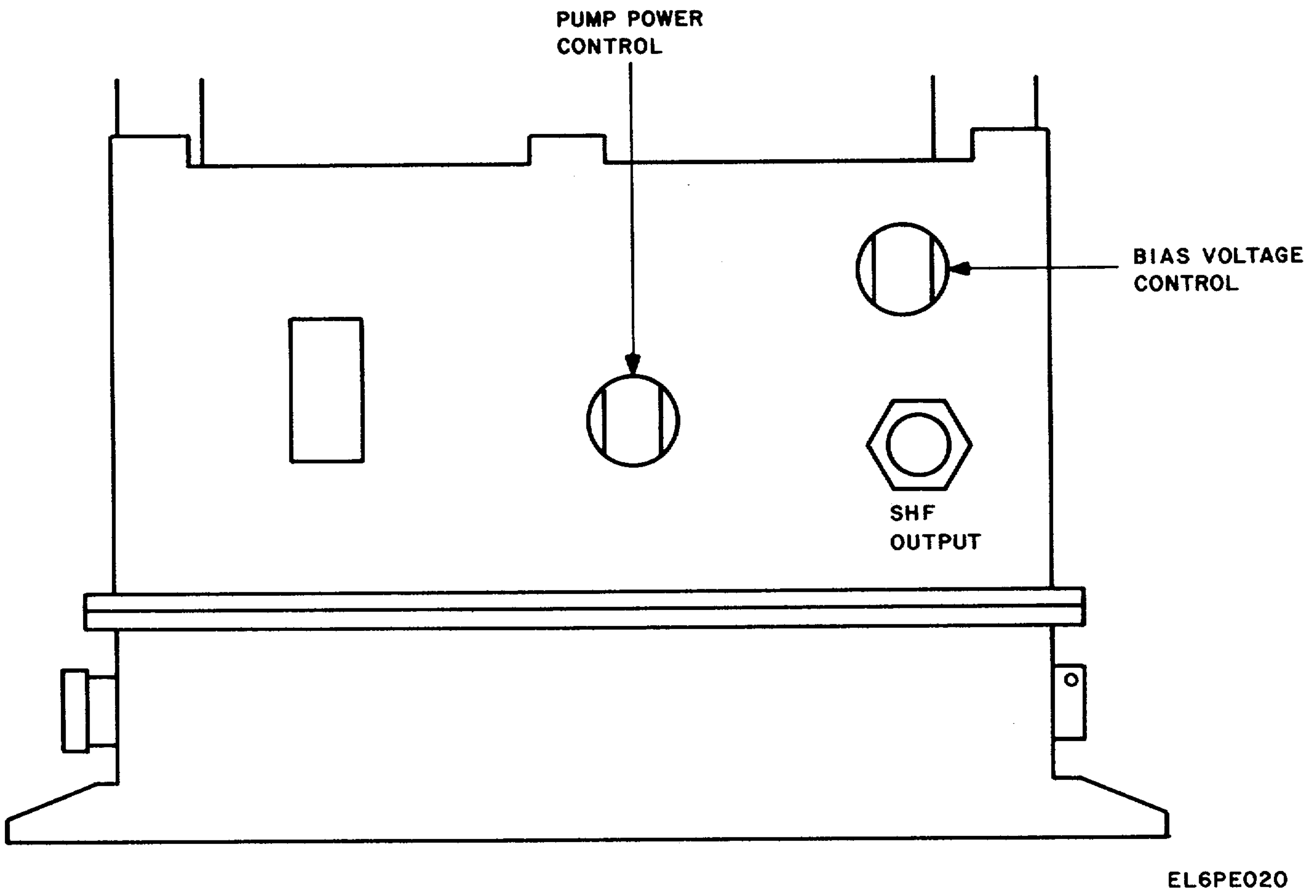


Figure 3-19. LNA Adjustment Locations.

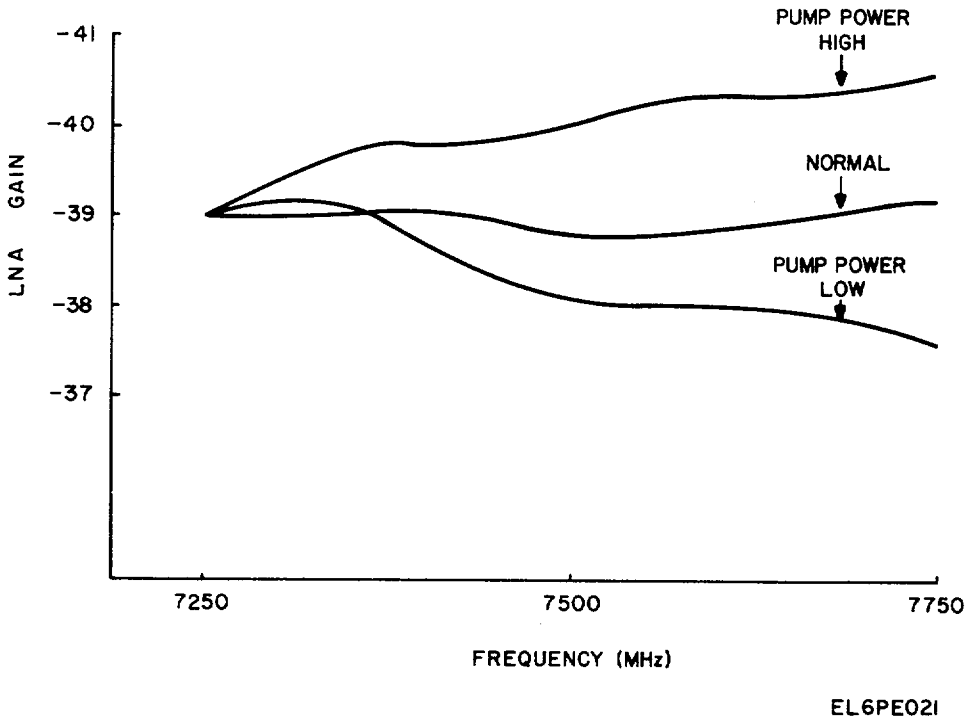


Figure 3-20. LNA Gain/Slope Level.

b. Overall Receiver Gain

NOTE

The overall receiver gain is calibrated using signal sources within the terminal in conjunction with precision attenuators and a low level SHF hard limiter as shown in figure 3-21. A signal at the local receiver frequency is obtained from the SHF local oscillator output of the frequency synthesizer in the upconverter drawer. The output level of this signal is between the limits of + 6 and + 12 dBm and is passed through the SHF hard limiter and attenuator to provide a -52 dBm signal at the 20 dB coupler on the AME subassembly, which gives a nominal -72 dBm signal at the LNA input.

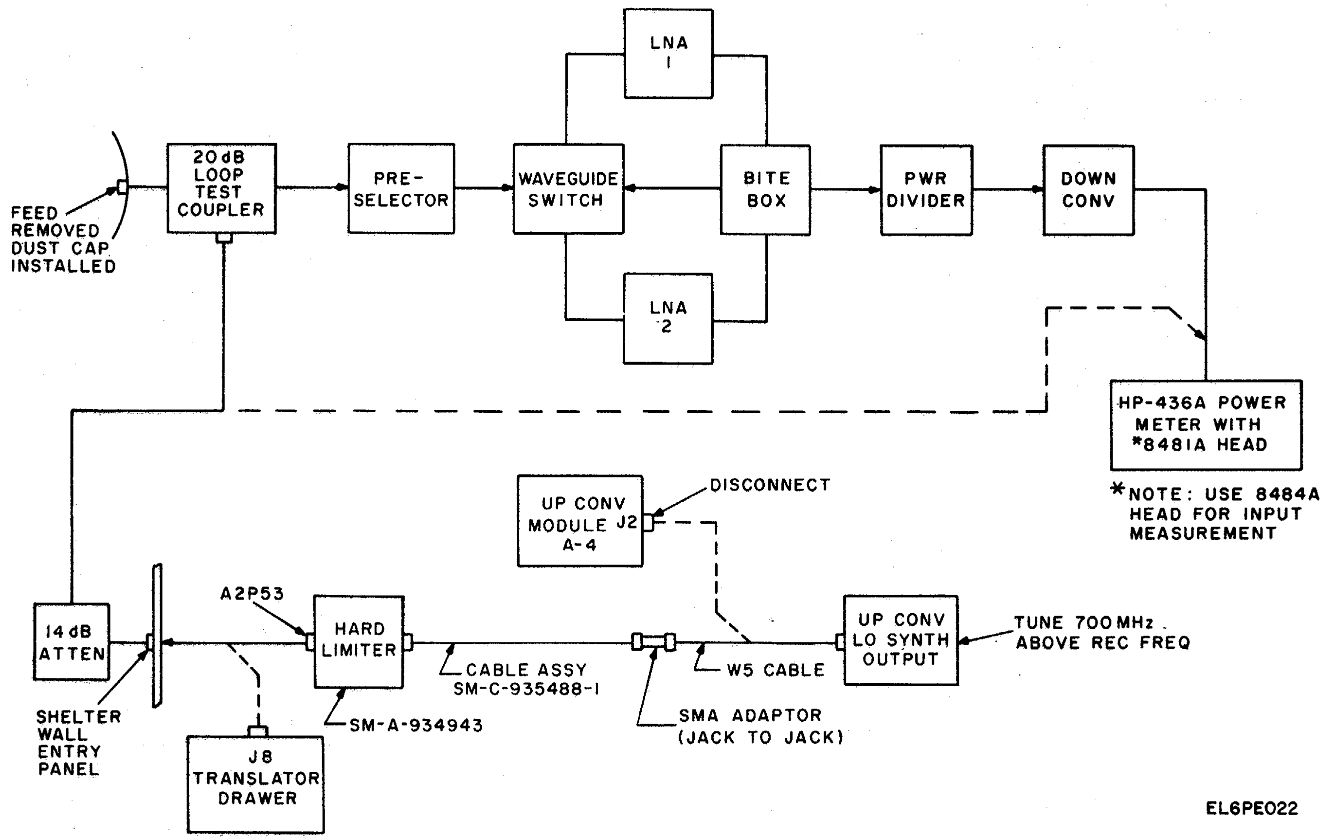


Figure 3-21. Overall Receiver Gain Adjustment Diagram.

(1) Remove the feed-tube from the antenna center section and replace it with a dust cap or aim the antenna at a quiet spot in the sky.

(2) Loosen the captive screws on the front panel of the upconverter drawer and pull the drawer forward on its slides.

(3) Disconnect cable W5 going from the synthesizer of the up converters at J2 on module A4 and connect the same to the hard limiter test assembly (SM-A-934943) through the test cable assembly (SMC-935488-1) and the SMA adapter provided.

(4) Loosen the captive screws on the front panel of the LNA control/translator drawer and pull the drawer forward on its slides.

(5) Disconnect the connector A2P53 going to receptacle J8 (SHF OUT) at the rear of the LNA control/translator drawer and connect it through a 6dB attenuator to the output of the hard limiter test assembly, SM-A-934943.

(6) Configure the shelter for normal operation and turn the power ON. The power amplifiers are left on standby.

(7) At the antenna mounted assembly, disconnect the terminal loop test cable from the LOOP TEST coupler and connect the cable to the RF power meter with low power head HP-8484A using a UG-29B/U adapter.

(8) Set the upconverter synthesizer to 8399 MHz and the downconverter to 7699.000 MHz and measure and record the signal level.

(9) Repeat step 8 above at 8200 MHz and 7500.000 MHz.

(10) Repeat step 8 above at 7950 MHz and 7250.000 MHz.

(11) Disconnect the loop test cable from the power meter and connect it through the 14 dB attenuator to the LOOP TEST coupler.

(12) Calculate and record the input levels for each frequency by subtracting 14 dB from the measured levels of steps 8, 9 and 10 above.

(13) Connect the power meter with the HP8481A head to the 70 MHz OUTPUT (4) of the downconverter to be measured.

(14) Read and record the measured level. The level should be at least 50 dB above the level calculated in step 12 above.

(15) The output level may be adjusted if necessary at the 700/70 MHz mixer assembly A2A1 in the downconverter drawer, with the receiver gain adjustment control R5 or MDL gain control R6.

(16) The overall receiver gain may be measured for receive frequencies of 7250 MHz and 7699 MHz by tuning the upconverter synthesizer to 7950 MHz and 8399 MHz respectively. Output levels should be at least 50 dB above the input at the 20 dB coupler.

(17) Repeat the above steps for other downconverters as required.

(18) Replace the antenna feed, remove all test cables, and restore all normal connections on the drawers to return the shelter to normal operation.

3-15. Performing the Transmit-Receive System Loop Test

Accomplishment of this procedure will check the continuity and/or performance of the transmit-receive loop through the following on-line units or functions; transmit side of transmit-receive modem, upconverter, power amplifier (and associated power supply), antenna receiver directional coupler, LNA waveguide switch, selected on-line LNA, LNA BITE unit coaxial transfer switch, SHF IN cable, receiver power splitter (downconverter input patch), the downconverter associated with the transmit-receive modem and the receive side of the transmit-receive modem. Check that AC power is applied to all units. The transmitter will drive into the dummy load and not transmit to the satellite. The transmitter group 1 is assumed to be online along with transmit-receive modem 1 and associated downconverter.

a. On the alarm monitor, place the AUDIBLE SIGNAL/FAULT switch to the OFF position.

b. On the downconverter, place the FREQ SELECT MHz switches to that receive frequency which is 725 MHz below the on-line upconverter transmit frequency (refer to para 3-11 for receiver tuning procedure). This frequency setting is temporary only and in support of this translator loop test and the satellite acquisition procedure.

c. On the power distribution panel check that the PA/AIR COND switch is in the (on-line) PA1/AIR COND2, PA2/AIR COND2 position. Restart the air conditioner, if necessary.

d. Position the transmit waveguide switch so that this transmitter group (PA1) is terminated into the dummy load (PA2 is set to on-line).

e. On the PA1 power supply, place the OPERATESTANDBY switch to the OPERATE position.

J. On the antenna control, place the MODE switch to the MANUAL position and the MONITOR switch to the CARRIER LEVEL position.

g. On the LNA control/translator, place the TRANSLATOR switch to the ON position. Observe that the TRANSLATOR indicator is illuminated.

h. On the antenna control, set the MGC control to the 130 position.

i. On the selected transmit-receive modem, open the unit (approx. two inches) and place the XMT and RCVR function switches as follows:

(1) Switch S13 to the center position.

(2) Switch S14 to the NORMAL position.

(3) Switch S15 to the FAST position.

(4) Switch S17 to the FULL position.

(5) Switches S18 and S19 to the OFF position.

i. Observe that the fault indicators on the on-line (active) units and the SYSTEM FAULT/CSS and RSS indicators on the alarm monitor are extinguished.

NOTE

If a modem fault exists, place the applicable alarm monitor OVERRIDE-NORMAL switch to OVERRIDE or the off-line modem POWER switch to the OFF position.

k. If the observations in steps *i* and *j* above are correct, the equipment is functioning properly; proceed to step I below. If the observations are not correct, refer to chapter 5 and perform the necessary troubleshooting and maintenance.

I. Switch the other LNA on-line and repeat steps *i* through *k* above and then proceed to step *m* below.

m. On the LNA control/translator, place the TRANSLATOR switch to the OFF position. Switch the original LNA on line.

n. On the associated (on-line) power supply, place the OPERATE-STANDBY switch to the STANDBY position.

o. On the alarm monitor, open the access cover and place all fault switches to the NORMAL position; close the cover. Leave the AUDIBLE SIGNAL/FAULT switch in the OFF position.

3-16. Acquiring the Satellite

NOTE

If the input carrier level is anticipated to be below 125 dBm and if the satellite has not been previously acquired at the assigned frequency or with the selected LNA/downconverter combination, adjust the gain of the communications tracking module (A12) in the antenna control unit. After performing the gain adjustment, return to this procedure and acquire the satellite.

a. Acquisition with Antenna Control.

NOTE

Do not connect the remote control unit.

(1) Check that the TRANSLATOR switch on the LNA/control translator is in the OFF position. Place the transmit waveguide switch to the PA 1 ON LINE position. On the PA1 (on-line) power supply, place the OPERATE-STANDBY switch to the STANDBY position.

(2) Set the receive frequency on downconverter 5 to the beacon frequency (7250.1 or 7675.1 MHz),

(3) On the antenna control, check that the POWER switch is in the ON position and the POWER indicator is illuminated.

(4) Place the SCAN MODE switch to the MANUAL position.

(5) Operate the AXIS CONTROL switch in the UP/DOWN direction until the EL DEG POSITION indicator shows 0.4 degrees below the expected elevation of the satellite.

(6) Operate the AXIS CONTROL switch in the LEFT/RIGHT direction until the CROSS EL DEG POSITION indicator shows approximately 9.0 degrees to the right of the expected azimuth position on the satellite.

(7) Set the MGC control to the 130 position or 10 dB below the expected receive level; the TRACK SIG LOSS indicator should be illuminated.

(8) Place the SCAN MODE switch to the ACQ position and the MONITOR switch to the CARRIER LEVEL position.

(9) Antenna travel will stop when the satellite is acquired, the MONITOR meter will indicate a satellite signal, and the TRACK SIG LOSS indicator will be extinguished.

(10) Decrease the MGC control setting (adjust CW) until the TRACK SIG LOSS indicator is just illuminated.

(11) Increase the MGC control setting (CCW) to the next higher position on its dial (i.e., if the TRACK SIG LOSS indicator is illuminated at 110, set the control to 115); the indicator should be extinguished.

(12) Place the SCAN MODE switch to the MANUAL position.

(13) Operate the AXIS CONTROL switch for a maximum indication on the MONITOR meter. (Repeat step (11) above if necessary.)

(14) Place the SCAN MODE switch to the AUTO TRACK position. The antenna now will automatically track the satellite.

NOTE

If the satellite cannot be acquired it will be necessary to recheck the sighting points and antenna heading; refer to paragraph 2-9.

b. Acquisition with Remote Control Unit.

(1) Repeat steps a(1l) through a(6) above.

(2) Connect the remote control unit cable to the RCU connector on the antenna entry panel.

(3) On the remote control unit, set the MGC control to the 130 position or 10 dB below the expected receive level.

(4) Get into a position to observe the antenna from the side of the antenna.

WARNING

ELECTROMAGNETIC RADIATION
DO NOT STAND IN THE DIRECT PATH OF THE ANTENNA WHEN THE POWER IS ONI DO NOT WORK ON THE WAVEGUIDES WHILE THE POWER IS ONI High Frequency electromagnetic radiation can cause fatal internal burns. It can literally cook internal organs and flesh. If you feel the slightest warming effect while near this equipment, MOVE AWAY QUICKLYI

(5) Observe that the REMOTE ON and TRACK SIG LOSS indicators are illuminated.

(6) Place the MODE switch to the ACQ position.

(7) Antenna travel will stop when the satellite is acquired, the MONITOR meter will indicate a satellite signal, and the TRACK SIG LOSS indicator will be extinguished.

(8) Decrease the MGC control setting (adjust CW) until the TRACK SIG LOSS indicator is just illuminated.

(9) Increase the MGC control setting (CCW) to the next higher position on its dial (i.e., if the TRACK SIG LOSS indicator is illuminated at 110, set the control to 115): the indicator should be extinguished.

(10) Place the MODE switch to the MANUAL position.

(11) Operate the AXIS CONTROL switch for a maximum indication on the CARRIER LEVEL meter.

(12) Place the MODE switch to the AUTO position. The antenna now will automatically track the satellite.

NOTE

If it is necessary or desirable to remove the remote control unit after acquisition has been accomplished, place the antenna control (drawer unit) SCAN MODE switch to the AUTO position and its MGC control to the same setting as that on the remote control unit. Disconnect the remote control unit cable from the antenna entry panel. The antenna will continue to automatically track the satellite.

NOTE

If the satellite cannot be acquired it will be necessary to recheck the sighting points and the antenna heading; refer to paragraph 2-9.

3-17. Setting the Antenna Elevation Safety Switch for the 8-foot antenna

After the satellite is acquired, set the antenna elevation safety switch. The control knob for the switch is located on top of the elevation position readout assembly on the antenna's left pillow block (fig. 3-22). Proceed as follows:

a. If the satellite elevation angle is approximately 20 degrees or above, set the control knob to 16 degrees. Maintain a tracking angle difference of approximately 4 degrees, minimum.

b. If the satellite elevation angle is approximately 29 degrees or below, set the control knob to 15 degrees or below, respectively. Maintain a tracking angle difference of approximately 4 degrees.

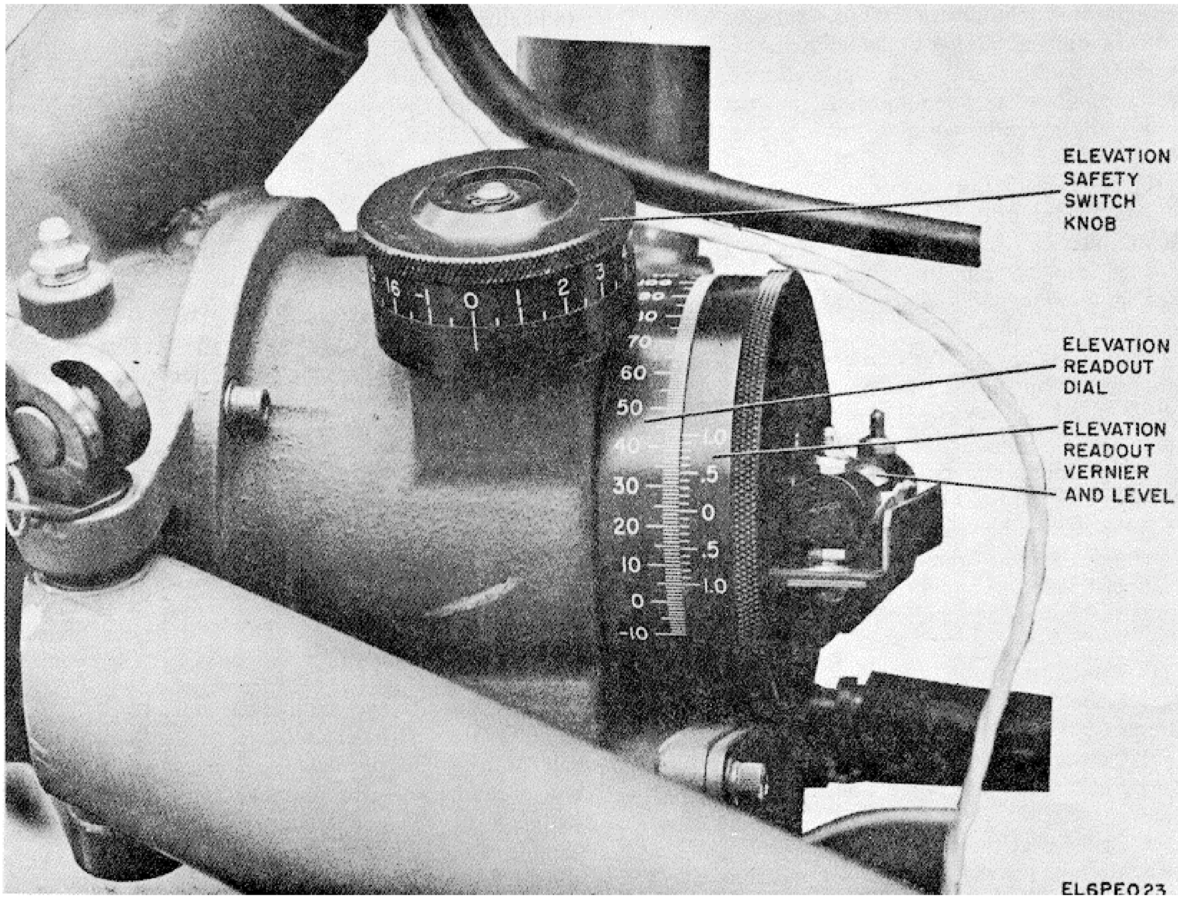


Figure 3-22. Antenna Elevation Safety switch and Elevation Readout Items.

3-18. Establishing Orderwire Communications.

Establish orderwire communications with the appropriate terminals by patching the appropriate up and down converters to the operational modem through the IF patch panel, according to the operating mode assignment. Proceed as follows.

a. Retune the on-line downconverter to its assigned receiver frequency.

b. Check that all remaining active converters are tuned to their respective assigned frequency.

c. Patch the orderwire to the assigned channel on the VF patch panel.

d. Transmit a ring signal to the selected terminal by activating the RING switch on the orderwire.

e. Patch the converter for other terminals to be contacted and repeat steps c and d above for the remaining terminals according to the operating mode assignment.

Section III.OPERATION UNDER UNUSUAL CONDITIONS

3-19. Scope.

This section contains instruction and procedures which allow the operator to keep the equipment in operation under equipment failure conditions. It also contains procedures for manual operation of the antenna should the antenna control or actuators fail.

3-20. Operation Under Failure Conditions.

a. Scope.

(1) When one or more of the mission-essential equipment groups or units fails, the terminal can continue to be operated, at full capability, by substituting the related standby group or units for the failed, on-line equipment.

Thus, substitution of standby equipment applies to the following redundant groups: transmitter groups 1 and 2 (up-converter, power supply and power amplifier), downconverter groups 1 the antenna-mounted low noise amplifiers (LNA) 1 and 2.

(2) Should a failure occur in a downconverter group the lowest priority traffic group is selected to have its service discontinued. If necessary, this procedure can be repeated until the terminal is operating in a point-to-point mode, i.e., only one transmit-receive condition.

b. Failure of On-Line Transmitter Group. When a failure occurs in either the on-line upconverter, amplifier/mixer, power supply, or power amplifier, all four units are switched off-line as a complete transmitter group. The standby transmitter group is then switched on-line by patching. The modem patching must also be switched to the standby group.

For example, assume transmitter group 1 is on-line and has just failed. Assume transmitter group 2 is in standby but now will be switched on-line. Proceed as follows:

(1) Disable the audible alarm.

(2) Place the on-line power supply to the standby condition.

(3) On the power distribution panel, turn off the circuit breaker to the failed, on-line transmitter group.

(4) Check that the standby upconverter and PA klystron are tuned to the assigned transmit frequency.

(5) Check that ac power is on the standby upconverter, amplifier/mixer and power supply. Check that the power supply is in the standby condition and there are no fault or status inhibit indications.

(6) Place the transmit waveguide switch to the PA2 position.

(7) Place the standby power supply to the operation condition.

(8) Enable the audible alarm.

(9) Patch the modem from the failed unit to the standby unit.

c. Failure of On-Line Low Noise Amplifier (LNA). If the on-line low noise amplifier (LNA) fails, the standby LNA can be switched on-line to replace it. For example, assume LNA 1 is on-line and has just failed and LNA 2 is in standby. If (warmup) power has been applied to the standby LNA and its associated FAULT indicator on the LNA control panel is not illuminated proceed to step (3) below. If not, proceed to step (1) below.

(1) At the LNA control/translator, on the standby LNA (2) control, place the POWER circuit breaker to the ON position. Observe that the associated POWER indicator is illuminated.

(2) The FAULT indicator will remain illuminated until the stabilization temperature is reached in the standby LNA (approximately 8 minutes). If desired, place the HI HEAT switch to the ON position to speed up the warming cycle (the HI HEAT indicator will be illuminated).

(3) Check that the FAULT indicator is not illuminated. Momentarily place and hold the STBY LNA TEST/ON-TEST switch in the ON position. Observe that the LNA NORMAL (and TEST OSC) indicator is illuminated; release the switch.

(4) Place the ON LINE switch to the standby LNA position (No. 2 in this example). Observe that the ON LINE/LNA indicators change state.

(5) Turn off power to the failed LNA at its LNA control panel (No. 1 in this example).

d. Failure of the LNA Waveguide Switch or BITE Unit Coaxial Switch on the 8-foot Antenna. When the waveguide switch fails to transfer over, either through its own failure or loss of the on-line control signal, it can be operated manually. The ON LINE indicator on the LNA control/translator will not indicate a transfer. When the BITE unit coaxial switch fails to transfer, it can be bypassed. If the coaxial switch itself is faulty, the ON LINE indicator will still indicate a valid transfer, but of the waveguide switch only. This type of failure will crisscross the two LNA SHF output signals to the BITE unit and the downconverters and would, no doubt, trigger multiple receiver fault alarms. Manual operation is the same regardless of the type of failure. Proceed as follows:

WARNING

This procedure should not be performed with the transmitter power on. On both power supplies place the OPERATESTANDBY switches to the STANDBY position.

(1) On the rear of the antenna center section, loosen the four captive screws on the MANUAL ACCESS cover of the waveguide switch.

(2) Using the switching knob, place the waveguide switch to the selected online LNA position.

(3) Remove the cable from the SHF OUT connector on the selected on-line LNA.

(4) At the LNA BITE unit remove the coaxial cable from the SHF OUT connector and connect it to the SHF OUT connector on the selected on-line LNA.

NOTE

Step (4) above bypasses the coaxial switch in the LNA BITE unit.

e. Failure of the Antenna Control Unit, Elevation Actuator, or Cross Elevation Actuator on the 8-foot Antenna.

If one or more of these equipments should fail, proceed as follows:

(1) At the antenna control unit, place the POWER circuit breaker to the OFF position.

(2) Loosen the four captive screws on the front panel and pull on the handles to extend the unit from the rack.

(3) At the rear of the unit, place the power select switch for the communications tracking module to the LNA position.

(4) Return the unit to its closed position and tighten the four captive screws.

(5) The antenna can now be operated in both the elevation and cross elevation axis by the use of the hand crank supplied. The hand crank is stored in stowage bag SM-C-937355-3 (see fig. 2-4 and refer to table 2-1).

Section IV. PREPARATION FOR MOVEMENT

3-21. Scope

This section includes instructions for disassembly and dismantling and the stowing of the equipment for transport to a new location.

WARNING

Before starting any of these procedures, be sure that the terminal equipment is in a complete shutdown condition and that the generator set is not operating.

3-22. Disassembly, Dismantling, and Stowage of the 8-foot Antenna

Refer to table 2-1 for a list of stowed items. See figure 2-4 for the location of stowed items.

a. Removing External Connections.

(1) At the signal entry panel, remove all interfacing cabling.

(2) Secure and stow all these cables with the equipment to which they are connected.

b. Removing Power Cables and Ground Cables.

(1) Disconnect primary power cable from the generator and the power entry panel.

(2) Disconnect ground cables from the power distribution box, the shelter power entry panel, and the antenna left pillow block.

(3) Disconnect ground cables from the two ground rods.

(4) Coil, secure, and stow these cables in their bag assemblies.

(5) Retrieve both ground rods (at the pallet and shelter). Separate the rod sections and stow them.

c. Removing Antenna Cables and Waveguide.

(1) Loosen the hanger straps on the messenger cable.

CAUTION

Always handle the transmit waveguide with care. Damage caused by poor handling can result in loss of performance.

(2) Release the quick disconnect clamps at the antenna and shelter and remove the transmit waveguide, W3. Coil the waveguide and stow it in its storage box.

(3) Disconnect the following cables at the antenna entry panel:

(a) W1-elevation actuator drive.

(b) W2-cross elevation actuator drive.

(c) 3OAlW1-receive SHF.

(d) 30A1W5-LNA 1 power and control.

(e 30A1W6-LNA 2 power and control.

(f) 30A1W7-LNA BITE power and control.

(g) 30A1W8-antenna auxiliary.

(h) 30AlW10-loop test.

(i) W4-remote control cable (if connected).

(4) Disconnect the elevation (W1 and cross elevation (W2) actuator cables at the antenna. Carefully remove them from the messenger cable hanger straps.

(5) Carefully coil the actuator cables and stow them in their bag.

(6) Remove the remaining cables from the messenger cable hanger straps and wrap them around the center section gimbal and secure them using brackets and straps provided.

(7) Disassemble the messenger cable and its support pole. Stow the support pole. Stow the messenger cable assembly in its bag.

(8) Coil the cable and stow the remote control and cable.

d. Removal of Shelter Anchor Cables (fig. 2-15, sheet 1).

WARNING

Wear work gloves to protect the hands while removing the anchor cables.

(1) At one of the tie-down assemblies, rotate the take-up handle on the take-up device to loosen the cable.

(2) Unlock the cable locking handle and pull cable through the take-up device to put several inches of slack in the cable.

(3) Remove the screw-bolt-end hook of the takeup device from the O-ring of the ground anchor cable.

(4) Remove the cable-end hook from the shelter guy ring.

(5) Repeat steps (1) through (4) above to remove the remaining tie-down assemblies.

(6) Stow these tie-down assemblies in their bag.

e. Removal of Antenna Anchor Cables (fig. 2-15, sheet 2).

WARNING

Wear work gloves to protect the hands while removing the anchor cables.

(1) At one of the tie-down assemblies, rotate the take-up handle on the take-up device to loosen the cable.

(2) Unlock the cable locking handle and pull cable through the take-up device to put several inches of slack in the cable.

(3) Remove the screw-bolt-end hook of the takeup device from the O-ring of the ground anchor cable.

(4) Remove the tension hook from the antenna guy ring.

(5) Repeat step (1) through (4) above to remove the other tie-down assembly.

(6) Stow these tie-down assemblies in their bag.

f. Dismantling the Radiation Hazard Fence (fig. 2-12 and 2-13.)

(1) Remove the six warning signs from the selected fence posts.

(2) Remove the rope from the 11 fence posts and coil it for stowage.

(3) Retrieve the 11 posts.

(4) Stow the rope and warning signs in the (same) stowage bag provided. Check that the fence post driving cap is also in this bag.

(5) Stow six fence posts and five fence posts in the two stowage bags provided.

(6) Stow the bags. Refer to table 2-1 for stowage locations.

g. Disassembling the Antenna (fig. 2-7 through 2-9).

CAUTION

Personnel shall exercise care and observe warning signs strategically placed about the antenna structure and assemblies. Failure to do so may cause damage to the equipment. The antenna quarter section reflector assemblies are marked WARNING-HANDLE WITH CARE. The feed tube assembly is marked NO STEP NO PULL.

CAUTION

Temporarily place the disassembled items in a convenient position but away from the shelter and antenna location so that disassembly may proceed without interference or damage to the items. Unless noted otherwise, the items will be stowed after the antenna has been completely disassembled.

(1) Hold the antenna and elevation actuator rod end and unlock and remove the mounting pin holding the rod end to the elevation drive ring. Rotate the antenna upward until it is pointing at approximately 90 degrees relative to the ground mounting plane.

(2) Aline the rod end with the degree hole in the drive ring that will best maintain this position (80, 85, 90, or ASSY). Insert the mounting pin.

(3) At the left pillow block, disconnect the lightning probe cable from the ground lug.

(4) Remove the lightning probe from the upper quarter section, coil the cable and stow the cable and the probe on the rear of the center section. (The stowage area is approximately at the 1 o'clock position on the center section.)

(5) Using the 5/16 inch hex wrench, unlock and open the petal latches between the quarter sections.

(6) At the lower quarter section, unlock and remove the two mounting pins and remove the quarter section.

(7) At the left quarter section, unlock and remove the two mounting pins and remove the quarter section.

(8) At the right quarter section, unlock and remove the two mounting pins and remove the quarter section.

(9) At the upper quarter section, unlock and remove the two mounting pins and remove the quarter section.

(10) Insert and lock (stow) the above eight mounting pins around the rim of the center section.

(11) Hold the elevation drive ring and elevaion actuator and remove the pin holding the actuator rod end to the elevation drive ring. Carefully allow the center section to rotate downward and come to rest on the front leg assembly. Stow the pin on the elevation drive ring.

(12) While holding the elevation actuator housing (not the rod) remove the pin that secures the bottom of the elevation actuator to the Y casting bracket. Carefully remove the elevation actuator and stow the pin in the Y casting bracket.

CAUTION

Exercise care when handling and working with the feed tube assembly and the feed tube adapter. At the opening, the feed tube adapter has a thin dielectric membrane which is extremely fragile and easily ruptured. Do not allow anything, including fingers, to come in contact with the membrane. In addition, special care must be exercised to prevent dirt, dust, moisture, or any foreign material from entering the open ports of the feed tube and the adapter.

(13) Remove the feed tube by first removing the clamp around the adapter flange and then rotating the feed tube until the alinement pins allow the unit to be removed.

(14) Replace the feed tube adapter cover and clamp.

(15) Carefully place the feed tube in its canister and stow the canister on the carriage assembly.

(16) Remove the pin that secures the rod end of the cross elevation actuator to the center section.

(17) Remove the two pins that secure the cross elevation actuator trailing arm. One pin is located on the right pillow block, the other at the elevation drive ring.

(18) Carefully remove the cross elevation actuator and then stow the pins in their respective places.

(19) Remove the left trailing arm by removing the pins at each end. One pin is located at the left pillow block, the other at the elevation drive ring. Stow the left trailing arm in bag assembly no. 1.

(20) Unstow the stow bar from the center section and connect it to the right pillow block.

(21) Remove the two mounting pins holding the elevation drive ring. One is located at the top of the center section, the other at the bottom.

(22) Remove the elevation drive ring and replace the pins in their respective stowage positions.

(23) Bring the carriage assembly and support handles to the antenna site. Unstow the handle bars from the base of the carriage assembly.

(24) Install the support handles on the center section and then install the handle bars on the support handles (fig. 2-5). Please note the side on which the support handle with the stow brackets is installed.

(25) Unlock and open the pillow blocks on the antenna support structure and on the carriage assembly. Remove two rim pins from the bottom of the center section.

CAUTION

Handle the center with care and use four persons to stow it on the carriage assembly. Failure to do so could result in possible damage to the equipment because of its bulk, weight, and delicate construction of the mounted electronics.

(26) Carefully lift the center section from the antenna support structure and place it on the carriage assembly. Check that the bottom of the center section is properly seated in the base of the carriage assembly. Insert the two center section rim pins.

(27) Close and lock the pillow blocks on the carriage assembly and on the antenna support structure.

CAUTION

After one of the side leg assemblies has been removed the antenna support structure is no longer free standing and requires that one person support the structure while the other proceeds with the disassembly.

(28) Loosen the hand clamp on the right side leg assembly. Loosen the ball joint couplings at the pillow block and the ground pad. Remove the side leg assembly.

(29) Loosen the hand clamp on the left side leg assembly. Loosen the ball joint couplings at the pillow block and the ground pad. Remove the left side leg assembly.

(30) Remove the two side base frame members. Remove the two front base frame members. Remove the center base frame member.

(31) Separate the front and rear leg assemblies by loosening the two ball joint/pillow block couplings. Lift the leg assemblies off the ground pads.

h. Stowage of Items in the Shelter (fig. 2-4)

(1) Attach all of the mounting hardware and place the antenna reflector quarter sections in place against the rear wall of the shelter.

(2) Stow and secure the ground reds.

(3) Stow and secure the base frame members.

(4) Attach the storage bar to the rear leg assembly and then stow same. Stow the front leg assembly.

(5) Stow and secure the stowage bags on the floor of the shelter.

(6) Stow and secure the ground pads.

(7) tow and secure the elevation drive ring and the side leg assemblies.

(8) tow and secure the elevation and crosselevation actuators.

i. towage of Antenna Center Section and Other Shelter Items.

(1) Inside the shelter check for or perform the following, as required.

(a) All rack equipment is closed and fasteners are secured.

(b) All recirculating vents are closed.

(c) All housekeeping, accessory, and auxiliary items are stowed and secured in place (table 2-1).

(d) The air conditioner vents are closed.

(2) Retrieve the center section carriage bar assemblies and stow bars. Set the rear carriage bar assembly in place in the shelter floor and secure it to the rack brackets. Install the carriage bar in the same orientation as marked in paragraph 2-14*b*, steps 1 and 17.

CAUTION

Possible damage to the equipment could result due to the delicate construction of the mounted electronics and the bulk and weight of the combined assemblies. Handle with care and use four persons to move the equipment.

(3) Lift the carriage assembly and place it at the rear of the shelter. Orient the equipment so that the front of the center section faces roadside.

((4) See figure 2-5. Remove the handle bars from the support handles, retract the extension bars, and stow the handle bars in the base of the carriage assembly.

(5) Remove the center section rim pins from the extender handles and close them into the support handles. Pin the extender handles.

(6) Engage the support handle brace bushings in the center section and replace the rim pins.

WARNING

When placing the equipment in the shelter, stay clear of the ceiling stow bracket otherwise injury to personnel may result.

CAUTION

When placing the equipment in the shelter, be careful not to touch the rack front panels otherwise damage to the equipment may result.

(7) Lift the carriage assembly through the shelter door, and into the shelter.

(8) Slide the carriage assembly in until the base tongues are wedged securely under the rear carriage bar assembly.

(9) Place the top support plate in place on top of the center section and secure it with two of the rim pins.

(10) Install the rack and ceiling stow bar on the top support plate. Tighten the lock nuts. Install the ceiling stow bars in the same positions marked in paragraph 2-14*b* step 2.

(11) Install the front carriage bar assembly on the base tongues and secure it to the rack brackets. Install the carriage bar in the same orientation as marked in paragraph 2-14*b*, steps 2 and 17.

(12) Rotate the wedge knob CW to tighten the wedge block.

j. Final Preparation for Movement.

(1) Close, secure, and lock the shelter doors.

(2) On the air conditioner replace the drain plug. Untie, roll down, and snap the cover in place.

(3) On the shelter, close and secure all outside vents and access covers.

(4) On the entry panels, replace all protective covers on the connectors.

(5) Move the truck into position in front of the shelter and pallet.

(6) Using two persons, lift the transporter tongue onto the truck hitch. Lock the truck hitch.

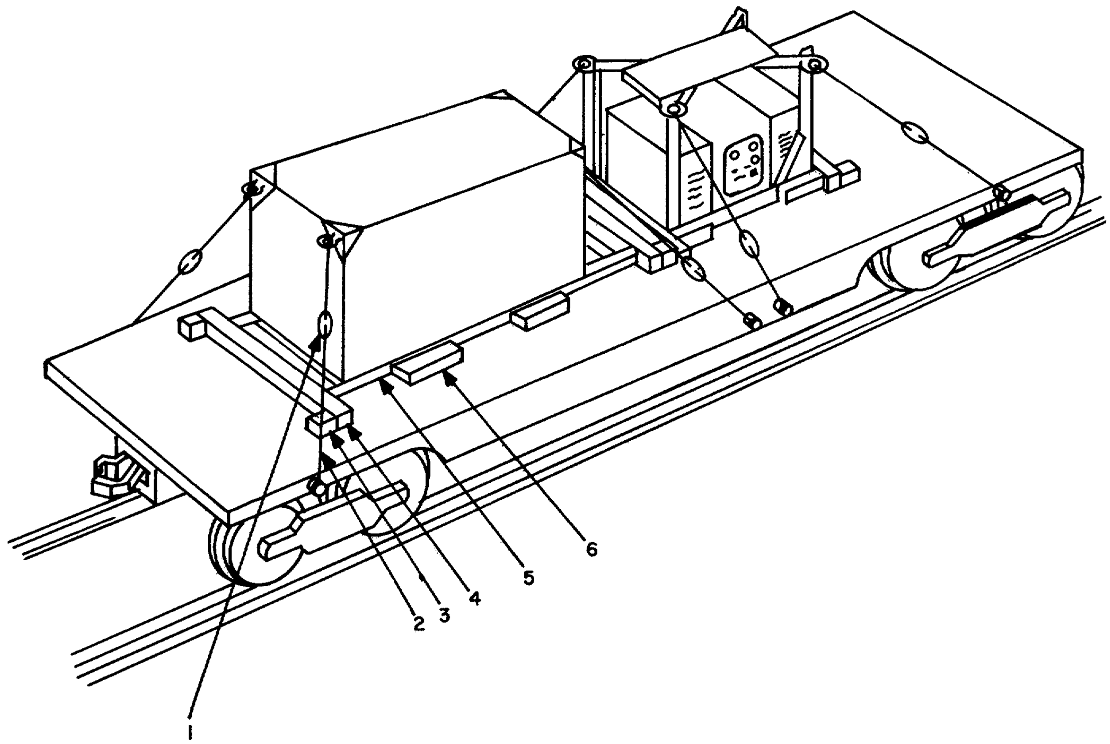
(7) Connect the transporter safety chains to the truck eye hooks.

(8) Connect the transporter brake hoses and electrical cable to the truck fittings and electrical receptacle, respectively.

(9) Check the site area for any unstowed items.

3-23. Transport by Rail (fig. 3-23)

When transporting the terminal by rail, both the shelter and pallet must be secured to the bed of the flat car to avoid damage to the equipment. Prepare the terminal for rail transport as follows:



LUMBER

ITEM	REQ	SIZE
1	8	TRNBKL
2	AS REQ	TIE DOWNS
3	8	6 x6 TO SUIT
4	4	6 x 6 TO SUIT
5	4	6 x 6 TO SUIT
6	8	6 x 6 TO SUIT

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Figure 3-23. Preparation for Transport by Rail.

a. Stow all the equipment in accordance with the procedures of paragraph 3-22.

b. Place the shelter and pallet on a flat car as shown in figure 3-23.

c. Add blocks and supports as shown and secure these items by nailing (use proper size nails).

d. Attach and tighten tie-downs as shown.

3-24. Transport by Air (fig. 3-24)

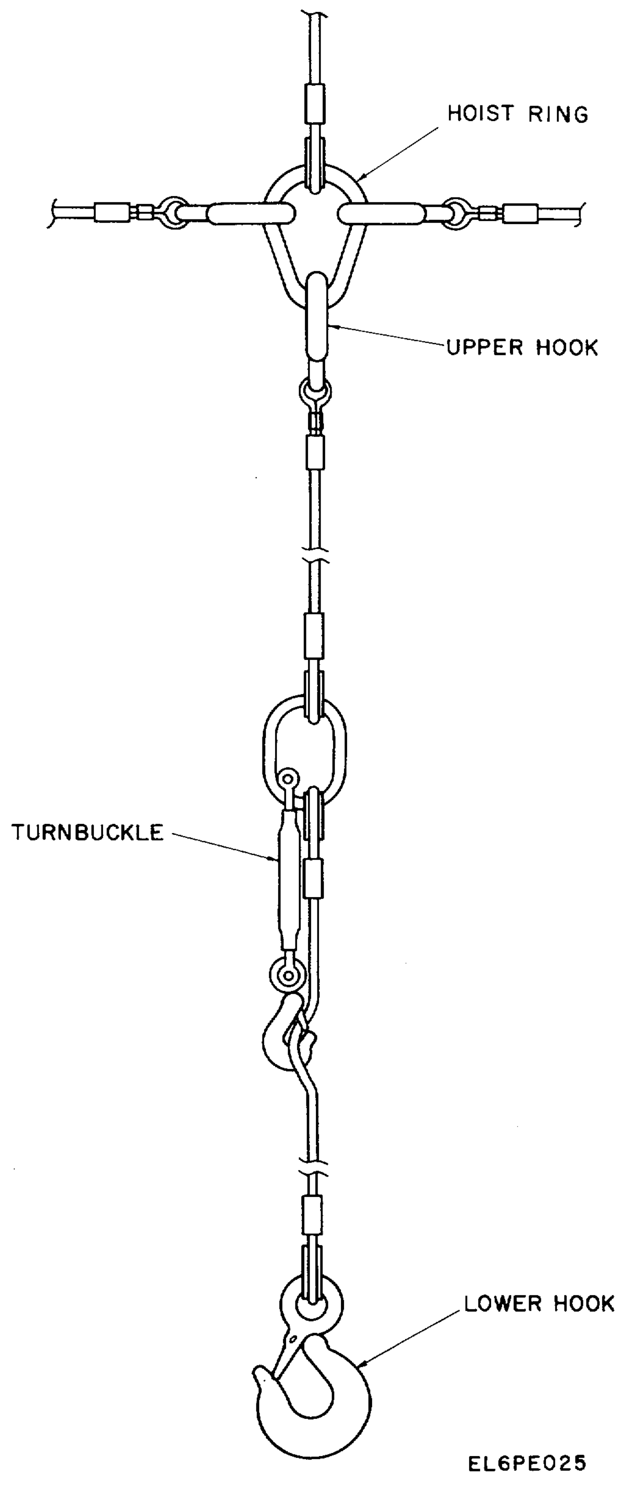

Figure 3-24. Shelter, Sling Assembly and Typical Air Lift Configuration (Sheet 1 of 2)

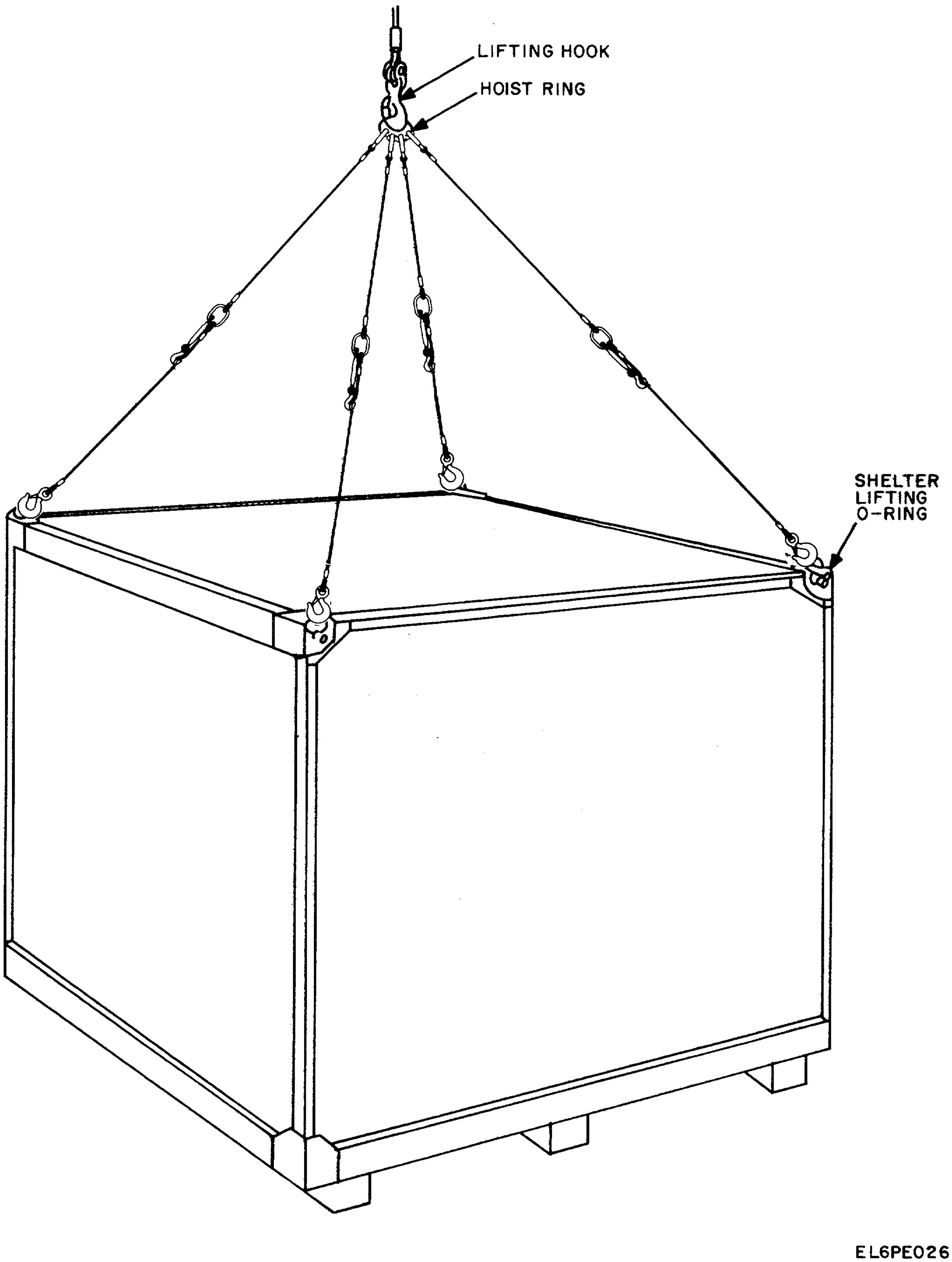

Figure 3-24. Shelter, Sling Assembly and Typical Air Lift Configuration (Sheet 2 of 2)

This procedure assumes that the shelter and pallet are on the transporter and have been prepared for transport as described in paragraph 3-22 above. Drive the truck to the selected pick-up area. Unhitch the transporter from the truck. Drive the truck away from the pick-up point and park it.

CHAPTER 4
OPERATORICREW MAINTENANCE INSTRUCTIONS

Procedures in this chapter are limited to those which will be performed at the operator level. This chapter contains preventive maintenance checks and services, cleaning, and lamp test.

Section I. TOOLS AND TEST EQUIPMENT

4-1. Tools

For operator/crew maintenance, no tools beyond those listed in the maintenance allocation chart (MAC) in appendix B are required for maintenance of this terminal.

4-2. Test Equipment

No test equipment is required to perform operator/crew maintenance.

Section II. LUBRIXATION INSTRUCTIONS

4-3. Lubrication Instructions

No lubrication is required at the operator/crew maintenance level.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-4. Scope

a. This section provides information and procedures for the preventive maintenance checks and services which should be performed to maintain the equipment in good operating condition, prevent deterioration of performance, and reduce equipment down-time. Observe the following when performing preventive maintenance.

(1) *Before you operate*: Always keep in mind the CAUTIONS and WARNINGS. Perform your before (B)PMCS.

(2) *While you operate*. Always keep in mind the CAUTION S and WARNINGS. Perform your during (D)PMCS.

(3) *After you operate*. Be sure to perform your after (A)PMCS.

(4) *If your equipment fails to operate.* Report equipment failure to higher level maintenance personnel (refer to para *b* below).

b. Defects which cannot be corrected must be reported to higher level maintenance personnel. Records and reports of repairs and preventive maintenance must be made in accordance with TM 38-750.

4-5. Preventive Maintenance

a. During an operational period perform each of the preventive maintenance checks and services listed in table 4-1. In addition, the daily checks and services must also be performed whenever the following conditions apply:

(1) When the terminal is initially installed at a site.

(2) When the terminal is reinstalled after moving to another site.

(3) Before the start of an operational period if the equipment has been in a shutdown condition.

Table 4-1. Operator/Crew Preventative Maintenance Checks and Services

Interval **B—Before Operation** **D—During Operation** **W—Weekly**

Item No.	Daily B	Daily D	Daily W	Item to be inspected	Procedure	Equipment will be reported not ready (Red) if:
1	•			Equipment panels and surfaces	Clean front panels, cases, and meter glasses. (para 4-6).	
2	•			Cable connectors	Check all cable connections and finger tighten, if necessary. (para 2-22).	
3	•			Grounding system	Check for loose ground straps at grounding rods. Check ground leads for tight connection at equipment connection points. (para 2-22).	
4		•		Power distribution panel	Check that each circuit breaker is in the ON position (fig. 3-1.)	Any circuit, breaker is in the OFF position.
5		•		Alarm monitor	Check that the audible signal is working by placing the FAULT switch to TEST. (fig. 3-10.)	
6		•		Indicator lamps	Test all indicator lamps; replace burned out bulbs. (para 4-8.)	
7			•	Hardware	Tighten loose screws and nuts and replace any missing hardware as necessary.	
8			•	Control and switch knobs.	Check all front panel knobs and tighten as necessary.	
9			•	Spare fuses	Check spare fuse holders on the power supply to see that spare fuses of the proper size are stored in the holders (fig. 3-9).	
10			•	Gaskets, shelter air vents and door	Inspect gaskets around air vent covers and door for damage or looseness	
11			•	Cables	Inspect for wear and fraying. Repair with electrical insulating tape, if necessary.	
12			•	Filters	Clean the filters in the exterior bottom roadside vents (para 4-7)	

(4) At least once each week if the equipment is maintained while in a shutdown condition.

b. Cleaning of the filters should be accomplished on a more frequent basis if the equipment is operating in an extremely dusty environment.

c. Record the results of the preventive maintenance on DA Form 2024, Equipment Inspection and Maintenance Worksheet. Use the item number in table 4-1 as the source item number for entry in the TM Number column of Form 2404.

4-6. General Cleaning WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

a. Use a dry, clean, lint-free cloth or brush to remove dust or dirt. If necessary, moisten the cloth or brush with cleaning compound (NSN 6850-00-5979765).

b. After cleaning, wipe dry with a clean cloth.

c. If available, dry compressed air not exceeding 60 pounds per square inch may be used to remove dirt and dust from inaccessible places.

4-7. Cleaning Filters

a. Location of Filters to be Cleaned.

(1) Two on the interior side of the shelter door.

(2) One in each of the two exterior bottom roadside openings.

b. Removing Exterior Filters.

(1) Release the cover latch and lift the cover.

(2) Loosen the 14 captive screws on the lower frame; remove the frame from the opening.

(3) Remove and clean the filter.

(4) Replace the filter and frame by performing steps 1 through 3 in reverse order.

c. Removing the Door Filters.

(1) Remove the filter from the top holding frame and the filter from the bottom holding frame.

(2) Clean both filters.

(3) Replace the filters in the frames.

d. Cleaning the Filters.

(1) Wash the filters with soap and water.

(2) Rinse the filters.

(3) Dry the filter completely before reinstallation in the frame.

4-8. Testing Indicator Lamps

a. The indicator lamps on the units in the radio subsystem racks, except the high voltage power supply, are tested by pressing the push-to-test lamp sockets. The high voltage power supply has a FAULT CKT switch to test the FAULT/STATUS indicator lamps. When the switch is set to the TEST position, all lamps should light.

b. To test the indicator lamps on the units in the communications subsystem racks, refer to the technical manuals of these units.

Section IV. MAINTENANCE OF ANTENNA AS-3036/TSC

4-9. Scope

This section contains information and instructions for inspection and cleaning of the antenna items.

4-10. Inspection

WARNING

Prior to initiating inspection procedures, ensure that the equipment is in a shutdown condition. Observe conventional personal safety precautions while working on the shelter and around the antenna.

Inspection of the antenna involves the checking for mechanical damage and for proper tightness and fit of connectors and interfacing items. The following list should be used as a guide for inspection.

a. Metal surfaces are free from holes and are not bent, dented, torn, or otherwise ruptured.

b. Casting are not cracked or broken, mate properly, and securing hardware is in place and tight.

c. Metal structures are not deformed, and alinement is not altered.

d. Moveable items are free from binding.

e. Mechanical bindings are tight where required.

f. Mounting hardware is tight and undamaged.

g. Connectors are not loose, corroded, or broken.

h. Connector pins are straight, locked properly, clean and free from arcing.

i. Connector mountings are complete and tight.

i. Panels and covers seal well and close without interference.

k. All assemblies and parts are seated in mountings as applicable and, if attached by hardware, are properly secured.

l. Movement of all quick release pins is normal and free from binding.

m. All cable clamps are tight, mounted at proper locations, and are not cracked or broken.

n. Insulation is not broken or frayed.

o. All cables are properly routed and do not rub, bind, or restrict installation, operation or replacement of equipment items.

p. All mechanical items are free of rust, corrosion, mud, or dirt.

q. Paint and lubrication, where required, has not excessively deteriorated.

4-11. Cleaning

CAUTION

Use only those cleaning items and methods specified. Any other substance or method may damage protective coatings or remove lubricants.

a. Remove dirt, dust, mud, and other foreign substances with soft cloths dampened with Krylon No. 1323 cleaner and degreaser and finish with a dry cloth.

b. When required, deteriorated paint, corrosion, and rust may be removed from mechanical parts with a wire brush or emery cloth.

c. Lubricants may be removed with Krylon No. 1323 spray cleaner and degreaser.

Section V. MAINTENANCE OF ANCILLARY EQUIPMENT

4-12. Failure of Air Conditioners, Intercom, Power Distribution Panel, Transformer, Shelter Wiring, Rack Fans and Panels

If any of the above equipment should fail, refer maintenance to the direct support level as covered in Chapter 7

CHAPTER 5
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. TOOLS AND TEST EQUIPMENT

5-1. Special Tools and Test Equipment

No special tools or test equipment beyond that supplied with the equipment are required for the organizational level maintenance of the terminal. Fault isolation and troubleshooting of the terminal is performed through the use of built-in-test-equipment (BITE) and no additional test equipment is required other than a multimeter which may be used to perform voltage and continuity checks.

Section II. REPAINTING AND REFINISHING

5-2. Repainting and Refinishing

The following paragraphs contain instructions for paint touch-up and refinishing which can be accomplished by organizational level personnel. It includes instructions for the shelter exterior surfaces, the electronic equipment units, and the antenna and its parts. Paint touch-up may be required due to damage caused by handling during set-up and erection, preparation for movement, stowage, and environmental and tactical conditions during operation. Paint and other finish items are listed in table 5-1.

Table 5-1. Paint and Finish Materials

Material	Specification
Turcoat No.4354 3, Clear)	(ClassMIL-C-5541B
Zinc Chromate Primer	MIL-P-8585
Lusterless Enamel, White (Undercoat)	MIL-C-22750
Lusterless Enamel, Dark Green	MIL-C-46168 (Pigmented per MIL-E-46061)
Silicone Base Paint, Dark Green (Color No. 24087 FED-STD-595)	TT-E-490
Paint, Olive Drab (Color No. 24087 FED-STD-595)	MIL-C-22750
Semi-Gloss Enamel, Light Green (Color No. 24533 FED-STD-595)	MIL-C-22750
Semi-Gloss Enamel, White (Color No. 27875 FED-STD-595)	MIL-C-22750
Lusterless Enamel, Dark Gray (Color No. 36118 FED-STD-595)	MIL-C-22750
Semi-Gloss Enamel, Light Gray No. 26307	MIL-C-22750

5-3. Paint Touch-Up of Shelter, Electronic Equipment, and Antenna Mounted Electronics

a. Paint Touch-Up of Shelter. Various surfaces of the shelter require different finishes and the proper procedure must be used. The roof and exterior walls require the application of solar and heat reflecting finishes; other exterior surfaces are painted olive drab; interior walls are painted light green; the ceiling is painted white and the floor is painted a dark gray. The following procedures cover these conditions.

(1) Touch-up of roof and exterior walls (solar reflective).

(a) Thoroughly clean the area to be painted and lightly sand it with 00 sandpaper.

(b) Apply a thin coat of white (undercoat) lusterless enamel (MIL-C-22750). Allow to dry thoroughly.

(c) Brush on a coat of dark green lusterless enamel (MIL-C-46158, pigmented per MIL-C-46061). Allow to dry thoroughly.

(2) *Shelter ceiling.*

(a) Thoroughly clean the surfaces to be painted and lightly sand them with 00 sandpaper.

(b) Apply a thin coat of white (undercoat) lusterless enamel (MIL-C-22750). Allow to dry thoroughly.

(c) Brush on a coat of white semi-gloss enamel (MIL-C-22750). Allow to dry thoroughly.

(3) *Shelter floor.*

(a) Thoroughly clean the surfaces to be painted and lightly sand them with 00 sandpaper.

(b) Apply a thin coat of zinc chromate primer. Allow to dry thoroughly.

(c) Brush on a coat of dark gray lusterless enamel (MIL-C-22750). Allow to dry thoroughly.

(4) *Shelter interior walls.* Touch up same as shelter ceiling (a(2) above) except final coat is light green (MIL-*C-22750).*

b. Paint Touch-Up of Electronic Equipment. The front panel surfaces of the electronic equipment in the terminal should be painted in accordance with this procedure.

(1) Thoroughly clean the area to be painted and lightly sand it with 00 sandpaper.

(2) Apply a thin coat of zinc chromate primer (MIL-P-8585). Allow to dry thoroughly.

(3) Brush on light gray paint (MIL-C-22750). Allow to dry thoroughly.

CAUTION

When touching up front panels do not destroy or cover the stenciled information and labels.

c. Paint Touch-Up of Antenna and Antenna Mounted Electronics.

(1) *Items not requiring painting.* The following items shall not be painted or refinished.

NOTE

When in doubt, do not paint.

(a) All clamps, quick release pins, expanding bolts and inserts and mating parts.

(b) Feed tube assembly.

(c) Feed tube adapter.

(d) Pillow blocks and mating parts.

(e) Lightning probe.

(f) Elevation index dial and elevation disc vernier.

(g) Cross elevation index drum and cross elevation vernier.

(h) Levels.

(i) Orthomode transducer.

(i) round rods and ground studs.

(2) *Paint touch-up for aluminum parts.*

(a) The following parts should be painted in accordance with this procedure.

1. Front leg assembly except pillow blocks, quick release (expanding pins), clamps and mating parts.

2. Rear leg assembly except quick release (expanding) pins and mating parts.

3. Elevation drive ring.

4. Ring-to-gimbal support arm.

5. Reflectors

6. Elevation actuator except boot.

7. Ring-actuator support.

8. Cross elevation actuator except boot.

(b) Thoroughly clean surfaces and sand them lightly with 00 sandpaper.

(c) Brush on solution of Turcoat No. 4354 (Class 3, Clear) MIL-C-5541B diluted to 3.0 ±0.5 ounces per gallon of water.

WARNING

Do not allow Turcoat solution to come in contact with skin.

(d) Allow solution to remain for 6 ± 2 minutes. wipe dry with clean cloth.

(e) Apply lusterless white enamel undercoat (MIL-C-22750). Allow to dry thoroughly.

(f) Brush on lusterless dark green (MILC-46168 pigmented per MIL-C-46061). Allow to dry thoroughly.

Section III. LUBRICATION INSTRUCTIONS

5-4. Scope

Lubrication on the terminal is limited to mechanical items which are a part of the antenna. No additional lubrication is required or desirable.

5-5. Lubrication

These procedures should be performed only when examination has determined that the parts are without lubrication or operation is difficult. Normally lubrication should be accomplished when the equipment is being disassembled for another purpose or prior to installation. The only lubricants are Aeroshell Grease No. 7 (MIL-G-23827A) and Antiseize Compound (NSN 8030-00-251-3980). Perform the lubrication procedure as follows:

a. Actuator Drive Rods. This procedure applies to the drive rods on both the elevation and crosselevation actuators.

(1) Operate the antenna control (or the hand crank) to extend the drive rod to its maximum length.

(2) Remove the boot clamp and slide the boot away.

(3) Clean the rod and apply a thin coating of grease.

(4) Return the boot to the normal position and tighten the clamp.

(5) Operate the antenna control to return the drive rod to its original position.

b. Clamps and Pillow Block.

(1) Clean all sliding surfaces of the side leg assembly clamps, the quick-release pins, the pillow blocks and the saddle clamp.

(2) Spray the cleaned surfaces with anti-seize compound.

c. Ball Joints and Threaded Couplings.

(1) Loosen threaded couplings and separate balls from sockets.

(2) Clean each of the items.

(3) Spray the cleaned surfaces with anti-seize compound.

(4) Reassemble the ball joints and tighten the threaded couplings.

d. Elevation Bearings. The Zerke fitting on each elevation bearing should be lubricated once a year using Aeroshell Grease No. 7.

(1) On the underside of the bearing open the drain port by removing the hex nut.

(2) Using a hand grease gun slowly pump the lubricant into the Zerke fitting on top of the bearing.

(3) Continue pumping until fresh lubricant comes out of the drain ports. Wipe away excess lubricant from the drain port and the Zerke fitting.

(4) Replace and tighten the hex nut on the drain port.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

5-6. Scope

a. This section provides information and procedures for the preventive maintenance checks and services which should be performed to maintain the equipment in good operating condition, prevent deterioration of performance, and reduce equipment down-time. Observe the following when performing preventive maintenance.

(1) Keep in mind the cautions and warnings.

(2) Apply proper and safe maintenance practices.

(3) Observe the note at the head of the PMCS table.

b. Refer any discrepancies or requisition/replacement requirements to higher level maintenance personnel. Records and reports of repairs and preventive maintenance must be made in accordance with TM 38-750.

5-7. Preventive Maintenance

a. Perform the preventive maintenance checks and services listed in table 5-2 once every month.

Table 5-2. Organizational Preventive Maintenance Checks and Services Monthly Schedule

Item No.	Item To Be Inspected	Procedure	Equipment Will Be Reported Not Ready (Red) If:
1	Components	Inventory the equipment; (refer to table 1-2) requisition missing and defective parts.	Equipment missing.
2	Power and signal cables	Replace cable assemblies in which wiring, insulation, or connectors are defective.	Cables have shorts or expose bare wire.
3	Shelter, antenna, and unit surfaces	Clean and paint bare metal spots, blistered, pitted, or flaking areas. (para. 5-2.)	
4	Gaskets, rack	Check for loose or torn gaskets, repair or replace if necessary.	

b. Record the results of this preventive maintenance on DA Form 2404, Equipment Inspection and Maintenance Worksheet. Use the item number in table 5-2 as the source item number for entry in the TM Number column of Form 2404.

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

Section V. SYSTEM TROUBLESHOOTING

5-8. Scope

a. The procedures presented herein are to be used for troubleshooting on a system level basis and are accomplished by the observation of system level and unit level alarm indications. A system alarm can be generated by a CSS system fault or an RSS system fault. A system alarm indication CSS or RSS, generally will be accompanied by at least one unit level fault indication generated by selected on-line units only. When a system alarm is received by the alarm monitor, the audible alarm will sound provided the AUDIBLE SIGNAL FAULT switch is in the NORMAL position. The audible alarm may be disabled by placing the FAULT switch to the OFF position.

The SYSTEM FAULT indicator (RSS and/or CSS) will remain illuminated.

b. A safety-related (SAFETY ALERT) display will generate an RSS system alarm only when the on-line transmit system is affected.

c. During the data mode of operation, the operator will be alerted to a loss of data traffic or loss of a receive or transmit carrier. The audible alarm will sound and RSS and CSS system faults will be displayed on the alarm monitor. The receive modem in the affected traffic channel will indicate, as applicable, a receiver out of lock condition and a loss of sync. If the operator so desires, the receiving equipment may be loop tested to determine that the equipment is functioning properly and that the fault is indeed external to the terminal equipment; refer to paragraph 3-15.

d. Similarly, on the CSS side, a loss of data traffic from the modem or mux will generate a CSS system fault and sound the audible alarm.

e. A CSS temperature indication display will not generate a system fault alarm. The audible alarm will sound. The CSS TEMP FAULT is illuminated when the temperature in the CSS rack system is not in the +32°F to + 120°F range required by several CSS equipments.

5-9. RSS System Troubleshooting Chart

Figure FO-1 presents a flow-type procedure to aid in isolating a transmit or receive system fault to the unit level. Note that more than one unit-level fault may be displayed at any one time. When the audible alarm sounds, the technician observes the fault display. As close as possible, the actual display is matched to those in the troubleshooting chart to help locate the source of the failure. A notation at the end of each display then defines the corrective action to be taken.

5-10. CSS System Troubleshooting Chart

Paragraph 5-8 above applies except the technician will refer to figure FO-2 to aid in isolating CSS system faults.

5.11. Using the Fault Alarm System as a Troubleshooting Aid

a. *Safety Related Faults*. On the alarm monitor, the SAFETY ALERT group displays two types of safety elated faults as follows: antenna elevation and waveguide interlock. The two faults will sound the audible alarm. The following is a description of these safety-related faults and their effect on system operation (refer to para 5-17*i* for more detail on the two faults).

(1) *Antenna elevation indication*. This fault will be displayed whenever the antenna drops below a preset elevation angle. The audible alarm will sound and an RSS system fault will be displayed on the alarm monitor. The on-line power amplifier will be shut down and the associated power supply will display several status faults. It is highly probable that this fault cycle will have been initiated by a scan fault failure in the antenna control drawer.

(2) *Waveguide interlock indication*. This fault will be displayed if a transmit waveguide connection opens at the antenna, antenna entry panel, or the SHF output port of either power amplifier (PA). An open connection at the standby (off-line) PA will not affect the transmitter. An open connection at any one of these three (on-line) locations will sound the audible alarm, display an RSS system fault, and shut down the on-line transmitter (PA). The associated power supply will display several status faults.

b. *Fault Switches.*

(1) On the alarm monitor, and located behind the access cover, are 12 fault switches. Switches 1-5 are associated with the CSS faults, switches 6 and 7 with RSS-CSS fault and switches 8-12 with RSS faults. The alarm monitor will recognize a fault signal (switches 8 and 9) from only the selected on-line transmit units. The fault alarm input from the off-line or standby unit will automatically be inhibited and the associated fault switch need not be placed in the OVERRIDE position.

(2) The selected alarmed units on the RSS side (RSS group) and CSS side (CSS group) are listed in table 5-3. The fault switches can be used as suggested below in (3), (4) and (5).

(3) When the terminal is not operating in a multichannel mode, the fault switches associated with the unused channels is placed to the OVERRIDE position (the OVERRIDE indicator will be illuminated). Any alarm input from the channels will be overridden and no system fault will be displayed.

Table 5-3. Alarm Monitor Fault Switches

Unit	Marking	Switch No.	
Not Used	Not Used	1	(CSS)
AN/FCC-98 No. 1	MUX 1	2	
AN/FCC-98-No. 2	MUX 2	3	
Not Used	Not Used	4	
Not Used	Not Used	5y	
MODEM 1	MODEM 1	6	(RSS/CSS)
MODEM 2	MODEM 2	7	(RSS/CSS)
Power Amplifier 1	PA1	8	(RSS)
Power Amplifier 2	PA2	9	
Not Used	Not Used	10	
Not Used	Not Used	11	
ANT CONTROL	ANT TRACK	12	

(4) When a system fault is displayed, the operator also will note any unit fault displays. In the appropriate CSS or RSS group of fault switches, the operator can momentarily place each fault switch to the OVERRIDE position. The switch that turns off the (RSS or CSS) SYSTEM FAULT indicator identifies the unit sending the alarm. The switch may be placed to the OVERRIDE position to clear the system fault display.

(5) In some instances, a system alarm may be initiated by more than one alarmed unit in the RSS or CSS group. Activating the fault switches as in (4) above will not clear the system fault display. The operator then must place, and leave, more than one fault switch in the OVERRIDE position until the correct combination clears the system fault display.

c. RSS Only Faults.

(1) The alarm monitor will recognize alarm inputs from only the selected on-line PA in the RSS. The on-line PA is selected by the position of the transmit waveguide switch. The alarm monitor will recognize transmit system faults from the on-line PA only when it is in the operate condition (power supply OPERATE-STANDBY switch to OPERATE). When the on-line PA is in a standby condition (power supply to STANDBY) and a fault is generated, the audible alarm will not sound and no RSS fault will be displayed on the alarm monitor. However, the fault will be displayed on the affected transmit system units and, if a safety-related fault, also on the alarm monitor.

(2) The antenna control alarm input (ANT TRACK) is hardwired directly to the alarm monitor so no on-line selection is required.

d. CSS Only Faults. The on-line MUX is selected at the DATA patch panel by patch cabling. The fault input line of the off-line or standby MUX must be disabled by placing the appropriate fault switch to the OVERRIDE position.

CAUTION

When testing the AN/FCC-98 use special test cable SM-C-983209 for signalling test with BITE otherwise equipment damage may result.

e. RSS and CSS Faults. The on-line modem, along with the associated downconverter, are selected by patch cabling on the IF patch panel. The fault input line of the off-line or standby modem must be disabled by placing the appropriate fault switch to the OVERRIDE position.

Section VI. MAINTENANCE OF ANTENNA CONTROL C-10273 AND REMOTE CONTROL UNIT

5-12. Scope

a. This section covers instructions and procedures for testing and fault isolation to a removable item and for the removal and replacement of the items. The test procedures are based on the use of built-in-test equipment (BITE). No additional support or test equipment is required. Fault isolation procedures for the comm track module (A12) are on figure FO-1.

b. See figures 3-4 and 3-16 for location of controls and indicators. See figure 5-1 for location of removable items. When it is necessary to remove and replace an item, refer to paragraph 5-14 for the procedure.

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

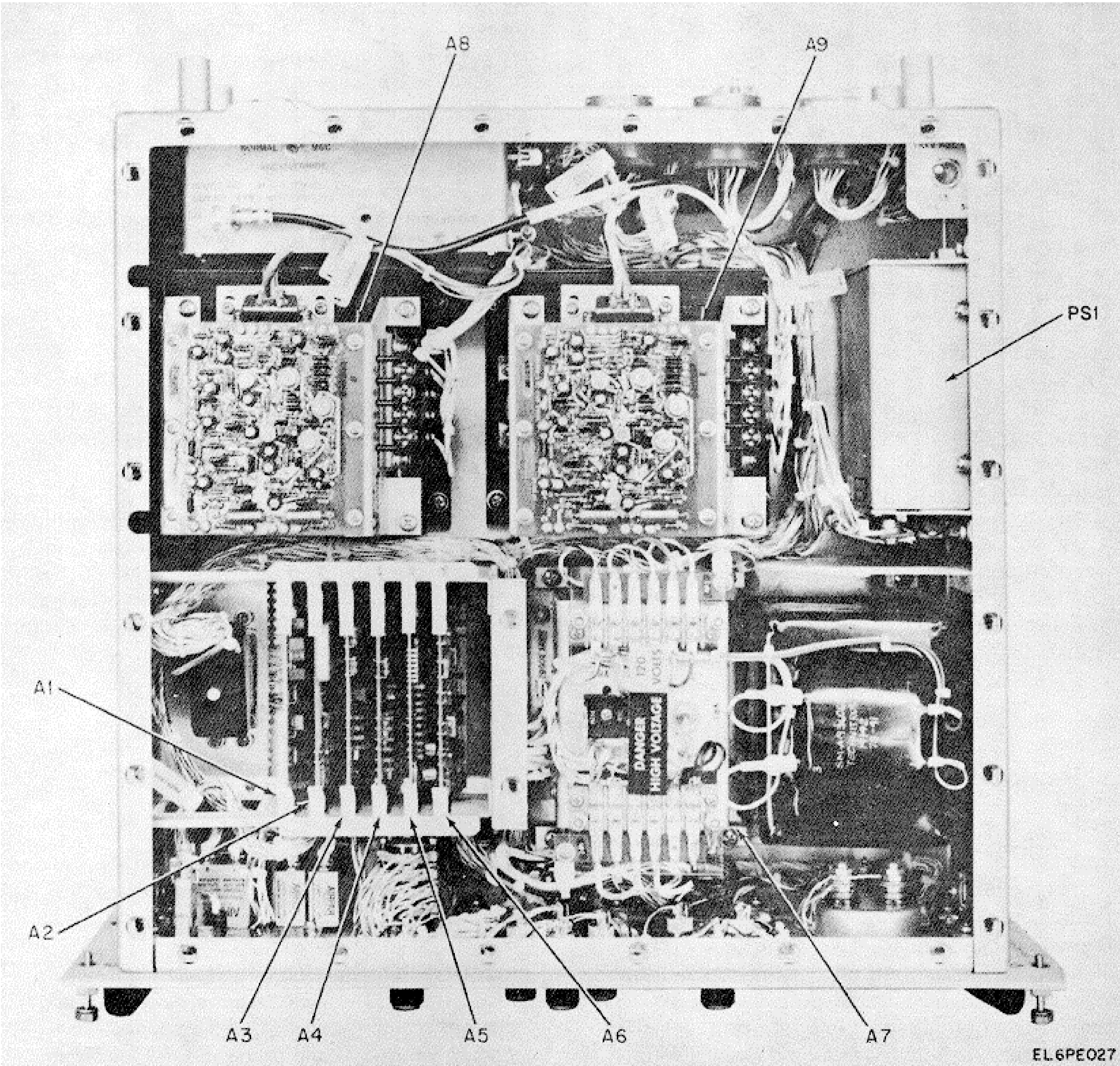

Figure 5-1. Antenna Control Module Location

5-13. Testing and Fault Isolation

a. Antenna Control

NOTE

Before proceeding with the following tests, make certain that the remote control unit is not connected at the antenna entry panel.

Observe for the fault indication on the front panel. Refer to table 5-4 and check power supply voltage readings on the MONITOR meter. If readings are incorrect, refer to step 1 of figure FO-3. If the fault mode can be determined by observation, fault isolation can be limited to that area. If the fault mode cannot e determined, refer to the flow chart (fig. FO-3 supplemented with tables 5-4 through 5-7), and start with step 1. If the fault mode can be determined, start in accordance with the following.

Fault Mode	*Figure FO-3 step*
Auto track	5
Scan	6
Manual	2
Display (Position)	7

b. Remote Control.

(1) Connect the remote control cable to the RCU connector on the antenna entry panel.

(2) On the antenna control, place the MONITOR switch to the CARRIER LEVEL position, the TRACK SIGNAL/IF-VIDEO switch to IF, and the POWER switch to the ON position. On the remote control, place the MODE switch to the MANUAL position.

(3) Observe on the antenna control that the POWER indicator is illuminated, and on the remote control the REMOTE ON indicator is illuminated.

Also on both units the TRACK SIG LOSS indicators will be illuminated if there is no signal present.

(4) On the remote control, operate the AXIS CONTROL switch to the following positions and observe the antenna operation.

Position	*Indication*
UP	Antenna travels up in elevation
DOWN	Antenna travels down in elevation
L	Antenna travels left in cross elevation
R	Antenna travels right in cross elevation

Table 5-4. Monitor Meter Normal Indications

MONITOR Switch Position		Meter Indication 8-Foot Antenna	20-Foot Antenna
PS-2	+ 60V	55-70	55-70
PS-1	+ 24 V	20-32	20-32
	- 15 V	- 24 (- 36)	- 24 - (- 36)
	+15 V	24 - 36	24 - 36
	+5	44 - 56	44 - 56
	X -ELA9V	L = +10 ±2 R = -10 ±2	L = +55 +10 R = -55 ±10
	X-ELA9A	L = +5 ±1 R = -5 ±1	L =+15 ±3 R = -15 ±3
	X-ELA6	L = -7 ±3 R = +7 ±3	L = -18 ±4 R = +18 ±4
	X -EL TACH	L = -40 ±8 R = +40 ±8	L = -75 ±12 R = +75 ±12
	X - EL POT	Figure 5-2	Figure 5-2
	EL POT	Figure 5-3	Figure 5-3
	ELA8A	U = -10 ±3 D = +5 ±2	U = -20 ±6 D = +10 ±3
	EL A8V	U = -10 ±3 D = +10 ±3	U = -44 ±6 D = +40 ±6
	ELA6	U = +6 ±3 D = -6 ±3	U = +20 ±5 D = -20 ±5
	EL TACH	U = +40 ±6 D = -40 ±6	U = +70 ±8 D = -70 ±8
	Carrier	0 to +90°	0 to +90°

Table 5-5. Mode Logic (A5) LED, Normal Indication

AXIS CONTROL Command	DS8	DS10	DS5	DSS7	DS6
Left	Off	On	Off	Off	On
Right	Off	On	Off	On	On
Up	On	Off	On	On	Off
Down	On	Off	On	Off	Off

Table 5-6. Anolg Card (A6) Meter Test, CB-3 (DC PWR 60V) OFF

AXIS CONTROL COMMAND	MONITOR Meter Switch Position A6 EL	X-EL
Right	0	100
Left	0	-100
Up	100	0
Down	-100	0

Table 5-7. Autotrack Circuit Card (A4)LED Indicator Sequence

*Step	DS1	DS2	DS6	DS3	DS5	DS4
1	1	1	1	1	0	0
2	0	0	1	0	0	0
3	1	1	0	0	0	0
4	0	0	0	0	0	0
5	1	1	1	1	0	0
6	1	1	1	1	0	1
7	0	1	1	1	0	0

NOTE

***Always begin in the X-EL axis (DS5-OFF, shown as 0 in step 1). Each step should be 0.5 second in duration with the exception of step 7 which is a random interval of 0 to 8 seconds. After step 7, the sequence should repeat steps 1 through 6 but with DS5 ON, thus stepping in the EL axis.**

(5) On the remote control, place the MODE switch to the ACQ position and operate the AXIS CONTROL switch to the same positions as in step (4) above and observe for the same indications.

NOTE

If a signal is acquired, antenna travel will stop and the AXIS CONTROL switch will no longer drive the antenna.

(6) On the remote control, place the MODE switch to the AUTO position and observe the antenna. The antenna will scan in one axis (elevation or cross elevation) for one minute. This motion is barely perceptible (about ± 0.5 inches at the edge of the antenna).

(7) If any of the indications in steps (3) through (6) above are not correct and the antenna control has no faults, the problem is in the remote control or its cabling; proceed to step (8) below.

(8) Remove and replace the remote control or remove the remote control and continue operation without it.

5-14. Removal and Replacement of Antenna Control

a. Place POWER AC switch in the OFF position

b. Loosen the four captive screws holding the drawer to the rack.

c. Pull on the two handles and extend the drawer to its maximum extension.

d. Remove each of the cable connectors on the rear of the drawer.

e. Press the slide releases on each slide and carefully remove the drawer from the slides.

f. Replace the drawer by extending the slides from the rack, placing the drawer on the slides and pushing inward until the releases snap in place. Replace the cables, close the drawer and secure it with the four captive screws.

5-15. Removal and Replacement of Modules

a. Removal and Replacement of Modules Al through A6.

(1) Place POWER AC switch in the OFF position.

(2) Loosen the four captive screws holding the drawer to the rack.

(3) Pull on the two handles and extend the drawer to its maximum extension.

(4) Loosen the 26 quarter-turn screws which secure the cover to the drawer.

(5) Remove the cover.

(6) Locate the module to be removed (fig. 5-1).

(7) Pull up on the extractor levers at each end of the module until the module is clear of its connector.

Lift the module out of the drawer.

(8) To replace the module, place it in the guides on each side and push down firmly until the module is properly seated in its connector.

b. Removal and Replacement of Modules A8 and A9.

(1) Place POWER AC switch in the OFF position.

(2) Loosen the four captive screws holding the drawer to the rack.

(3) Pull on the two handles and extend the drawer to its maximum extension.

(4) Loosen the 26 quarter-turn screws which secure the cover to the drawer.

(5) Remove the cover.

(6) Locate the module to be removed (fig. 5-1).

(7) Loosen the two captive screws and remove the connector at J1.

(8) Loosen the screws on TB1 and remove the wires connected to the terminal board.

(9) Loosen the four Phillips screws which secure the module to the chassis.

(10)Carefully lift the module from the drawer taking care not to damage wires or components.

(11) To replace the module place it in position in the drawer.

(a) Tighten the four Phillips screws.

(b) Replace the wires on TB1.

(c) Replace the connector at J1 and tighten the captive screws.

(d) Replace the cover and close the drawer.

(12) lose and secure the drawer.

c. Removal and replacement of module A7.

(1) Place POWER AC switch in the OFF position.

(2) Loosen the four captive screws holding the drawer to the rack.

(3) Pull on the two handles and extend the drawer to its maximum extension.

(4) Loosen the 26 quarter-turn screws which secure the cover to the drawer.

(5) Remove the cover.

CAUTION

This module is heavy, has some sharp corners and is closely fitted into the drawer. Avoid cuts or damage to parts when removing it.

(6) Disconnect the power cable at the rear of the drawer.

(7) At both TB1 and TB2 loosen the six screws which secure the wires to the terminal boards.

(8) Remove the cable clamp adjacent to each terminal board.

(9) Loosen the six Phillips captive screws which secure the base of the module to the chassis.

(10) Carefully lift the module from the drawer.

(11) Replace the module by the following:

(a) Carefully lower the module into place within the drawer.

(b) Tighten the six Phillips screws to secure the module to the chassis.

(c) Replace the cable clamps which are adjacent to each terminal board.

(d) Place the wire lugs in place on TB1 AND TB2.

(e) Tighten the six screws on each terminal board.

(f) Replace the cover.

(g) Replace the power connector on the rear of the drawer. Close and secure the drawer.

(d) Removal and Replacement of Module A12.

(1) Place AC POWER switch in the OFF position.

(2) Loosen the four captive screws holding the drawer to the rack.

(3) Pull on the two handles and extend the drawer to its maximum extension.

(4) Loosen the 26 quarter-turn screws which secure the cover to the drawer and remove the cover.

(5) In the module, remove the coaxial cable from the 70 MHz in connector J2.

(6) On the right side of the module, loosen the two captive screws which secure the power connector and remove the connector.

(7) Loosen the three captive screws which secure the module to the chassis and remove the module.

(8) Replace the module by performing the above steps in reverse order except replace the connectors and tighten the screws. On the replacement module place the AGC OVERRIDE and FILTER SELECT switches to NORMAL.

e. Removal and Replacement of Power Supply PS1.

(1) Place the AC POWER switch in the OFF position.

(2) Loosen the four captive screws holding the drawer to the rack.

(3) Pull on the two handles and extend the drawer to its maximum extension.

(4) Loosen the 26 quarter-turn screws which secure the cover to the drawer and remove the cover.

(5) On PS1 loosen the seven screws on TB1 and remove the cable with its attached block.

Move the cable and block aside.

(6) On the side of the drawer remove the four screws which hold the power supply in place. Support the power supply while performing this step.

(7) Remove the power supply and its attached mounting bars from the drawer.

(8) Remove the mounting bars from the power supply.

(9) Attach the mounting bars to the replacement power supply and replace it in the drawer by performing steps (1) through (7) above in reverse order.

Section VII. MAINTENANCE OF RADIO FREQUENCY AMPLIFIER AM-6703/TSC AND POWER SUPPLY PP-7087/TSC

5-16. Scope

a. This section contains instructions and procedures for testing and fault isolation, and removal and replacement. The fault isolation procedures are based on the use of built-in-test equipment (BITE) and no additional support equipment or test equipment is required; however, the two units are functionally inter-related and, therefore, must be tested as one functional unit. Refer to paragraph 5-18 for removal and replacement of power amplifier modules and to paragraph 5-19 for removal and replacement of the power amplifier.

b. Refer to paragraph 5-20 for removal and replacement of power supply modules and to paragraph 5-21 for removal and replacement of the power supply.

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

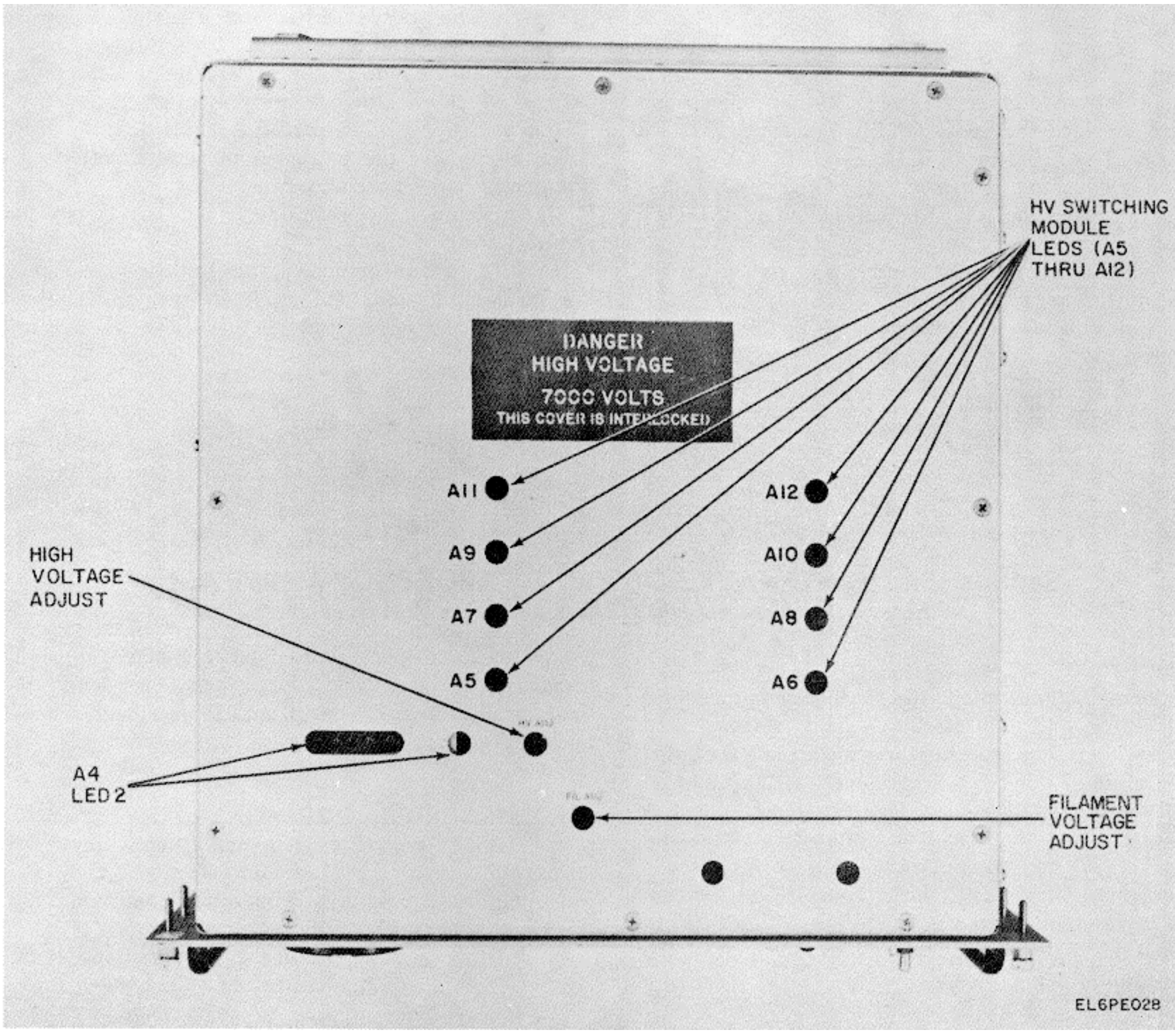

Figure 5-2. Power Supply, Module LED Indicators.

5-17. Testing and Fault Isolation

The following procedures are based upon observation of an indication. Each procedure is based on the kind of fault indicated and it is not necessary to perform other procedures unless an applicable fault indication has occurred (fig. 5-2).

a. Power Amplifier FAULT Indication (Signifying low power output).

(1) On the power supply, check that the FAULT lamp or the STATUS display WG/ANTENNA INHIBIT lamp is not illuminated and that there is no blown fuse indication.

(2) Check that no fault (FAULT lamp illuminated) is indicated on the upconverter, amplifier/mixer and/or modem.

(3) On the power amplifier (PA) place the MONITOR switch to the appropriate range position and observe the MONITOR meter for an indication of correct operating power. Use the upper watts range scale (black stencil).

NOTE

The range position (X1, X10, X100) to be used will depend on the operating power as follows:

Up to 15 watts-X1
15 to 150 watts-X10
Over 150 watts-X100

(4) If the indication in step (3) above is correct, the problem is in the power amplifier RF low power alarm module A1; remove and replace the module (para 5-18*a*).

(5) If the indication in step (3) above is below normal, or if the meter is pegged in either direction; proceed to step (6) below.

(6) Place the PA MONITOR switch to the TEST + 15 V X2 position and observe the MONITOR meter for an indication of ± 15 ± 0.5 Vdc (7.5 ± 0.25).

(7) Place the PA MONITOR switch to the TEST 15V X2 position and observe the MONITOR meter for an indication of 15 ± 0.5 Vdc (7.5 ± 0.25).

(8) f the indication in steps (6) and (7) above are correct proceed to step (11) below. If the indications in steps (6) and (7) above are not correct, place the power supply MONITOR switch to the 28 V CONT X4 position and observe the MONITOR meter for an indication of 25.5 ± Vdc (6.4 ± 1).

(9) f the voltage indication in step (8) above is low (below 21.5 V) the problem is in the power supply start module A19; remove and replace the module (para 5-20*i*).

(10) f the voltage indication in step (8) above is correct, the problem is in the power amplifier RF monitor module A2; remove and replace the module (para 5-18*b*).

(11) If all of the indications in steps (6) and (7) above are correct but the PA MONITOR meter is still pegged (step 5 above) the problem is in the RF monitor module A2; remove and replace it (refer to para 5-18*b*).

(12) If the fault has not been isolated to this point, place the power supply MONITOR switch to the positions listed in table 5-8 and check for a correct indication on the MONITOR meter. If all indications are normal proceed to step (35) below. If indications are not correct, proceed to the step listed in the Step Reference If Incorrect column in table 5-8.

(13) If the 28 V CONT X4, 10 V START X2, and 5 V LV CONT X1 indications of step (12) above were not correct, remove and replace the power supply start module A15 (para 5-20*i*).

(14) If the 6 V DRIVE X1 indication in step (12) above was not correct, perform steps (15) through (19) below.

(15) Loosen the eight captive screws on the front panel of the power supply.

(16) Open the power supply drawer.

Table 5-8. Power Amplifier Monitor Meter Indications

Position	Indication	Step reference if incorrect
280 VDC MAIN X 40	Approximately 240 to 320: (6 to 8) depending on input voltage and load.	
28 V CONT X4	25.5 +4 V (6.4 ± 1)	(13)
10 V START X2	10 ± 2 V (5 i 1)	(13)
5 V LV CONT X1	5.5 1V	(13)
6 V DRIVE X1	6 ± 1.0 V	(14)
6 V FIL X1	6 + 0.3, -0.1 V	(20)
	8 V or greater	(21)
BEAM V X1000	7000 ± 100 V (7 ±0.1)	(29)
	8000 V (E) or greater	(21)
COLL MA X100	580 ± 30 MA (5.8 + 0.3)	(35)
BODY MAX5	5 to 30 MA (1 to 6; overload occurs at 45 to 50 MA (9 to 10)	(35)

(17) See figure 5-2. On the pluse synthesizer module A4 (A4 LED) observe the fifth and sixth (last) LED indicators, counting from the left.

(18) If either one indicator, or both, is off, remove and replace the pulse synthesizer module A4 (para 5-20*d*).

(19) If both indicators are on, remove and replace the power supply low voltage module A2 (para 5-20*d*).

(20) If the 6 V FIL X1 indication in step (12) above was not correct (but not 8 volts or greater) remove and replace the power supply filament module A14 (para 5-20*h*). If the 6 V FIL x 1 indication in step (12) above was 8 volts greater refer to step (21) below.

(21) If the 6V FIL x 1 indication in step (12) above was 8 volts or greater and the BEAM V X1000 indication was 8000 volts or greater, the power supply is not being loaded by the klystron. To determine if the open circuit is caused by an open klystron filament or an open wire, an ohmmeter continuity check must be performed; proceed to steps (22) through (28) below.

(22) On the power supply, place the OPERATESTANDBY switch to the STANDBY position.

(23) Place the START and BLOWER circuit breakers to the OFF position (the AC POWER indicator will remain illuminated).

(24) Place the MONITOR switch to the BEAM V X1000 position. Observe on the MONITOR meter that the beam voltage has decayed to zero volts.

(25) On the front panel of the PA, loosen the thirteen quarter-turn fasteners on the access cover and remove the cover.

(26) Using a multimeter set to the X1 OHM scale, measure the resistance between the klystron heater and cathode terminals.

(27) If the resistance measured in step (26) above was greater than 3 ohms, remove and replace the klystron (para 5-18*a* and *f*).

(28) If the resistance measured in step (26) above was less than 3 ohms, an open circuit exists in the klystron filament wiring between the PA heater/cathode terminals and the power supply drawer or the power supply filament module A14. Refer the problem to the next higher level of maintenance.

(29) If all the indications in step (12) above were correct except the BEAM V X1000 indication was below normal value, perform steps (30) through (34) below.

(30) Repeat steps (15) and (16) above.

(31) See figure 5-2. On the pulse synthesizer module A4 (A4 LEDs) observe the LED indicators.

(32) If any one or more of the indicators in step (31) above is off, remove and replace the pulse synthesizer module A4 (para 5-20*d*).

(33) Observe the LED indicators on the high voltage switching module A5 through A12 (A5 LED through A12 LED, fig. 5-2).

(34) If any one or both of the indicators in step (33) above is off on a module, remove and replace that module (para 5-20*e*).

(35) If all the indications in step (12) above were correct, place the PA MONITOR switch to the upper scale X15 WATTS position (black stencil).

(36) On the PA, unlock and then adjust the OUTPUT LEVEL control for an approximate midscale, or lower, indication on the MONITOR meter.

(37) Place the power supply MONITOR switch to the BODY MA X5 position. Observe the MONITOR meter for an indication of 6 (30 ma) or lower.

(38) On the PA, adjust the OUTPUT LEVEL control to slowly increase the output level while observing both MONITOR meters.

(39) If the power supply MONITOR meter indication BODY MA increases above normal and the PA MONITOR meter output level does not increase or increases only slightly, remove and replace the klystron (para 5-18*e* and *f*).

b. TEMP-KLYSTRON Fault and HV INHIBIT Status Indicators.

(1) Check (by listening) that the PA klystron blower is operating.

(2) If the blower is operating, check the inlet and exhaust louvers for obstructions or dirty filters; remove obstructions or clean filters as necessary.

(3) If the blower is not operating, check the power supply BLOWER circuit breaker. If the circuit breaker is tripped (in the OFF position) reset it.

(4) If step (3) above does not correct the fault, the problem is in the PA klystron blower B1; remove and replace the blower (para 5-18*c* and *d*).

c. INTERLOCKS Faults and HV INHIBIT Status Indicators.

(1) Place the power supply OPERATESTANDBY switch to the STANDBY position.

(2) On the power amplifier (PA) disconnect the clamp securing the SHF output waveguide flange to the shelter waveguide flange and free the mated flanges.

(3) Remove the cables from the SHF IN and SHF TEST OUT connectors.

(4) Loosen the eight captive screws on the PA front panel.

(5) Pull on the two handles to extend the PA to its open position.

(6) Tighten all of the ¼-turn fasteners which secure the top cover, bottom cover, right side access cover, and front access cover to ensure that the interlock switches are in their closed positions.

(7) If the INTERLOCKS lamp is still illuminated, close the PA drawer, secure the captive screws and proceed to step (8) below.

(8) Loosen the eight captive screws on the power supply front panel.

(9) Open the power supply drawer.

(10) Tighten all the ¼-turn fasteners which secure the top cover on the power supply to ensure that the interlock switch is closed.

(11) If the INTERLOCKS lamp is still illuminated, remove the top cover and check the operation of the interlock switch.

(12) If the operation of the interlock switch is satisfactory, the problem is in the power supply control and overload module Al; remove and replace the module (para 5-20*a*).

(13) After correction of the fault, close the power supply drawer and tighten the eight captive screws on the front panel. Replace the cables and waveguide on the front panel of the PA.

d. TEMP LOAD Fault and HV INHIBIT Status Indicators. This fault is an indication of reflected power on the output waveguide system involving the power amplifier (PA), the flexible waveguide to the patch panel, the antenna waveguide and the feed horn. The fault will occur when the internal load has an excessive temperature condition and the thermal switch has opened. Before this procedure can be accomplished it will be necessary to wait until the load has cooled, the thermal switch has reset itself and output power is restored.

(1) In the PA, place the REFL WATTS/FWS WATTS switch to the FWD WATTS position and the MONITOR switch to the appropriate range position and record the output power as indicated on the MONITOR meter.

(2) Place the REFL WATTS/FWD WATTS switch to the REFL WATTS (hold) position and record the reflected power as indicated on the MONITOR meter.

(3) If the power recorded in step (2) above is over 10% of that recorded in step (1) above the problem is in the waveguide and connections between the SHF OUT and the antenna feed-horn.

(4) Place the power supply OPERATE-STANDBY switch to the STANDBY position.

(5) Carefully examine the waveguide, the connections and the feedhorn for damage. Remove and replace damaged items, as necessary.

(6) If the power recorded in step (2) above is not over 10 % of that recorded in step (1) above and the fault lamps are still illuminated, position the transmit waveguide switch so this PA is connected to the dummy load (not on-line).

(7) Again measure the power as in step (1) and (2) above.

(8) If the reflected power is more than 10% of the forward power, the problem is in the waveguide between the SHF OUT flange and the dummy load. Carefully examine the waveguide for damage and remove and replace, as necessary.

(9) If the reflected power is less than 10% of forward power and the fault lamps are still illuminated, the problem is in the internal waveguide; return the PA to the next higher level of maintenance.

e. BODY OVLD Fault and *HV INHIBIT Status Indicators.*

(1) On the power supply place the MONITOR switch to the BODY MA X5 position.

(2) On the power amplifier (PA) reduce the RF drive to the klystron by turning the OUTPUT LEVEL control several turns counterclockwise.

(3) On the power supply place the OPERATE-STANDBY switch to the STANDBY position.

(4) Place the FAULT CKT/RESET switch to the RESET position and then release it.

(5) Place the OPERATE-STANDBY switch to the OPERATE position and observe the MONITOR meter on the power supply.

(6) If the fault indicators are extinguished and the MONITOR meter indicates less than 10 ma, the fault was only a momentary one.

(7) If the fault indicators remain illuminated and the MONITOR meter fluctuates, the problem' is in the PA klystron; remove and replace it (para 5-19*e* and *f*).

f. HV ARC and BODY OVLD Fault and HV INHIBIT Status Indicators. In addition to the indicators, the HV MAIN fuse may have blown and its indicator will be illuminated.

(1) On the power supply place the OPERATE-STANDBY switch to the STANDBY position.

(2) Place the FAULT CKT/RESET switch to the RESET position and then release it.

(3) If necessary, replace the HV MAIN fuse.

NOTE

A spare fuse is located in the SPARE holder to the left of the HV MAIN fuse.

(4) Place the OPERATE-STANDBY switch to the OPERATE position.

(5) If all fault lamps are extinguished after step (3) above the failure was a random are and no further action is required.

NOTE

If a high voltage arc occurs at turn-on (STANDBY to OPERATE), the HV ARC indicator will not illuminate but the BODY OVLD indicator will illuminate and the HV MAIN fuse will blow.

(6) If the fault lamps remain illuminated after step (4) above, remove the primary power from the power supply by placing the associated PA/AUX circuit breaker to the OFF position on the power distribution panel. The AC POWER indicator on the power supply must be off.

(7) Loosen the eight captive screws on the power supply front panel.

(8) Pull on the two handles to extend the power supply from the rack.

(9) Disconnect the cable from connector J3 on the rear panel of the unit.

(10) Place the OPERATE-STANDBY switch in the STANDBY position.

(11) If necessary, replace the HV MAIN fuse.

(12) Remove fuses HV1 and HV2.

(13) On the power distribution panel place the associated PA/AUX circuit breaker to the ON position.

(14) Wait approximately 5 minutes until the FIL INHIBIT indicator turns off and then place the OPERATE-STANDBY switch to the OPERATE position.

(15) If the BODY OVLD and HV INHIBIT indicators are still illuminated, the problem is in the power supply. Remove the unit (para 5-21) and return it to the next higher level of maintenance.

NOTE

The HV MAIN fuse indicator may also be illuminated if the fuse has blown.

(16) If no fault indicators are illuminated after performing step (14) above , place the power supply MONITOR switch to the BEAM V X1000 position and observe the MONITOR meter for an indication of approximately 4600 volts.

(17) Place the OPERATE-STANDBY switch to the STANDBY position.

(18) Replace fuse HV2.

(19) Place the OPERATE-STANDBY switch to the OPERATE position.

(20) If the HV INHIBIT and BODY OVLD indicators are again illuminated, the problem is in the power supply. Remove the power supply (para 5-21) and return it to the next higher level of maintenance.

(21) If no fault indicators are illuminated after performing step (19) above , observe the MONITOR meter for a BEAM V X1000 indication of approximately 7000 volts.

(22) If the voltage indication of step (21) above is correct, the problem is in the PA klystron. Remove and replace the klystron (para 5-18*e* and *f*).

(23) Replace fuse HV1. Replace the high voltage cable removed from connector J3 in step (9) above and secure the power supply drawer.

g. HV INHIBIT Status Indicator and HV MAIN Fuse Indicator.

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Pull on the two handles to extend the power supply from the rack.

(3) Place the OPERATE-STANDBY switch to the STANDBY position and remove fuses HV1, HV2, HV3, and HV4.

(4) Replace the HV MAIN fuse.

NOTE

A spare fuse is located in the SPARE holder to the left of the HF MAIN fuse.

(5) Momentarily place the FAULT CKT/RESET switch to the RESET position and then release it. Place the OPERATE-STANDBY switch to the OPERATE position.

(6) Observe the LED indicators on the pulse synthesizer (A4) and high voltage switching (A5 through A12) modules (fig. 5-2).

(7) If any LED indicator is extinguished on the pulse synthesizer module A4, the problem is in that module, remove and replace the module (para 5-20*e*).

(8) If any LED indicator is extinguished on either of the high voltage switching modules A5 through A12, the problem is in that module; remove and replace the appropriate module (para 5-20*e*).

(9) If all LED indicators on the modules are illuminated, place the OPERATE-STANDBY switch to the STANDBY position.

(10) Remove the LV FUSE. On the power supply rear panel, remove the cable from connector J3.

(11) Remove the top cover of the power supply by turning each of the fasteners 1/4-turn counter-clockwise.

(12) Place the TEST-NORMAL switch (inside drawer on left side) to the TEST position.

(13) Replace the HV4 fuse and depress the top cover interlock switch.

(14) Replace the LV FUSE and place the OPERATOR-STANDBY switch to the OPERATE position.

(15) Place the MONITOR switch to the BEAM V X1000 position and observe the MONITOR meter.

(16) The voltage as indicated on the MONITOR meter should be approximately 2200 volts. If the voltage is low, the problem is in the high voltage transformer/rectifier module A17; remove and replace the module (para 5-20*g*).

(17) If the voltage is correct, place the OPERATE-STANDBY switch to the STANDBY position.

(18) Remove the HV4 fuse, replace the HV3 fuse and depress the interlock.

(19) Place the OPERATE-STANDBY switch to the OPERATE position and observe the MONITOR meter.

(20) The voltage as indicated on the MONITOR meter should be approximately 2200 volts. If the voltage is low, the problem is in the high voltage transformer/rectifier module A15; remove and replace the module (para 5-20*g*).

(21) If the voltage is correct, place the OPERATE-STANDBY switch to the STANDBY position.

(22) Remove the HV3 fuse, replace the HV2 fuse and depress the interlock.

(23) Place the OPERATE-STANDBY switch to the OPERATE position and observe the MONITOR meter.

(24) The voltage as indicated on the MONITOR meter should be approximately 2200 volts. If the voltage is low, the problem is in the high voltage transformer/rectifier module A16; remove and replace the module (para 5-20*g*).

(25) If the voltage is correct, place the OPERATE-STANDBY switch to the STANDBY position.

(26) Remove the HV2 fuse, replace the HV1 fuse and depress the interlock.

(27) Place the OPERATE-STANDBY switch to the OPERATE position and observe the MONITOR meter.

(28) The voltage as indicated on the MONITOR meter should be approximately 2200 volts. If the voltage is low, the problem is in the high voltage transformer/rectifier module A14; remove and replace the module (para 5-20*g*).

(29) Place the OPERATE-STANDBY switch to the STANDBY position.

(30) Replace all fuses.

(31) Place the TEST-NORMAL switch (inside the drawer) to the NORMAL position. Remove the LV FUSE.

(32) Reconnect the cable to connector J3 on the rear of the power supply. Replace the LV FUSE.

(33) Replace the top cover and tighten all of the 1/4-turn fasteners.

(34) Close the power supply drawer and tighten the eight captive screws on the front panel.

h. FIL INHIBIT and HV INHIBIT Status Indicators. These indicators will be illuminated when the power supply is placed in operation. If the FIL INHIBIT indicator is still illuminated for several minutes beyond the normal 5 minute delay, the problem is in the pulse synthesizer module A4; remove and replace the module (para 5-20*d*).

i. WG/ANTENNA INHIBIT and HV INHIBIT Status Indicators. When this power supply transmitter group is operating on-line, these indicators will be illuminated by a safety alert failure at any of the following: the flexible transmit waveguide interlocks at the antenna and antenna entry panel, the waveguide interlock on the front panel of the associated power amplifier, or if the antenna drops below a preset elevation angle. Any of these safety alert failures will shut down the on-line power amplifier and its associated transmitter group. When this power supply transmitter group is in standby, the indicators will be illuminated only if the waveguide interlock opens on the front panel of the associated power amplifier. In addition, if this standby group is operating, that is, driving the dummy load, the power amplifier will be shut down. To locate a failed safety alert item, compare actual indications and operating status with the following tabulation. Disable the audible alarm if it is sounding.

(1) On-line transmitter group: one of the flexible transmit waveguide interlocks has opened or the waveguide interlock has opened on the on-line power amplifier. The following conditions/indications will be generated:

(a) No unit fault indication on the power amplifier but the unit will be shut down.

(b) Power supply WG/ANTENNA INHIBIT and HV INHIBIT status indicators are illuminated.

(c) Alarm monitor SAFETY ALERT /WAVEGUIDE INTERLOCK indicator is illuminated.

(d) Alarm monitor SYSTEM FAULT/RSS indicator is illuminated and audible alarm is sounding.

(e) Place the power supply OPERATE-STANDBY switch to the STANDBY position and locate the open interlock.

(2) On-line transmitter group: the antenna has dropped below the preset safety-alert elevation angle. The following conditions/indications will be generated:

(a) No unit fault indication on the power amplifier but the unit will be shut down.

(b) Power supply WG/ANTENNA INHIBIT and HV INHIBIT indicators are illuminated.

(c) Alarm monitor SAFETY ALERT/ANTENNA ELEVATION indicator is illuminated.

(d) Alarm monitor SYSTEM FAULT/RSS indicator is illuminated and audible alarm is sounding (refer to step (*f*) below).

(e) Place the power supply OPERATE-STANDBY switch to the STANDBY position. Check the setting of the safety switch on the elevation readout assembly (refer to para 3-17).

(f) Check for these additional fault indications: a SCAN FAULT on the antenna control (TRACK SIG LOSS also may be on) and a SYSTEM FAULT/CSS on the alarm monitor. If these indications are displayed, the antenna control has failed; refer to paragraph 5-13 (and ignore step (*e*) above).

(3) Standby transmitter group with power supply in the standby condition: the waveguide interlock has opened on the associated power amplifier. The following conditions/indications will be generated:

(a) No unit fault indication on the power amplifier.

(b) Power supply WG/ANTENNA INHIBIT and HV INHIBIT indicators are illuminated.

(*c)* Alarm monitor SAFETY ALERT/WAVEGUIDE INTERLOCK indicator is illuminated.

(d) No system/RSS fault indication on the alarm monitor and no audible alarm.

(4) Standby transmitter group with power supply in the operate condition and driving the dummy load: the waveguide interlock has opened on the associated power amplifier. The following conditions/indications will be generated:

(a) No unit fault indication on the power amplifier but the unit will be shut down.

(b) Power supply WG/ANTENNA INHIBIT and HV INHIBIT indicators are illuminated.

(c) Alarm monitor SAFETY ALERT/WAVEGUIDE INTERLOCK indicator is illuminated.

(d) No system/RSS fault indication on the alarm monitor and no audible alarm.

(e) Place the power supply OPERATE-STANDBY switch to the STANDBY position and correct the failure.

j. Filament Voltage Adjustment. The power supply unit 6 volt filament voltage should be checked and adjusted, if necessary, whenever any one of the following is replaced: power supply low voltage module A2 or filament module A18, or the PA klystron V1.

Proceed as follows:

(1) It is assumed here that one of the above items has just been replaced, all access and/or chassis covers are replaced, and ac power is off.

(2) On the power supply place the OPERATE-STANDBY switch to the STANDBY position.

(3) On the power distribution panel place the associated AUX and PA circuit breakers to the ON position. On the power supply check that the AC POWER indicator is illuminated.

(4) On the power supply place the START and BLOWER circuit breakers to the ON position.

(5) On the power supply place the MONITOR switch to the 6V FIL X1 position.

(6) Observe the power supply MONITOR meter for a normal indication of + 0.3, - 0.1 V.

(7) If the 6 V FIL X1 indication is within tolerance, no adjustment is necessary and this procedure is completed. If the indication is not within tolerance, proceed to step (8) below.

(8) On the power supply front panel loosen the eight captive screws and open the power supply drawer.

(9) Locate the FIL ADJ opening on the top cover (fig. 5-2) and then observe the power supply MONITOR meter.

(10) Adjust the FIL ADJ control for a 6, + 0.3, 0.1 volt indication on the MONITOR meter.

(11) Close the power supply drawer and tighten the front panel captive screws.

5-18. Removal and Replacement of Power Amplifier Module

The following procedures contain instructions for the removal and replacement of modules, the blower, and the klystron.

WARNING

Voltages dangerous to life are present in the power amplifier. Also, the potential for an RF radiation hazard exists should the front panel waveguide flange become uncovered while the PA is operational. On the power distribution panel, place the appropriate AUX and PA circuit breakers to the OFF position. Check that the AC POWER indicator on the power supply is extinguished. On the power supply, place the START and BLOWER circuit breakers to the OFF position and the OPERATE-STANDBY switch to the STANDBY position.

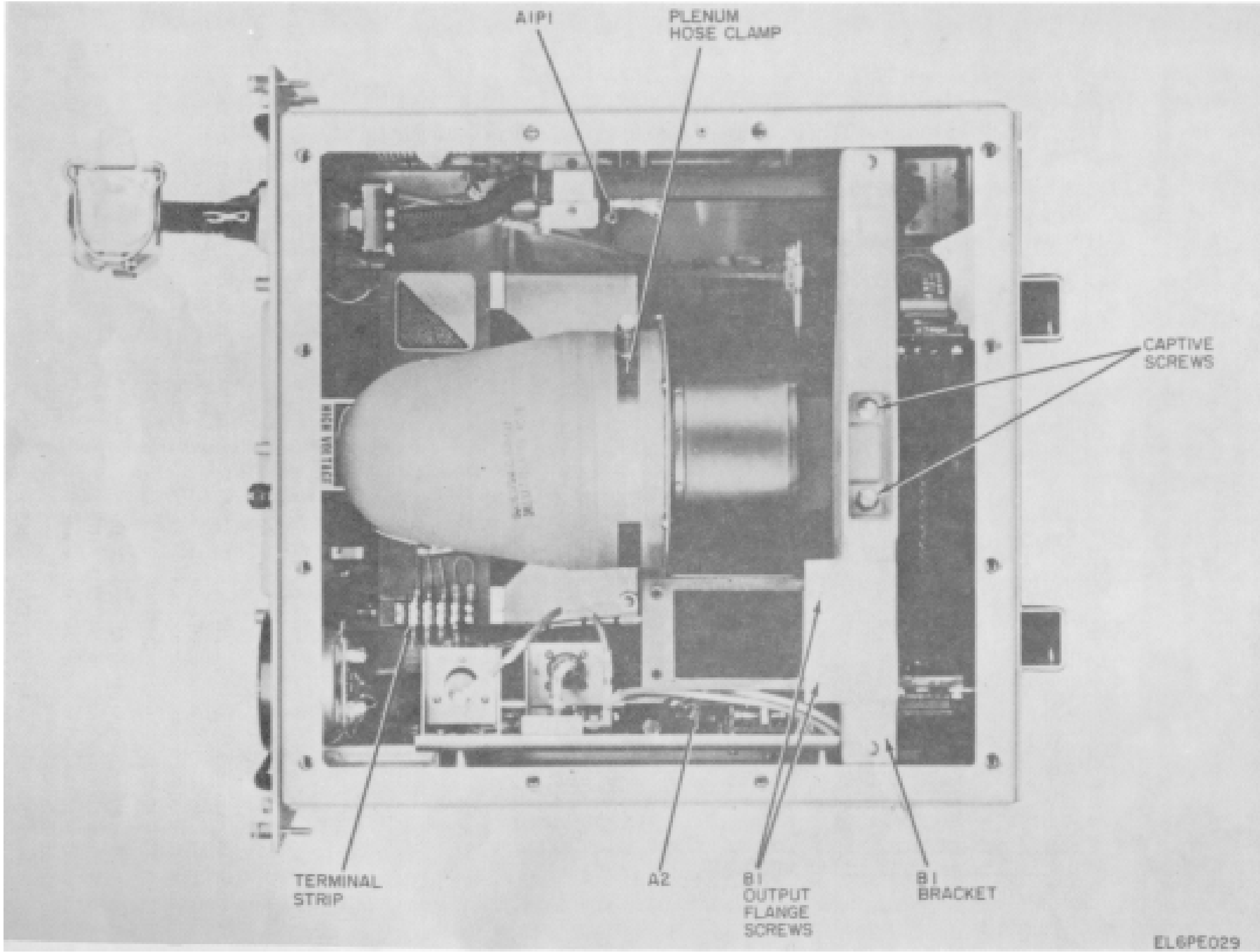

Figure 5-3. Power Amplifier, Top Access Opening. Removal Items.

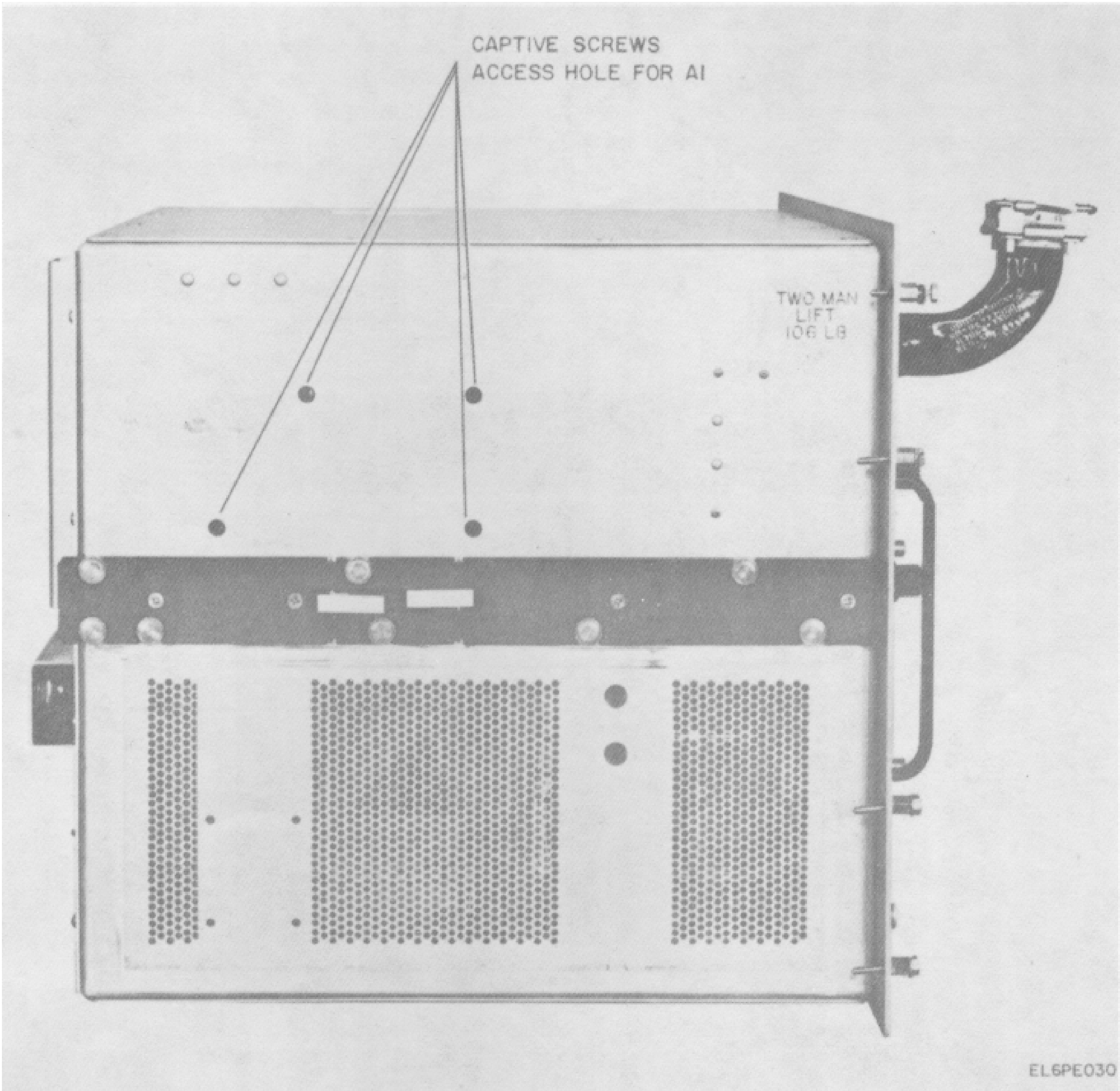

Figure 5-4. Power Amplifier, Module A1 Captive Screws.

a. Removal and Replacement of RF Low Power Alarm Module A1.

(1) Observe the warning note under paragraph 5-18 above.

CAUTION

Handle the waveguides below with care. If damaged, they may cause equipment malfunction. Also, remove your wristwatch to prevent it from becoming magnetized.

(2) On the power amplifier (PA), unlock the quick disconnect clamp securing the PA SHF OUT waveguide flange to the shelter waveguide flange and free the mated flanges.

(3) Remove the cables at the SHF IN and SHF TEST OUT connectors.

(4) Loosen the eight captive screws on the front panel of the PA.

(5) Pull on the two handles to extend the PA from the rack.

(6) Loosen the twelve 1/4-turn fasteners which secure the top cover and remove the cover.

(7) Remove module connector P1 from chassis cable connector J5 (fig. 5-3).

NOTE

If connectors J5 and P1 cannot be separated easily, refer to c below and remove the flexible plenum.

(8) Loosen the four captive screws which secure the module bracket. These captive screws are reached through access holes in the left side of the PA (fig. 5-4).

(9) Remove the module and bracket.

(10) Remove the four screws which secure the module to the bracket and separate the two.

(11) Replace the module by repeating steps (2) through (10) above in reverse order.

b. Removal and Replacement of RF Monitor Module A2.

(1) Observe the warning note under paragraph 5-18 above.

CAUTION

Handle the waveguides below with care. If damaged, they may cause equipment malfunction. Also, remove your wristwatch to prevent if from becoming magnetized.

(2) On the power amplifier (PA), unlock the quick disconnect clamp securing the PA SHF OUT waveguide flange and free the mated flanges.

(3) Remove the cables at the SHF IN and SHF TEST OUT connectors.

(4) Loosen the eight captive screws on the front panel of the PA.

(5) Pull on the two handles to extend the PA from the rack.

(6) Loosen the twelve 1/4-turn fasteners which secure the top cover and remove the cover.

(7) On the right outside of the PA, loosen the four captive screws which secure the module bracket (fig. 5-5).

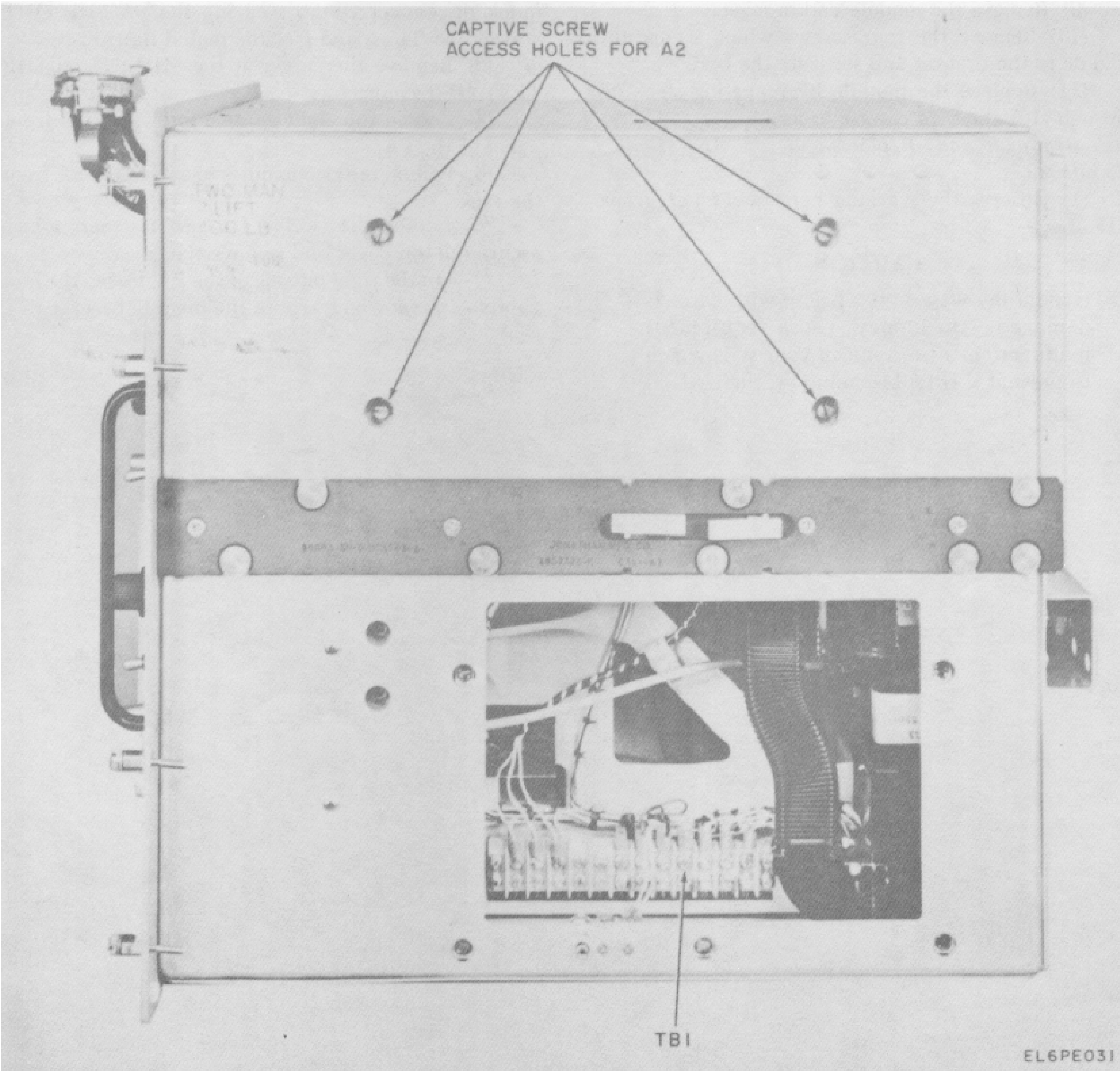

Figure 5-5. Power Amplifier, Module A2 Captive Screws and Right-Side Access Opening, Removal Items.

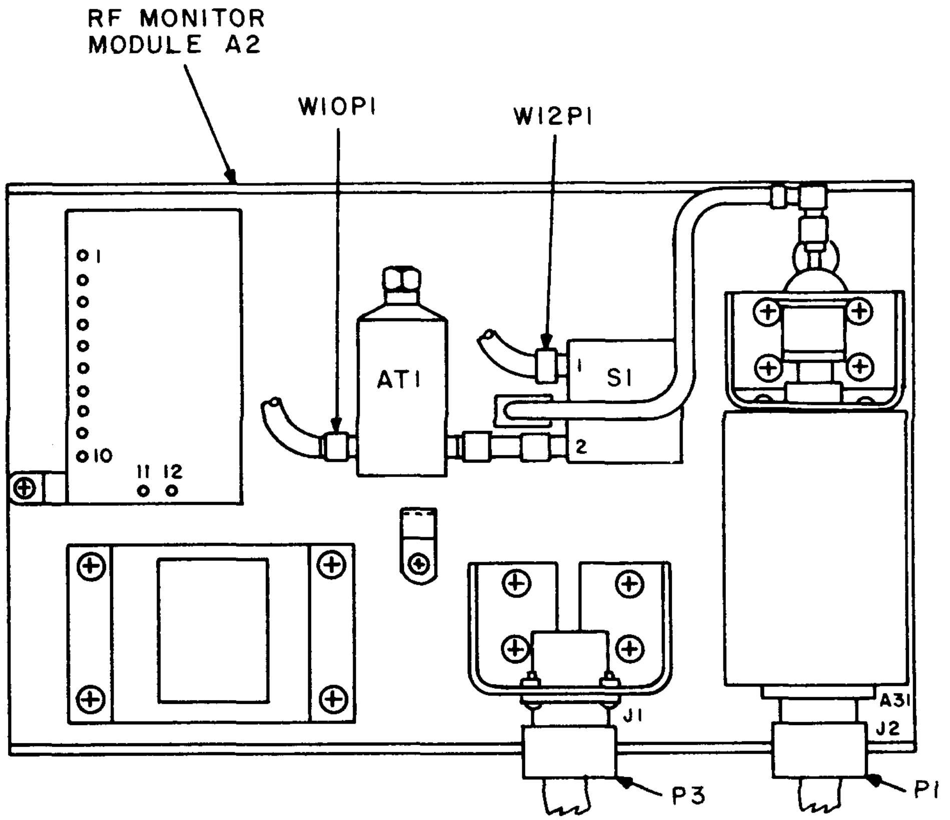

Figure 5-6. Power Amplifier, Module A2 Removal Cables.

(8) Lift the module bracket slightly to gain access to the cable and SHF coax connectors.

(9) Unscrew and remove two chassis cable plugs P1 and P3 from module connector jacks AR1 J2 and J1, respectively, at the bottom of the module (fig. 5-6).

(10) Unscrew and remove two SHF coax cables W10P1 and W12P1 from attenuator AT1 and switch S1, respectively (fig. 5-6).

(11) Remove the module.

(12) Replace module A2 by performing steps (2) through (11) above in reverse order.

c. Removal of Power Amplifier Blower B1.

(1) Observe the warning note under paragraph 5-18 above.

(2) On the power amplifier (PA), unlock the quick disconnect clamp securing the PA SHF OUT waveguide flange to the shelter waveguide flange and free the mated flanges.

CAUTION

Handle the waveguides with care. If damaged, they may cause equipment malfunction.

(3) Remove the cables at the SHF IN and SHF TEST OUT connectors.

(4) Loosen the eight captive screws on the front panel of the PA.

(5) Pull on the two handles to extend the PA from the rack.

(6) On the rear of the PA, remove two cables from connectors J3 and J4 and the ground wire from terminal E4.

(7) Release the latches on the chassis slide rails on each side of the PA.

WARNING

Because of the bulk and weight of the PA, use two persons to remove it. Handle the PA with care; otherwise, injury to personnel or damage to the PA may result.

(8) Remove the PA from the rack.

CAUTION

Remove your watch to prevent it from becoming magnetized.

(9) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(10) Remove the top cover.

(11) Loosen the thirteen 1/4-turn fasteners which secure the front access cover.

(12) Remove the front access cover.

(13) Through the top access and front access openings, loosen the screw on each of the hose clamps which secure the flexible plenum to the blower and klystron (fig. 5-3 and 5-7).

(14) Remove the flexible plenum.

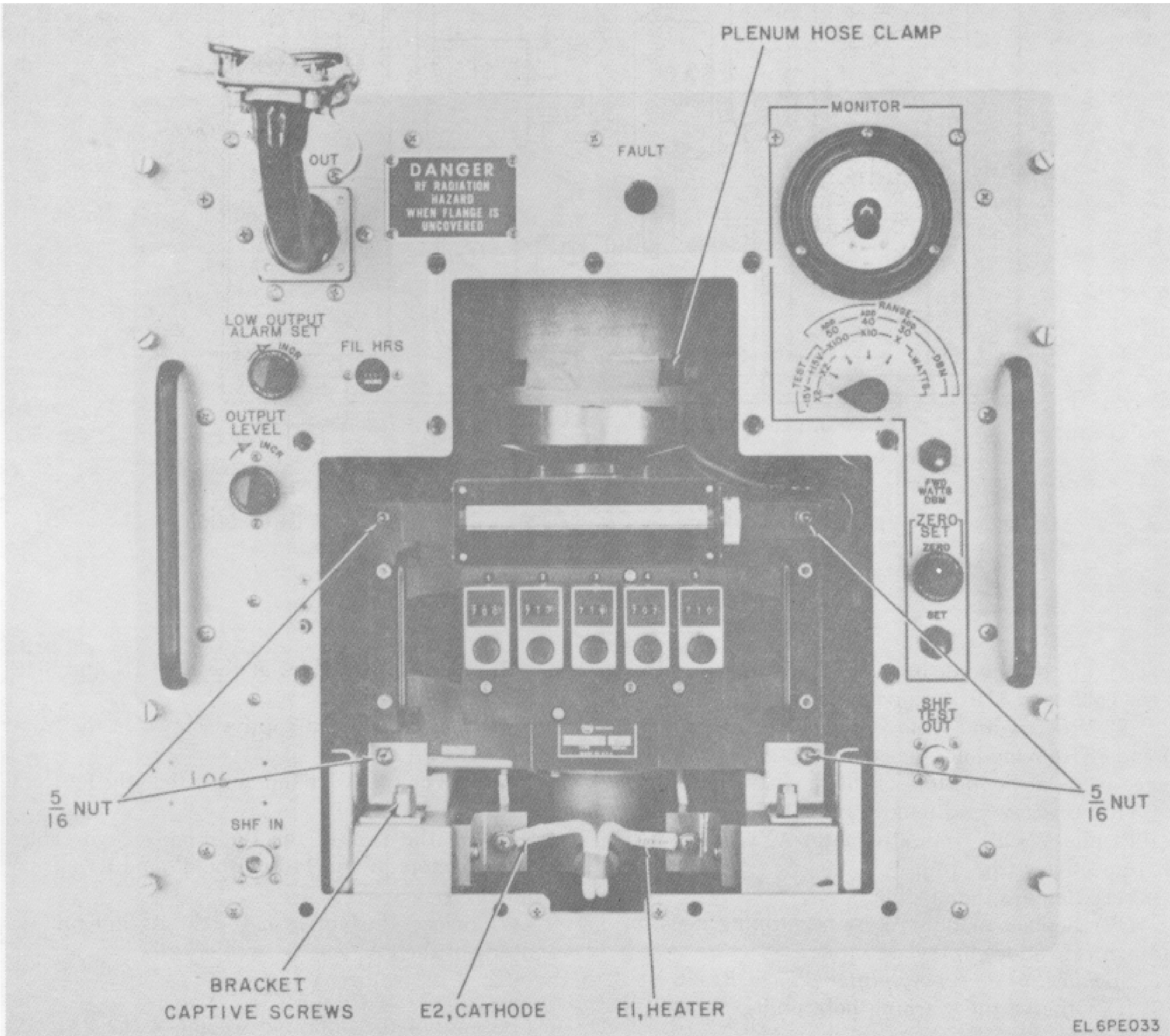

Figure 5-7. Power Amplifier, Front Access Opening, Removal Items.

(15) Loosen the five 1/4-turn fasteners which secure the right side access cover.

(16) Remove the right side access cover.

(17) Through the right side access opening remove three screws from terminals 1, 2, and 3 on terminal board TB1; tag these wires (fig. 5-5).

(18) Remove the three blower power wires from the terminal board.

(19) Remove the screw from the cable clamp holding the blower cable to the klystron support.

(20) On the blower mounting bracket (through the top opening) loosen the two captive screws down in the bracket well (fig. 5-3).

(21) Remove the two flathead screws securing the bracket to the blower output flange (fig. 5-3).

(22) At the left and right ends of the bracket remove the screws securing the bracket to the chassis.

(23) Note the orientation of the bracket and then remove it.

(24) On the rear panel of the PA remove the four screws that secure the blower to the chassis.

(25) Check that the blower power wires are free of any obstructions. Remove the blower through the top of the PA.

d. Replacement of Power Amplifier Blower B1.

CAUTION

Remove your watch to prevent it from becoming magnetized.

(1) Insert the blower through the top of the PA. Dress the blower power wires to the right side and towards terminal board TB1.

(2) Insert the four screws through the rear panel into the blower but do not tighten.

(3) Place the blower mounting bracket, in the proper orientation, on the chassis mounting.

(4) At the ends of the bracket, insert and tighten the screws to secure the bracket to the chassis.

(5) Insert two flathead screws through the bracket into the blower output flange; do not tighten.

(6) In the bracket well engage two captive screws with the blower housing. Tighten these screws and those in steps (2) and (5) above.

(7) Through the right side access opening, dress the three blower power wires above terminal board TB1.

(8) Connect the three wires to terminals TB1-1, 2, and 3; tighten the screws. Remove the tags and refasten the cable clamp.

(9) Through the top opening, replace the flexible plenum on the blower and klystron mounting flanges. Tighten the screw on each hose clamp to secure the flexible plenum.

(10) Replace the right side access cover, the front access cover, and the top cover on the PA. Tighten all 1/4-turn fasteners.

WARNING

Because of the bulk and weight of the PA, use two persons to replace it. Handle the PA with care; otherwise, damage to the PA or injury to personnel may result.

(11) Engage the unit slide rails with the rack chassis slide rails and push the PA into the rack. As necessary, disengage and lock the latches to accomplish this.

(12) Extend the PA from the rack.

(13) On the rear of the PA, connect the ground wire to terminal E4. Connect the two cable plugs to connectors J3 and J4.

(14) Close the PA drawer and tighten the eight captive screws on the front panel.

(15) Connect the front panel cables to the SHF IN and SHF TEST OUT connectors.

CAUTION

Handle the waveguides with care. If damaged they may cause equipment malfunction.

(16) On the front panel, mate the SHF OUT waveguide flange with the shelter waveguide flange and lock the quick disconnect clamp.

e. Removal of Klystron V1.

CAUTION

Use the nonmagnetic tools provided with the shelter tool kit to remove the klystron.

CAUTION

Do not allow magnetic tools, hardware, etc., to be pulled into the klystron magnet. Such objects rapping the magnet can alter its beam focusing properties and damage the tube. Also remove your wristwatch to prevent it from becoming magnetized.

(1) Observe the warning note under paragraph 5-18 above.

CAUTION

Handle the waveguides below with care. If damaged, they may cause equipment malfunction.

(2) On the power amplifier (PA), unlock the quick disconnect clamp securing the PA SHF OUT waveguide flange to the shelter waveguide flange and free the mated flanges.

(3) Remove front panel cables from the SHF IN and SHF TEST OUT connectors.

(4) Loosen the eight captive screws on the front panel of the PA.

(5) Pull on the two handles to extend the PA from the rack.

(6) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(7) Remove the top cover.

(8) Loosen the twelve 1/4-turn fasteners which secure the bottom cover.

(9) Remove the bottom cover.

(10) Loosen the thirteen 1/4-turn fasteners which secure the front access cover.

(11) Remove the front access cover.

(12) Loosen the five 1/4-turn fasteners which secure the right side access cover.

(13) Remove the right side access cover.

(14) Through the bottom access opening, loosen the waveguide clamp on the rear flange of flexible waveguide W3 (fig. 5-8). Accomplish this by inserting a standard blade screwdriver into the clamp handle slot and rotating it counterclockwise.

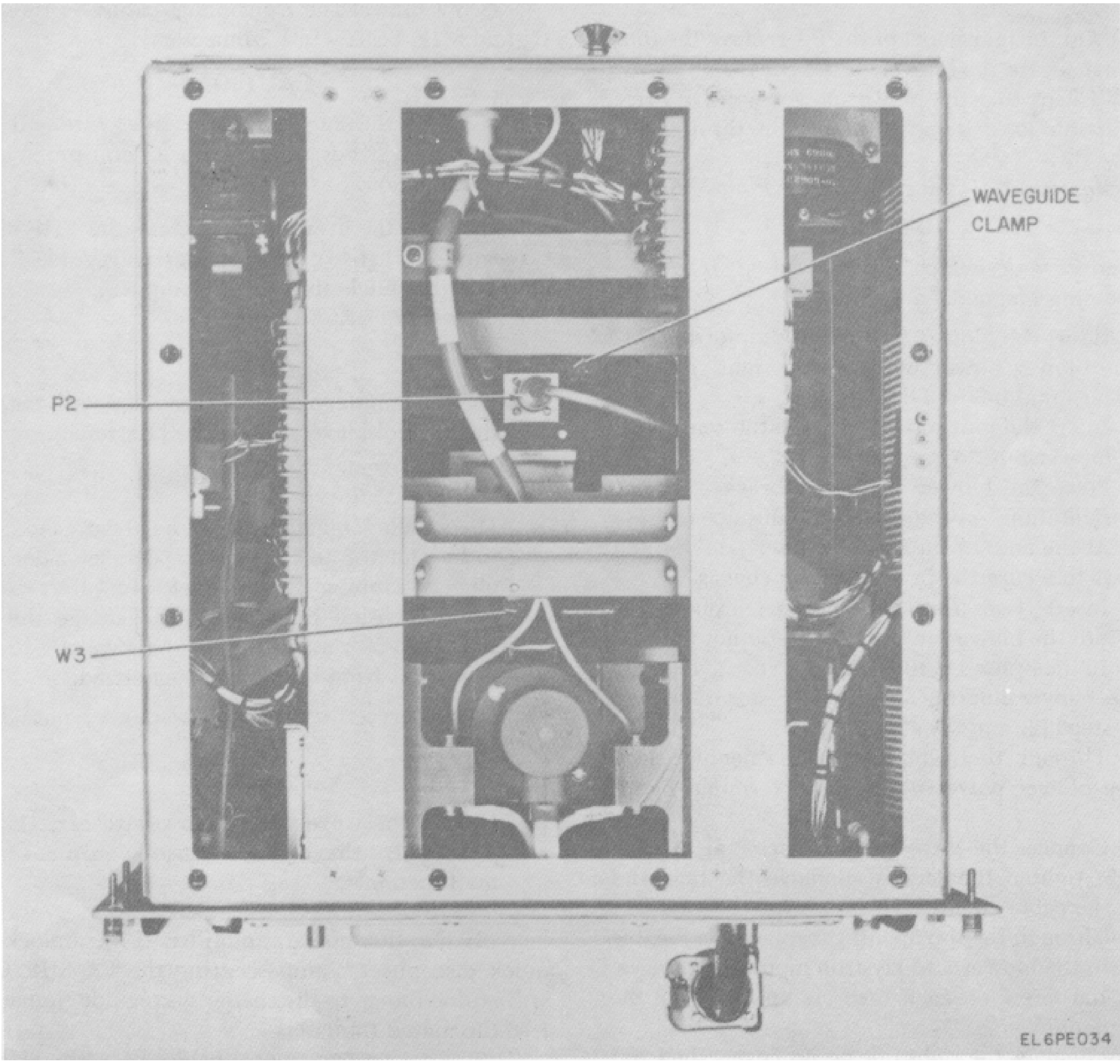

Figure 5-8. Power Amplifier, Bottom Access Opening, Removal Items.

(15) Move the clamp out of the way.

(16) Remove the SHF input cable plug P2 from the waveguide-to-coaxial adapter (fig. 5-8).

(17) Through the top access and front access openings, loosen the screw on each of the hose clamps which secure the flexible plenum to the blower and klystron (fig. 5-3 and 5-7).

(18) Remove the flexible plenum.

(19) On the top right side of the klystron magnet, tag and remove four wires from the terminal strip (use nonmagnetic tool). Hold on to the (magnetic) terminal screws during their removal to prevent their being pulled onto the magnet (fig. 5-3).

NOTE

Record the color coding of the tagged wires for later reference in step *f* (8) below.

(20) Close the PA drawer and tighten one captive screw in each corner of the front panel.

(21) Through the front access opening, remove the two screws which secure the heater and cathode wires to E1 and E2, respectively, at the bottom front of the klystron (use non-magnetic tool) (fig. 5-7).

(22) Remove the four 5/16 inch nuts which secure the klystron on the four corner guide posts (use nonmagnetic tool).

(23) At the bottom front of the klystron loosen the two captive screws which secure the two lower angle mounting brackets (use nonmagnetic tool).

WARNING

The klystron weighs approximately 43 pounds. Most of this weight is concentrated towards the rear of the assembly. During removal, be careful not to allow the rear of the assembly to tip downward. Otherwise, injury to personnel or damage to the equipment may result.

(24) Grasp the handles on the front of the klystron and slowly slide it forward. Lift the klystron slightly to allow the heater wire insulating boot to clear the bottom edge of the front panel. Hold the bottom of the klystron and then completely remove it from the PA making sure the rear flexible waveguide clears any chassis obstructions.

NOTE

On the rear of the klystron note the orientation of the rear clamp on the flexible waveguide and also the waveguide-to-coaxial adapter.

(25) Remove the four Allen head screws which secure the flexible waveguide to the klystron output flange (use nonmagnetic tool); remove the waveguide.

(26) Remove the four Allen head screws which secure the waveguide isolator to the klystron input flange (use nonmagnetic tool); remove the adapter.

f. Replacement of Klystron V1.

CAUTION

Use the nonmagnetic tools provided with the shelter tool kit to replace the klystron.

CAUTION

Do not allow magnetic tools, hardware, etc., to be pulled into the klystron magnet. Such objects rapping the magnet can alter its beam focusing properties and damage the tube. Also, remove your wristwatch to prevent it from becoming magnetized.

(1) Replace, in the proper orientation, the waveguide isolator and flexible waveguide on the klystron input and output flanges, respectively. Check that the rear clamp on the flexible waveguide will be squarely alined with the flange clamp in the chassis.

(2) Slowly slide the klystron onto the four corner guide posts and into the PA chassis. Be careful not to snag the heater wire insulating boot on the bottom edge of the front panel. The two waveguide flange clamps may or may not be mated properly at this time.

(3) Replace the four 5/16 inch nuts on the four corner guide posts. Screw them on only about four turns.

(4) Loosen all captive screws on the PA front panel. Extend the PA from the rack.

(5) Check that the two waveguide flange clamps are mated properly. As necessary, slide the klystron in and out and rotate the flexible waveguide flange to accomplish this.

(6) Insert a standard blade screwdriver into the clamp handle slot, rotate it clockwise, and lock the clamp.

(7) Connect the SHF input cable plug P2 to the waveguide-to-coaxial adapter.

(8) Replace the four wires on the klystron terminal strip and tighten the screws using nonmagnetic tools. Remove the tags.

(9) Replace the flexible plenum on the blower and klystron mounting flanges. Tighten the screw on each hose clamp to secure the flexible plenum.

(10) Replace the bottom cover, right side access cover, and top cover on the PA. Tighten all 1/4-turn fasteners.

(11) Close the PA drawer. Tighten all front panel captive screws.

(12) Replace the two angle mounting brackets at the bottom front of the klystron and tighten the two captive screws (use nonmagnetic tools). Tighten the four 5/16 inch nuts on the four corner guide posts (use nonmagnetic tools).

(13) Replace the heater and cathode wires to E1 and E2, respectively, at the bottom front of the klystron (use nonmagnetic tools). Tighten the two screws.

(14) Replace the front access cover on the PA. Tighten all 1/4-turn fasteners. Proceed to paragraph 5-17*j* above.

5-19. Removal and Replacement of Power Amplifier

a. On the power distribution panel place the associated AUX and PA circuit breakers to the OFF position. Check that the POWER indicator on the associated power supply is extinguished.

b. On the associated power supply place the START and BLOWER circuit breakers to the OFF position and the OPERATE-STANDBY switch to the STANDBY position.

CAUTION

Handle the waveguides below with care. If damaged, they may cause equipment malfunction.

c. On the power amplifier (PA), unlock the quick disconnect clamp which secures the PA SHF OUT waveguide flange to the shelter waveguide flange and free the mated flanges.

d. On the front panel, remove the cables from the SHF IN and SHF TEST OUT connectors.

e. Loosen the eight captive screws on the front panel of the PA.

f. Pull on the two handles to extend the PA from the rack.

g. On the rear of the PA, remove two cables from connectors J3 and J4 and the ground wire from terminal E4 (fig. 5-9).

WARNING

Because of the bulk and weight of the PA, two persons are required to remove it. Dropping the PA could cause injury to personnel or damage to the equipment.

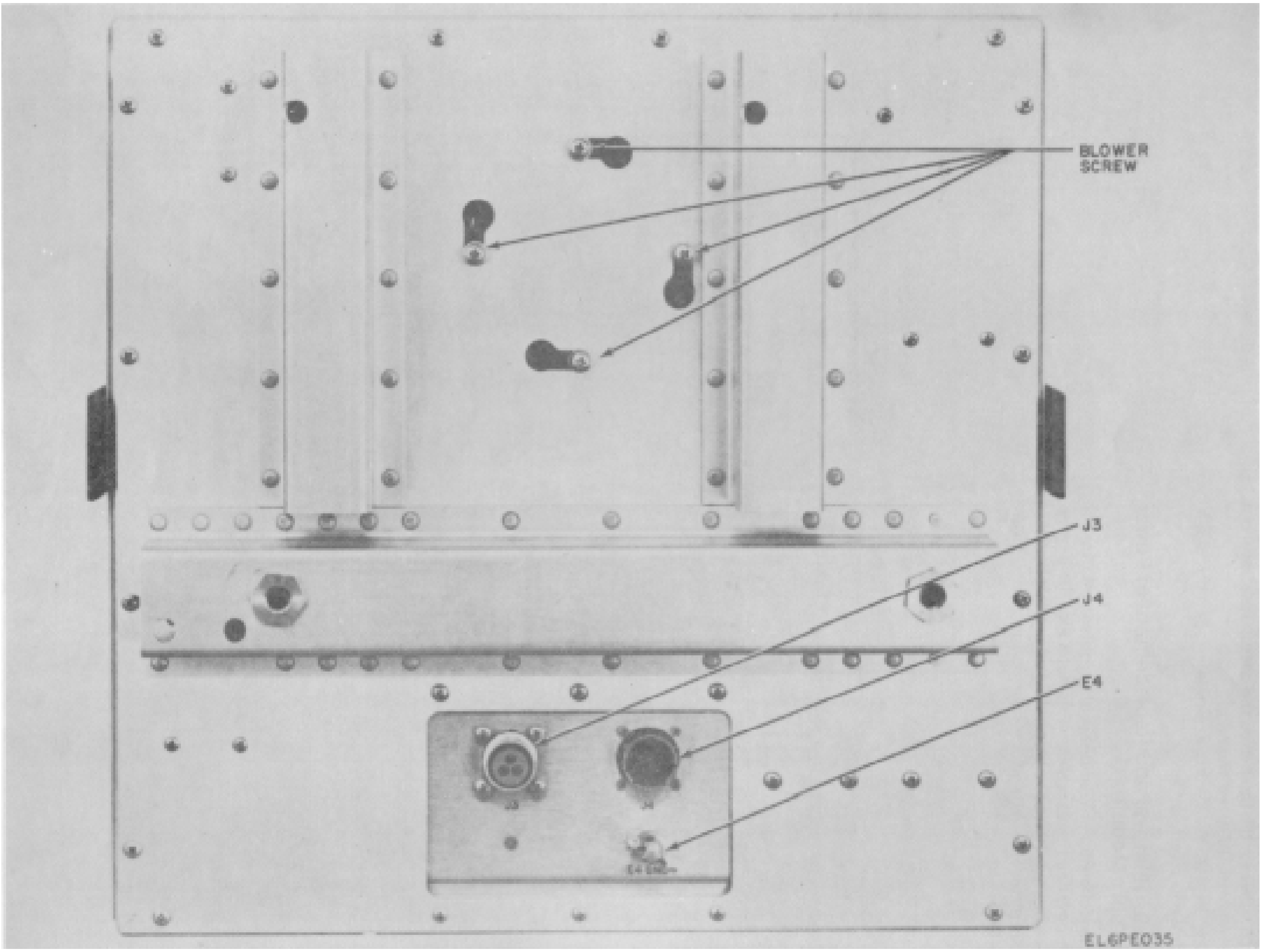

Figure 5-9. Power Amplifier, Rear Panel.

h. Release the latches on the chassis slide rails and remove the PA from the rack.

i. Replace the PA by performing steps *a* through *h* above in reverse order.

5-20. Removal and Replacement of Power Supply Modules

The following procedures contain instructions for the removal and replacement of modules and the blower. See figure 5-10 for the blower and all module locations except module A19 which may be located on figure 5-11.

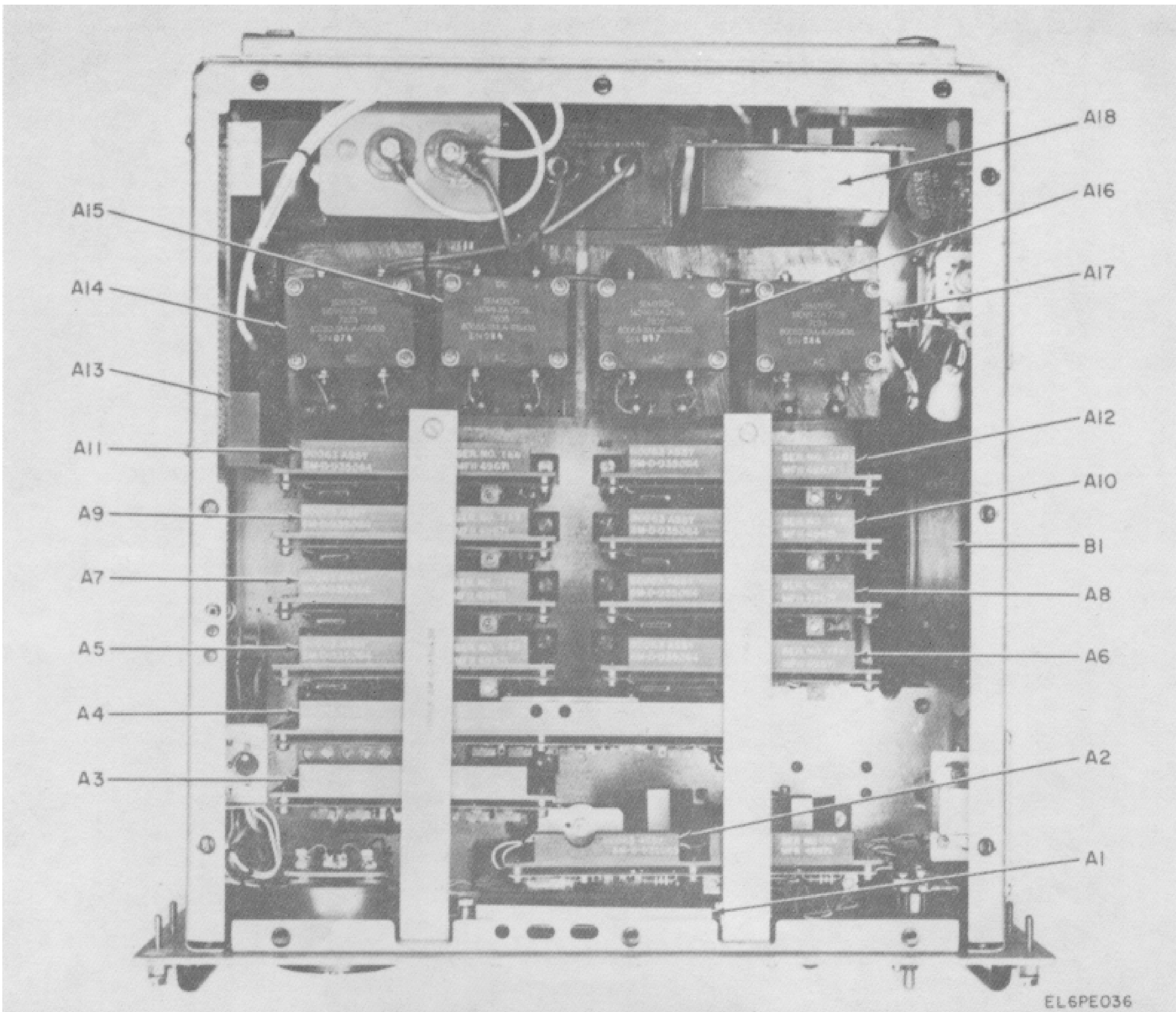

Figure 5-10. Power Supply Top View, Module Locations.

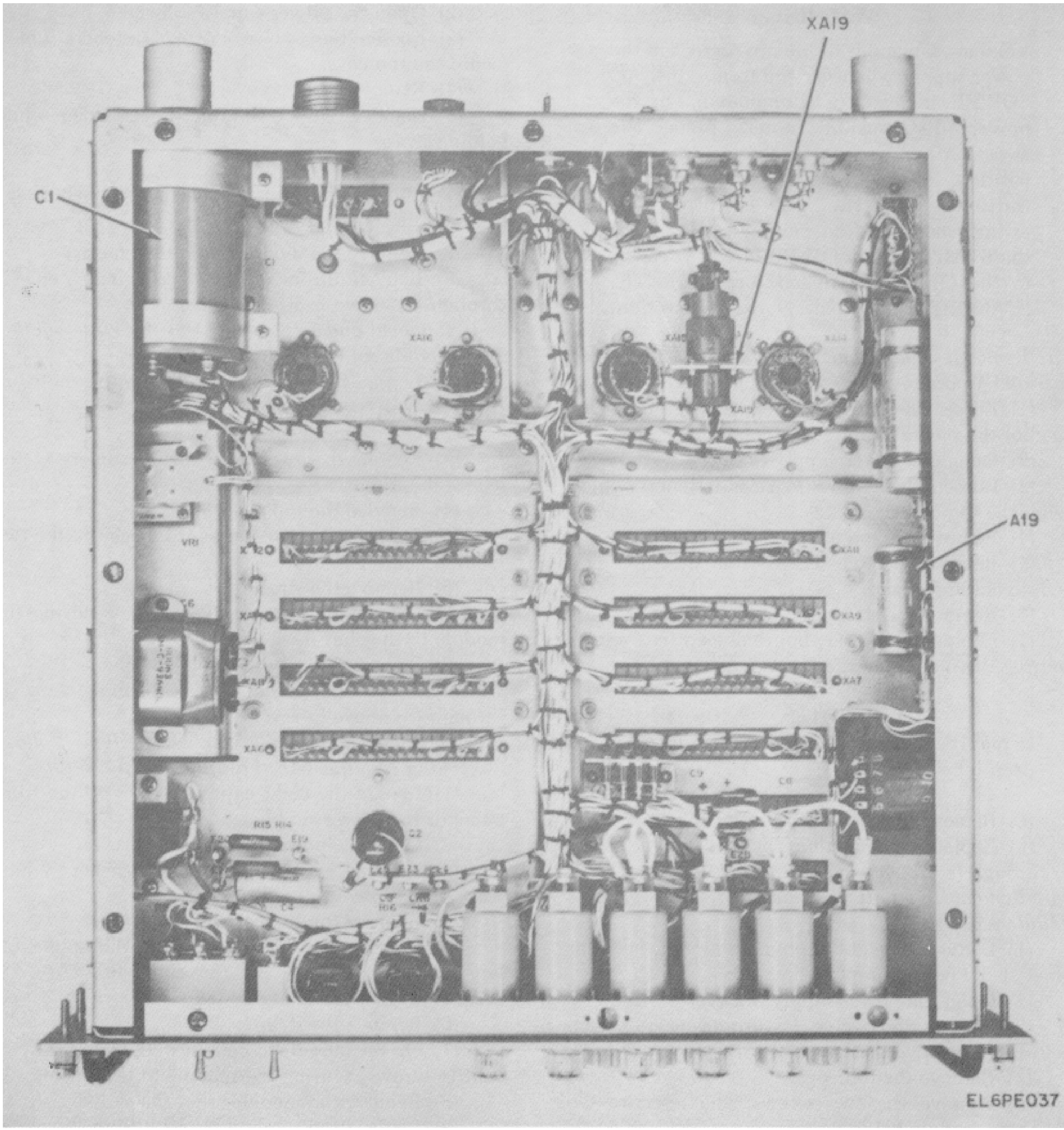

Figure 5-11. Power Supply Bottom View, Component Locations.

WARNING

Voltages dangerous to life are present in the power supply whenever the front panel AC POWER indicator is illuminated. On the power distribution panel, place the associated PA circuit breaker to the OFF position. Check that the AC POWER indicator on the power supply is extinguished. On the power supply, place the START and BLOWER circuit breakers to the OFF position and the OPERATE-STANDBY switch to the STANDBY position.

a. Removal and Replacement of Control and Overload Module A1 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve ¼/4-turn fasteners which secure the top cover.

(4) Remove the top cover.

(5) Remove the two screws from the right side module holding strap.

(6) Remove the strap.

(7) Loosen the two knurled captive screws securing the module to the front panel.

NOTE

It may be necessary to remove module A2 (step b below).

(8) Remove the module from the chassis.

(9) Replace the module by performing steps (1) through (8) above in reverse order.

b. Removal and Replacement of Low Voltage Module A2 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(4) Remove the top cover.

(5) Remove the two screws which secure the right side module holding strap.

(6) Remove the strap.

(7) Loosen the two captive screws which secure the module to the chassis.

(8) Remove the module from the chassis.

(9) Replace the module by performing steps (1) through (8) above in reverse order.

Proceed to step 5-18J above.

c. Removal and Replacement of High Voltage Overload Module A3 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(4) Remove the top cover.

(5) Remove two screws from the left side module holding strap.

(6) Remove the strap.

(7) Loosen the two captive screws securing the module to the chassis.

(8) Remove the module from the chassis.

(9) Replace the module by performing steps (1) through (8) above in reverse order.

d. Removal and Replacement of the Pulse Synthesizer Module A4 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(4) Remove the top cover.

(5) Remove the two screws from each of the two module holding straps.

(6) Remove the straps.

(7) Loosen the two captive screws securing the module to the chassis.

(8) Remove the module from the chassis.

(9) Replace the module by performing steps (1) through (8) above in reverse order.

e. Removal and Replacement of High Voltage Switching Modules A5 through A12 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(4) Remove the top cover.

(5) Remove the two screws from the applicable left side (A5, A7, A9, A11or right side (A6, A8, A10, A12) module holding strap.

(6) Remove the strap.

(7) On the module to be removed, loosen the two captive screws securing the module to the chassis.

(8) Remove the module from the chassis.

(9) Replace the module by performing steps (1) through (8) above in reverse order.

f. Removal and Replacement of High Voltage Module A-13 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover by turning each of them 1/4-turn counterclockwise.

(4) Remove the top cover.

(5) Unscrew and disconnect the three high voltage connectors on the top edge of the module.

(6) Loosen the three captive screws on the outside of the chassis which secure the module to the left side.

(7) Remove the module from the chassis.

(8) Replace the module by performing steps (1) through (7) above in reverse order.

g. Removal and Replacement of High Voltage Transformer/Rectifier Modules A14, A15, A16 and A17 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover and remove the top cover.

(4) Loosen the twelve 1/4-turn fasteners which secure the bottom cover and remove the bottom cover.

(5) On the dc side of the transformer/rectifier, remove the two nuts and washers which secure the two high voltage leads.

(6) From under the chassis, remove the four screws which secure the module to the chassis.

NOTE

When removing module A14 it will be necessary to loosen the capacitor C1 mounting bracket in order to have access to the module screws on the bottom of the chassis. Remove the four screws holding the capacitor bracket and move the capacitor aside.

(7) Remove the module from the chassis.

(8) Replace the module by performing steps (1) through (7) above in reverse order.

h. Removal and Replacement of Filament Module A18 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(4) Remove the top cover.

(5) Unscrew and disconnect the three high voltage connectors from the rear of the module.

(6) Loosen the four captive screws which secure the module to the chassis.

(7) Remove the module from the chassis.

(8) Replace the module by performing steps (1) through (7) above in reverse order.

Proceed to paragraph 5-18*j* above.

i. Removal and Replacement of Start Module A19 (fig. 5-11).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the bottom cover.

(4) Remove the cover.

(5) Under the chassis, unplug the module cable connector P1 from the chassis socket, XA19 (fig. 5-11).

(6) From the outside left side of the unit, remove the six screws which secure the module.

(7) Remove the module from the chassis.

(8) Replace the module by performing steps (1) through (7) above in reverse order.

j. Removal and Replacement of Power Supply Blower B1 (fig. 5-10).

(1) Loosen the eight captive screws on the front panel of the power supply.

(2) Open the power supply drawer.

(3) Loosen the twelve 1/4-turn fasteners which secure the top cover.

(4) Remove the top cover.

(5) Remove two screws from the right side module holding strap.

(6) Remove the strap.

(7) Loosen the captive screws securing modules A6, A8, A10 and A12 to the chassis.

(8) Remove modules A6, A8, A10 and A12.

(9) From the right outside of the chassis, remove the four screws which secure the blower and mounting ring.

(10) Lift the blower and mounting ring part way out of the chassis.

(11) Slide back the insulating boot and then tag the three wires to the blower; use the yellow dot as a reference point.

(12) Remove the three screws which secure the wires to the blower and remove the wires; remove the blower from the chassis.

(13) Separate the mounting ring from the blower by loosening the four screws and the clamps which secure it.

(14) Replace the blower by performing steps (1) through (13) above in reverse order.

5.21. Removal and Replacement of Power Supply

a. On the power distribution panel place the associated PA circuit breaker to the OFF position. Check that the AC POWER indicator on the power supply is extinguished.

b. On the power supply place the START and BLOWER circuit breakers to the OFF position and the OPERATE-STANDBY switch to the STANDBY position.

c. Loosen the eight captive screws on the front panel of the power supply.

d. Pull on the two handles to extend the power supply from the rack.

e. On the rear panel remove three cables from connectors J1, J2, and J3 and the ground wire from terminal E1 (fig. 5-12).

WARNING

Because of the bulk and weight of the power supply, two persons are required to remove it. Dropping the power supply could cause injury to personnel or damage to the equipment.

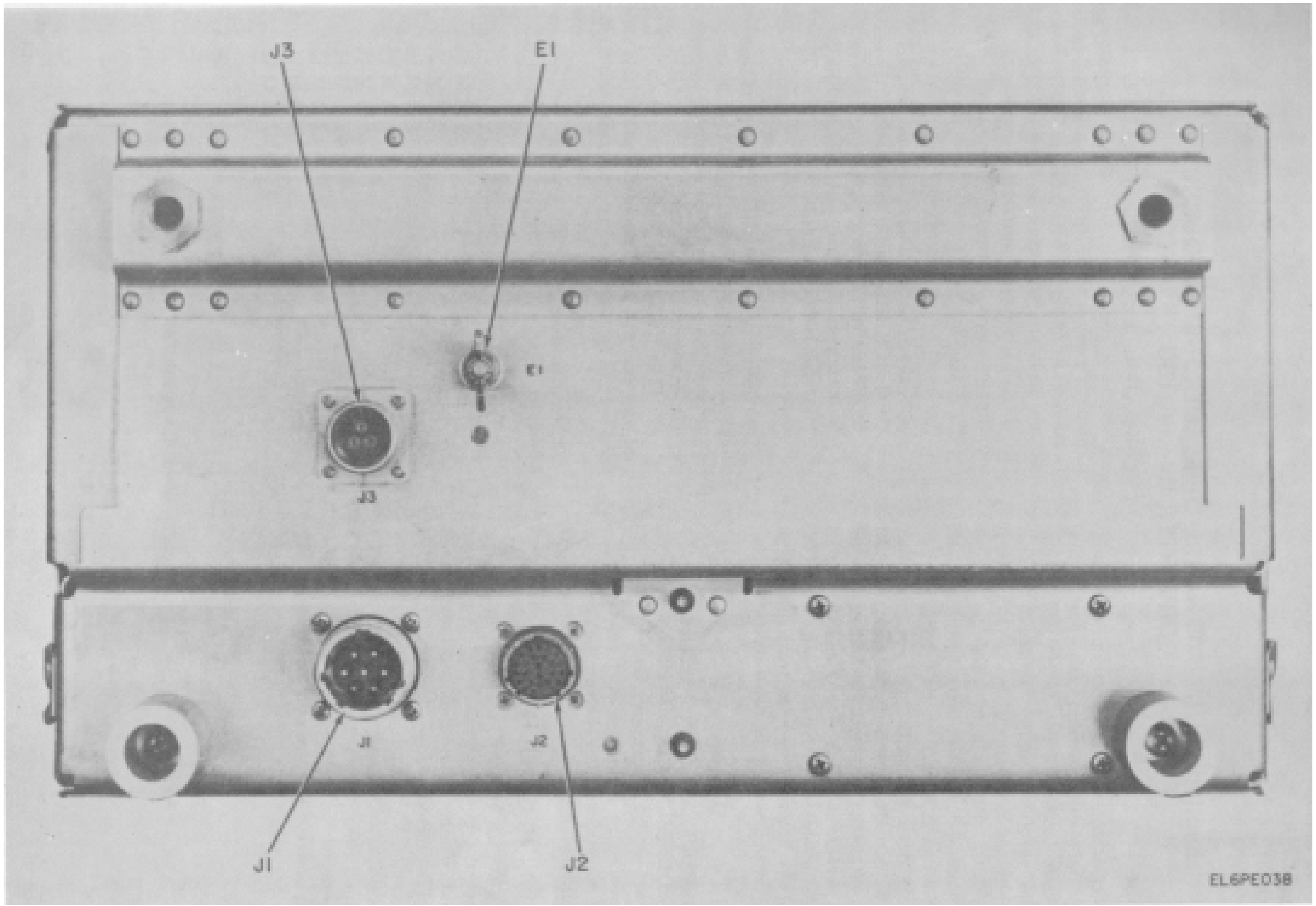

Figure 5-12. Power supply, rear panel.

f. Release the latches on the slide rails and remove the power supply from the rack.

g. Replace the unit by performing steps *a* through *f* above in reverse order.

Section VIII. MAINTENANCE OF ELECTRONIC FREQUENCY CONVERTER CV-3199/TSC

5-22. Scope

a. This section covers instructions and procedures for testing and fault isolation, adjustment, and removal and replacement. The test procedures are based on the use of built-in-test-equipment (BITE), and no additional support or test equipment is required.

b. See figure 3-6 for location of controls and indicators. See figures 5-13, 5-14, and 5-16 for location of the upconverter adjustments, modules, and other components. See figure 5-15 for location of submodules within the frequency synthesizer module. Refer to paragraph 5-25 for replacement of upconverter modules, to paragraph 5-26 for replacement of synthesizer modules, and to paragraph 5-27 for the replacement of the upconverter.

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a nonoperating condition and all power circuit breakers on the power distribution panel are in the OFF position.

5-23. Testing and Fault Isolation

a. Testing the Upconverter

(1) Place the power circuit breaker to the on position and observe that the associated power indicator is illuminated.

(2) Place the MONITOR switch to each of the following positions and observe the monitor meter for a correct indication. If an incorrect indication is observed, proceed to step (3) below. If a correct indication is observed at all positions, proceed to step (4) below.

Position	*Indication (Meter Units)*
+24 V x 1	22 to 26 M.U.
+ 15 V x 0.5	28 to 32 M.U.
- 15 V x 0.5	28 to 32 M.U.
+6 V x 0.2	28 to 32 M.U.
-6 V x 0.2	28 to 32 M.U.

(3) Replace power supply module PS1, (para 5-25).

(4) Place the monitor switch to the SYNTH position. Place the SYNTH MONITOR switch to the ϕ ERR position. Check the status of the OUT OF LOCK indicator. If the OUT OF LOCK indicator is illuminated, adjust the FREQ TUNE control to the frequency settings on the FREQ SELECT MHz switch settings. As the correct frequency is reached, the OUT OF LOCK indicator should extinguish. If the indicator will not extinguish, proceed to step (7) below.

NOTE

Care should be taken to ensure that the OUT OF LOCK indicator is extinguished when the FREQ TUNE control is reading the same frequency as that indicated by the FREQ SELECT MHz switches.

(5) Fine tune the FREQ TUNE control to obtain a mid-scale indication on the MONITOR meter. If a mid-scale indication cannot be obtained, proceed to step (7) below.

(6) Place the SYNTH MON switch to each of the following positions and observe the MONITOR meter for a correct indication. If an incorrect indication is observed, proceed to step (7) below. If a correct indication is observed at all positions, proceed to *b* below.

Position	*Indication (Meter Units)*
SHF LO	15 to 35 M.U.
630 MHz	15 to 35 M.U.
SP GEN	15 to 45 M.U.
1 MHz	15 to 35 M.U.
1 KHz	15 to 35 M.U.
125 KHz	15 to 35 M.U.
10 KHz	15 to 35 M.U.
FREQ STD	15 to 35 M.U.
IF	10 to 45 M.U.

(7) Test the frequency synthesizer module Al d below.

b. Upconverter with 70 MHz modem.

(1) Place the MONITOR switch to the IF IN position.

NOTE

The APC (automatic power control) switch on the SHF filter/detector module A5 should be in the ON position (fig. 5-13).

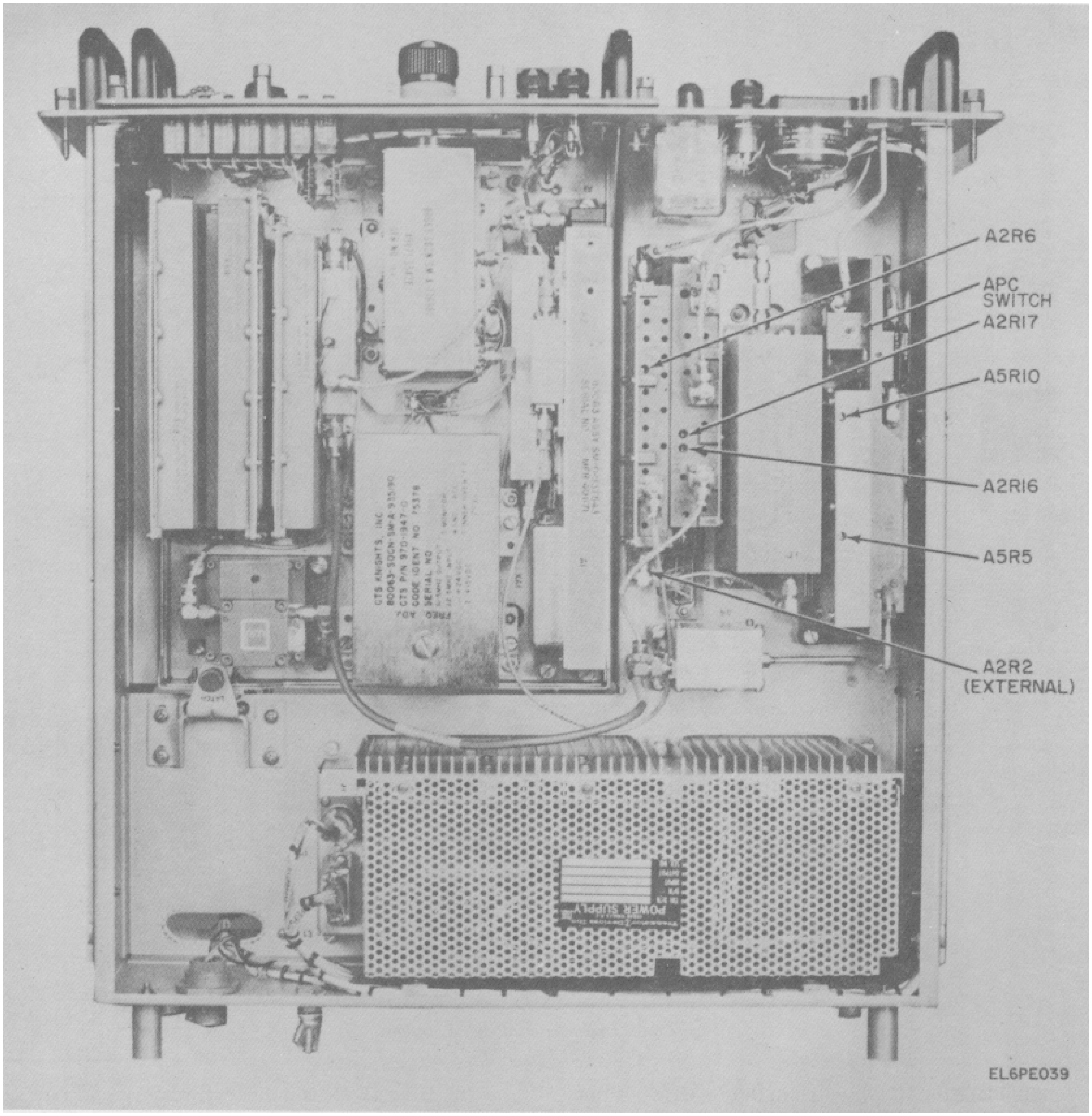

Figure 5-13. Upconverter Adjustment Controls.

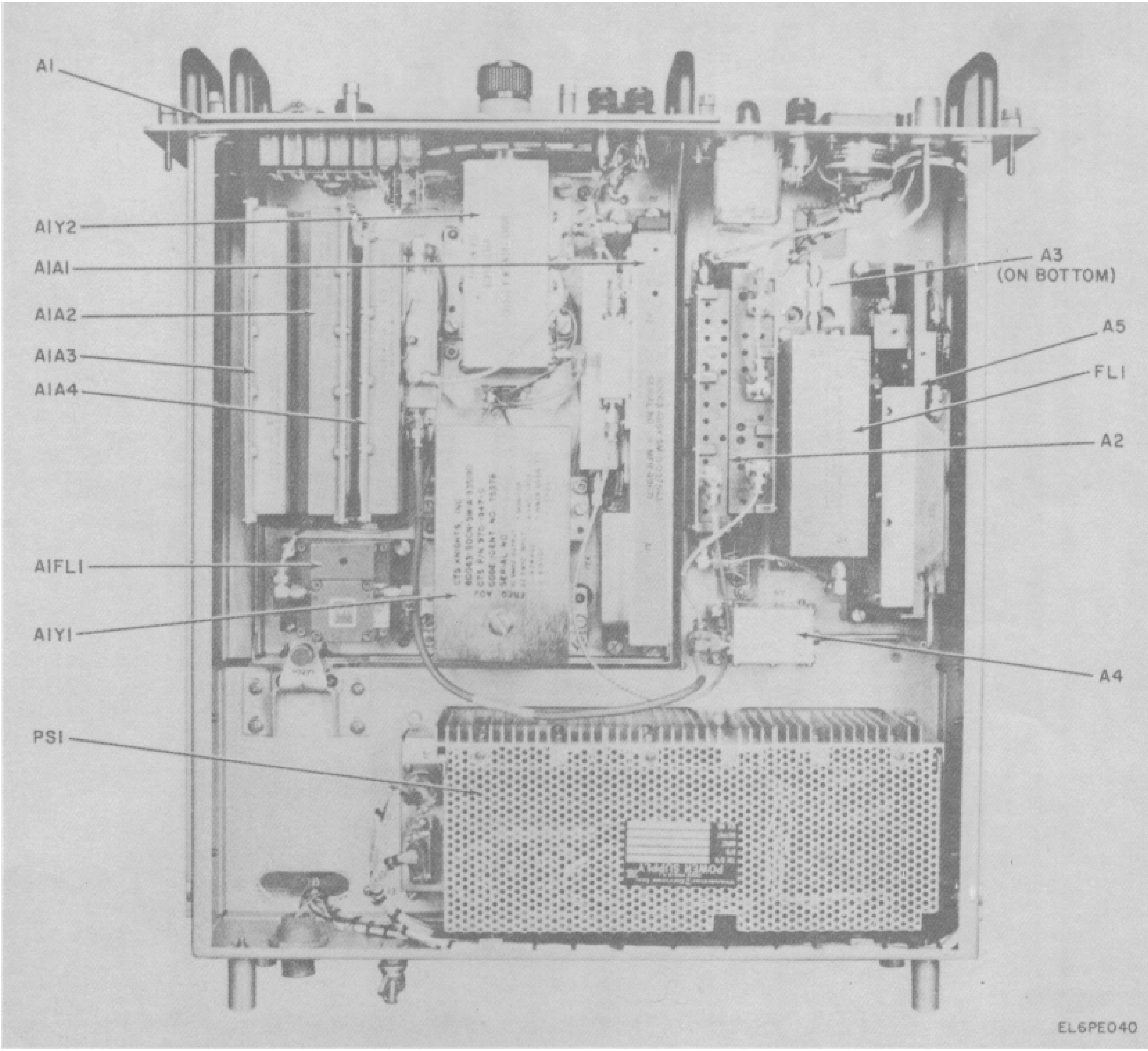

Figure 5-14. Upconverter Module Locations.

(2) Place the IF IN switch in the 70 MHz position and observe the MONITOR meter for an indication of 15 to 35. If the indication is correct, proceed to step (7) below. If the indication is incorrect, proceed to step (3) below.

(3) Disconnect the modem drive cable from the 70 MHz connector on the front panel.

(4) Place and momentarily hold the TEST OSC switch in the ON position. Observe the MONITOR meter for an IF input indication.

(5) If an IF input is indicated, the problem is very likely inadequate 70 MHz drive from the modem. Replace the drive cable back on the 70 MHz IF IN connector. No further testing is necessary.

(6) If no IF IN is indicated, remove and replace the 70/700 MHz upconverter module A2 (para 5-25*b*). After replacement, proceed to paragraph 5-24 below and perform the gain adjustments.

(7) Place the MONITOR switch to the 700 OUT position. (IF IN switch is still in 70 MHz position)

(8) Observe the MONITOR meter for an indication of 5 to 45. If the indication is correct, proceed to step (10) below. If the indication is incorrect, proceed to step (9) below.

(9) Place and momentarily hold the APC switch on the SHF filter/detector module A5 in the test position. Observe the MONITOR meter. If the indication is correct, proceed to step (10) below. If the indication is incorrect, remove and replace the 70/700 MHz upconverter module A2 (para 5-25*b*).

After replacement, proceed to paragraph 5-24 below and perform the gain adjustments.

(10) Place the MONITOR switch to the IPA IN position and observe the MONITOR meter for an indication of 5 to 45. If the indication is correct, proceed to step (12) below. If the indication is incorrect, proceed to step (11) below.

(11) Place and momentarily hold the APC switch on the SHF filter/detector module A5 in the test position. Observe the MONITOR meter. If the indication is correct, proceed to step (12) below. If indication is incorrect, remove and replace the SHF upconverter module A4. After replacement, proceed to paragraph 5-24 below and perform the gain adjustments.

(12) Place the monitor switch to the IPA out position and observe the monitor meter for an indication of 15 to 35. If the indication is correct, no further testing is necessary. If the indication is incorrect, proceed to step (13) below.

(13) Place and momentarily hold the APC switch on the SHF filter/detector module A5 in the test position. Observe the monitor meter. If the indication is correct, the problem is with the APC circuitry on the A5 module. If the indication is incorrect, the problem is the A5 module; and in either even, remove and replace the SHF filter/detector module A5. After replacement, proceed to paragraph 5-24 below and perform the gain adjustments.

c. Upconverter with 700 MHz Modem.

(1) Place the MONITOR switch to the IF IN position.

NOTE

The APC switch on the SHF filter/detector module A5 should be in the ON position.

(2) Place the IF IN switch in the 700 MHz position and observe the MONITOR meter for an indication of 15 to 35. If the indication is correct, proceed to step (7) below. If the indication is incorrect, proceed to step (3) below.

(3) Disconnect the modem drive cable from the 700 MHz IF connector on the front panel.

(4) Place and momentarily hold the TEST OSC switch in the ON position. Observe the monitor meter for an IF IN indication.

(5) If an IF IN is indicated, the problem is very likely inadequate 700 MHz drive from the modem. Replace the drive cable back on the 700 IF IN connector. No further testing necessary.

(6) If no IF IN is indicated, remove and replace the 70/700 MHz upconverter module A2 (para 5-25*b*). After replacement, proceed to paragraph 5-24 below and perform the gain adjustments.

(7) Place the MONITOR switch to the 700 OUT position. Observe the MONITOR meter for an indication of 5 to 45. If the indication is correct, and tests b(1) through (13) above have already been completed, no further testing is required. If the indication is incorrect, remove and replace the 70/700 MHz upconverter module A2 (para 5-25*b*). After replacement, proceed to paragraph 5-24 below and perform the gain adjustments.

d. Testing the Frequency Synthesizer Module Al (fig. 5-15).

NOTE

The FREQ TUNE must be adjusted to match the frequency dial with the FREQ SELECT setting.

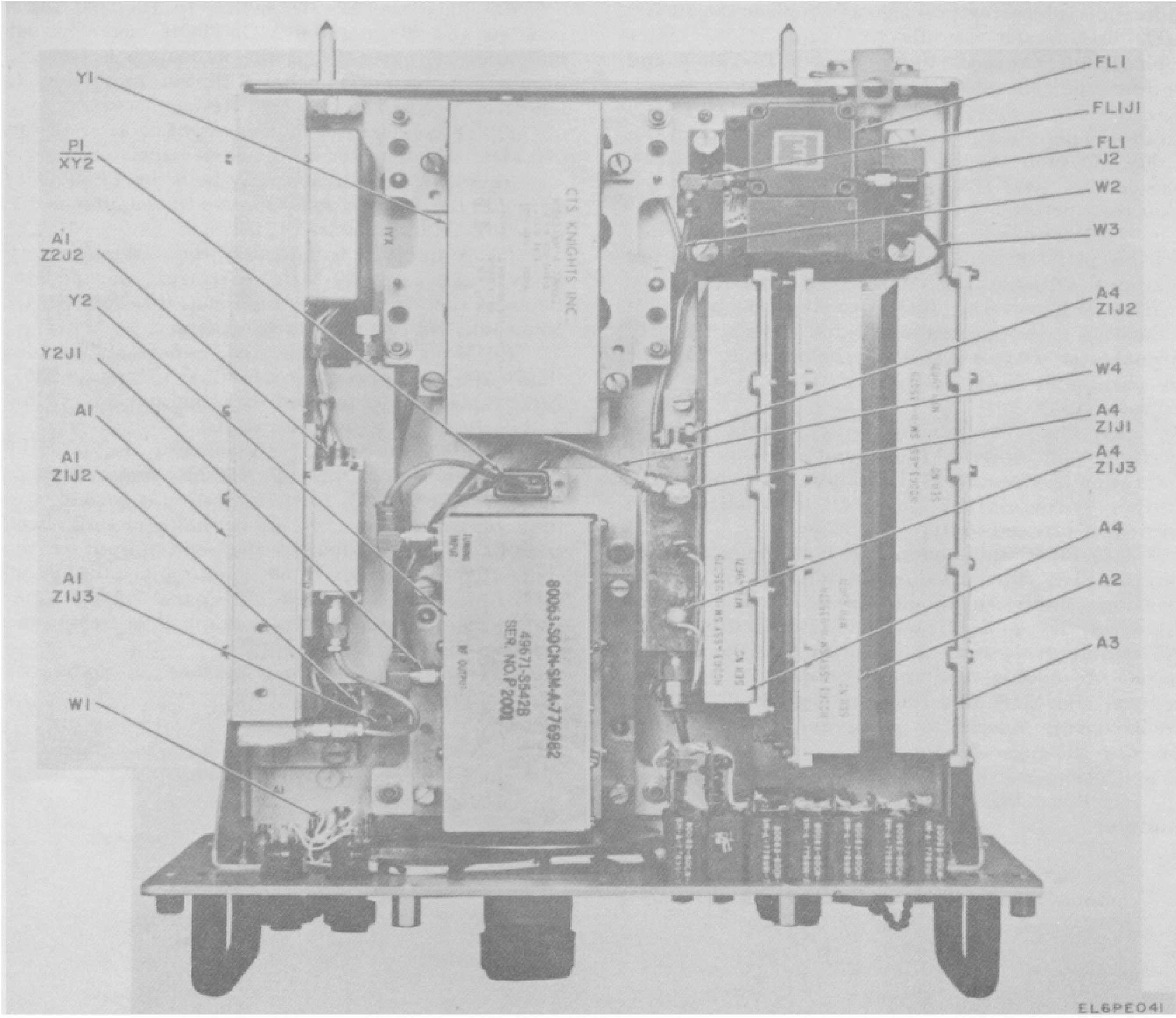

Figure 5-15. Frequency Synthesizer Module, Submodule Locations.

(1) Place the converter drawer MONITOR selector switch in the SYNTH position. Place the SYNTH MONITOR switch to 0 ERR position. Slowly adjust FREQ TUNE control for OUT OF LOCK indicator to be extinguished and meter indication to 25 (mid scale). If the indications are not correct, a problem exists, but in either case go to next step.

(2) Rotate SYNTH MONITOR switch to the SHF-LO position and verify a meter indication between 15 and 35.

(3) If the indications are correct, proceed to step (5) below. If the indication in step (2) above is not correct and the OUT OF LOCK lamp is illuminated, the problem is in the Gunn oscillator; proceed to step (4) below.

(4) Remove and replace the Gunn oscillator module Y2 (refer to para 5-26*b*).

(5) Rotate the SYNTH MONITOR switch to the FREQ STD position and observe for an indication between 15 and 35 on the MONITOR meter.

(6) If the indication is correct, proceed to step (7) below. If the indication of step (5) above is not correct, the problem is in the frequency standard; remove and replace the standard Y1 (refer to para 5-26*d*). If indication is still incorrect, replace synthesizer.

(7) Rotate the SYNTH MONITOR switch to 630 position and observe for an indication between 15 and 35 on the meter. Rotate the switch to SP GEN position and verify an indication between 12 and 38.

(8) If indications are correct, proceed to step (10) below. If one or both indications in step (7) above are not correct, the fixed frequency generator is defective; proceed to step (9) below.

(9) Remove and replace the fixed frequency generator module Al (refer to para 5-26*a*).

(10) Rotate the SYNTH MONITOR switch to the 1MHz position and observe for an indication between 15 and 42 on the MONITOR meter.

(11) If the indication in step (10) above is not correct and/or the FAULT 1 MHz LOOP lamp is illuminated, the problem is in the one MHz step module A2; remove and replace it (refer to para 5-26*e*). If the indication is correct, proceed to step (12) below.

(12) Rotate the SYNTH MONITOR switch to the 1 kHz position and observe for an indication between 15 and 35 on the MONITOR meter.

(13) If the indication is correct, proceed to step (14) below. If the indication is not correct and/or the FAULT 1 kHz LOOP lamp is illuminated, the problem is in 1 kHz STEP module A3; remove and replace it (refer to para 5-26*e*).

(14) Rotate the SYNTH MONITOR switch to the 125 kHz position and observe an indication between 15 and 35.

(15) If the indication is correct, proceed to step (16) below. If indication is not correct remove and replace 1 MHz step module A2.

(16) Rotate the SYNTH MONITOR switch to the 10 kHz position and observe an indication between 15 and 35.

(17) If the indication is correct, proceed to step (18) below. If indication is not correct remove and replace the 1 kHz step module A3.

(18) With the OUT OF LOCK lamp illuminated, (indicating the synthesizer cannot be locked by fine tuning FREQ TUNE) rotate the SYNTH MONITOR switch to the IF position and observe an indication above 15.

(19) If indication is not correct, remove and replace YIG Filter module FLI. (refer to para 5-29*c*).

(20) If indication is correct or if step (19) above did not fix the problem, remove main loop module A4 (refer to para 5-*27b).*

(21) If the unit still will not lock-up, problem is n the switch assembly. Return the frequency synthesizer to the next higher level of maintenance.

5-24. Upconverter Gain Adjustments

The gain of the upconverter must be adjusted upon replacement of the 70/700 MHz upconverter module A2, the 700 SHF mixer module A4, or the SHF filter/detector module A5. This is necessary to accommodate individual gain variations. It is assumed here that a module has just been replaced, the front panel cables are disconnected, the upconverter is extended from the rack, and the AC power is turned off. Proceed as follows:

NOTE

Refer to table 5-9 for accessory items required to perform the gain adjustment procedure. Unless noted otherwise, these items are stowed in the shelter in an auxiliary test items bag. Refer to table 2-1 for the stowage location.

a. Initial Condition.

(1) Close the upconverter drawers and partially tighten one of the front panel captive screws.

(2) Place the front panel POWER circuit breaker to the ON position and tune the upconverter to a midband frequency between 8100 and 8200 MHz (para 3-9).

b. System Using 700. MHz Modem and 70 MHz Modem.

(1) On the rack cable through to the left side of the upconverter, loosen the captive screws and open all the cable access covers.

(2) Free the modem 700 MHz drive cable from the cable trough. Also free the SHF cable up to the amplifier/mixer. Do not remove this cable from the amplifier/mixer.

(3) Connect the amplifier/mixer cable to the front panel SHF OUT connector on the upconverter.

(4) At the IF patch panel, remove one of the c/kt test cables from its c/kt attenuator connector. If necessary, open the appropriate cable trough access cover to free the cable.

(5) Connect one end of the c/kt test cable to the upconverter 700 MHz IF IN connector. Turn IF IN switch to 700 MHz position.

Table 5-9. Accessory Items Required for Upconverter Gain Adjustments

No	Item	Comments
1	Step attenuator 1-12 dB	P/N SM-A-939970
2	c/kt cable, low loss, 3’	P/N SM-C-775834-19 P/O IF patch panel

(6) Connect one end of the step attenuator to the loose end of the c/kt test cable. Adjust the attenuator for 5 dB of attenuation.

(7) Connect the 700 MHz modem drive cable to the other end of step attenuator.

(8) Place the upconverter MONITOR switch to the IPA OUT position.

(9) See figure 5-13. Locate the APC switch on module A5 and gain control R17 on module A2.

(10) Loosen the front panel captive screw and slowly extend the upconverter from the rack just enough to gain access to the switch and control. Check that the modem and amplifier/mixer cables are not under undue strain.

(11) On the associated transmit modem, check that the XMT function switch is not in the OFF position and that the ac power is on.

(12) On the SHF filter/detector module A5, place the APC switch to the OFF position.

(13) On the 70/700 MHz upconverter module A2, adjust gain control R17 for an indication of 25 on the monitor meter.

(14) On the front panel, remove the c/kt test cable and step attenuator and connect the modem drive cable directly to the 700 MHz IF IN connector.

(15) On module A5, place the APC switch to the ON position.

(16) On module A5, adjust the IPA Out APC control R10 (fig. 5-13) for an indication of 25 on the monitor meter. Place the MONITOR switch to the 700 MHz position and adjust R16 on the A2 module for a reading of 25. Return the MONITOR switch to the IPA OUT position.

(17) Connect the test cable and attenuator to the 70 MHz IF IN connector. Turn the IF IN switch to the 70 MHz position.

(18) Connect the 70 MHz modem drive cable to the step attenuator (set at 5 dB).

NOTE

On the associated transmit modem, check that the XMIT function switch is not in the OFF position and that the AC power is on.

(19) On the SHF filter/detector module A5, place the APC switch to the OFF position.

(20) On the 70/700 MHz upconverter module A2, adjust gain control R6 for an indication of 25 on the MONITOR meter.

(21) On the SHF filter/detector module A5, adjust fault control R5 to just turn on the upconverter FAULT lamp (fig. 5-13). If the FAULT lamp is already lit, adjust R5 until the lamp goes out and then readjust R5 to just turn on the FAULT lamp.

(22) Remove the test cable and step attenuator from the 70 MHz IF IN and reinsert the cable and attenuator between the 700 MHz modem and the 700 MHz IF IN connector.

(23) Place the IF IN switch into the 700 MHz position, Locate R2 on the 70/700 MHz module A2 and adjust R2 to just turn on the FAULT lamp. If the UPCONV FAULT lamp is already lit, adjust R2 until the lamp goes out and then readjust R2 to turn on the FAULT UPCONV lamp.

(24) Remove the test cable and attenuator and reconnect the modem cables to the corresponding IF Input connectors. On the SHF filter/detector module A5, place the APC switch to ON position. Close the upconverter drawer, tighten the four front panel captive screws, dress the modem and mixer/amplifier cables into the cable trough, and close all cable access covers, and tighten the captive screws. On the front panel, connect the 5 MHz cable to the 5 MHz OUT connector.

c. System Using Only 700 MHz Modem. Repeat steps *b*(1) through (16) and steps *b*(24) and (25).

d. System Using Only 70 MHz Modem.

(1) Connect the test cable and attenuator to the 70 MHz IF IN connector. Turn the IF IN switch to the 70 MHz position.

(2) Connect the 70 MHz modem drive cable to the step attenuator (set at 5 dB).

NOTE

On the associated transmit modem, check that the XMIT function switch is not in the OFF position and that the ac power is on.

(3) On the SHF filter/detector module A5, place and hold the APC switch to the test position.

(4) On the 70/700 MHz upconverter module A2, adjust the gain control R6 for an indication of 25 on the MONITOR meter.

(5) On the SHF filter/detector module A5, adjust fault control R5 to just turn on the upconverter FAULT lamp (fig. 5-13). If the FAULT lamp is already lit, adjust R5 until the lamp goes out, and then readjust R5 to just turn on the FAULT lamp.

(6) Release the APC switch from the test position on the SHF filter/detector module A5, and place the APC switch in the OFF position.

(7) On the 70/700 MHz upconverter module A2, adjust the gain control R17 for a reading of 25 on the MONITOR meter.

(8) Remove the test cable and step attenuator from the 70 MHz IF IN and reconnect the modem cable to the corresponding IF input connector.

(9) On the SHF filter/detector module A5, place the APC switch to the ON position.

(10) On module A5, adjust the IPA OUT APC control R10 (fig. 5-13) for an indication of 25 on the monitor meter.

(11) Place the MONITOR switch to the 700 MHz position and adjust R16 on the A2 module for an indication of 25 on the MONITOR meter. Return the MONITOR switch to the IPA OUT position.

(12) Close the upconverter drawer, tighten the four front panel captive screws, dress the modem and amplifier/mixer cables into the cable trough, close all cable access covers, connect the 5 MHz cable to the 5 MHz OUT connector.

5-25. Removal and Replacement of Upconverter Modules (fig. 5-14)

a. Removal and Replacement of Frequency Synthesizer Module Al (fig. 5-15).

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a nonoperating condition and all power circuit breakers on the power distribution panel are in the OFF postion.

(1) On the upconverter front panel, place the POWER circuit breaker to the OFF position.

(2) Remove cables from the following front panel connectors: SHF OUT, 700 MHz IF, 70 MHz IF, 5 MHz IN, and 5 MHz OUT.

(3) Loosen the four captive screws on the front panel and open the upconverter drawer.

(4) At the 630 MHz in connector J2 on the 70/700 MHz upconverter module A2, disconnect coaxial cable (J2) W6, which is connected to the frequency synthesizer module Al.

(5) On the frequency synthesizer module A1, disconnect coaxial cable W5 from the RF output connector on Gunn oscillator submodule Y2.

(6) Loosen the captive screws which secure control submodule A2 to the frequency synthesizer chassis.

(7) Hold control submodule A2 above the chassis to gain access to the L.O. OUT connector J2. Remove the upconverter coaxial cable W5 from connector J2.

(8) Replace control submodule A2 and tighten the captive screws. Replace the coaxial cable W6 which was removed above.

(9) Loosen the captive screws on the front panel of the frequency synthesizer.

(10) At the right rear of the frequency synthesizer module A1, lift and momentarily hold the red latch button while pulling forward on the module to disengage its connector, then release the latch button. Check that the disconnected coaxial cables are clear and then continue to pull forward on the module and remove it from the unit.

(11) Replace the frequency synthesizer module by performing steps (1) through (10) above in reverse order.

b. Removal and Replacement of 70/700 MHz Upconverter Module A2 (fig. 5-14).

(1) On the upconverter front panel, place the POWER circuit breaker to the OFF position.

(2) Remove cables from the following front panel connectors: SHF OUT, 700 MHz IF, 70 MHz IF, 5 MHz IN, and 5 MHz OUT.

(3) Loosen the four captive screws on the front panel and open the upconverter drawer.

(4) On module A2, remove the frequency synthesizer coaxial cable (2) W6 from coaxial connector J2 (630 in).

(5) Remove coaxial cable W1 from coaxial connector J4 (700 MHz input). Remove coaxial cable W10 from coaxial connector J5 (NB 700 MHz input). Remove coaxial cable W9 from coaxial connector J6 (700 MHz output)

(6) Loosen the captive screws which secure the module to the chassis. Lift the module above the chassis to gain access to the bottom connectors.

(7) Remove coaxial cable W4 from coaxial connector J1 (NB 700 MHz output). Remove coaxial cable W1 from coaxial connector J3 (70 MHz input).

(8) Remove the module.

(9) Replace by performing steps (1) through (8) above in the reverse order. Replace the coaxial cables and tighten the connectors with the torque wrench provided.

(10) After replacement, perform the gain adjustment procedure of paragraph 5-24 above.

c. Removal and Replacement of Equalizer Module A3 (fig. 5-14).

(1) On the upconverter front panel, place the power circuit breaker to the OFF Position.

(2) Remove cables from the following front panel connectors: SHF OUT, 700 MHz IF, 70 MHz IF, 5 MHz IN, and 5 MHz OUT.

(3) Loosen the four captive screws on the front panel and open the upconverter drawer.

(4) Locate the A3 module on the underside of the upconverter drawer in the left front area.

(5) Remove coaxial cable W2 from coaxial connector J1 (input) and coaxial cable W8 from coaxial connector J2 (output).

(6) Loosen the captive screws which secure equalizer module A3 to the upconverter chassis.

(7) Remove the module and replace by performing steps (1) through (6) above in the reverse order. Replace the coaxial cables and tighten the connectors with the torque wrench provided.

d. Removal and Replacement of 700/SHF Mixer Module A4 (fig. 5-14).

1. On the upconverter front panel, place the power circuit breaker to the OFF position.

(2) Remove cables from the following front panel connectors: SHF OUT, 700 MHz IF, 70 MHz IF, 5 MHz IN, and 5 MHz OUT.

(3) Loosen the four captive screws on the front panel and open the upconverter drawer.

(4) Remove coaxial cable W9 from module connector J3 (700 MHz input) and disconnect semiriged cable W3 from the SHF filter/detector module A5 at the FL1 input connector.

(5) Loosen semirigid cable W3 at the J4 connector (SHF output) of the 700/SHF mixer module.

(6) Loosen the four captive screws which secure the module to the chassis and lift the module above the chassis to gain access to the coaxial connectors at the base of the module. (The module multipin connector will be disengaged from the chassis connector.) (7) Remove coaxial cable W5 from the bottom right module connector J2 (SHF input).

(8) Remove the module and remove the semirigid cable W3 from the bottom left module connector J4 (SHF output).

(9) Replace the module by performing steps (1) through (8) above in reverse order. Replace coaxial cables and tighten the connectors with the torque wrench provided.

(10) After replacement, perform the gain adjustment procedure of paragraph 5-24 above.

e. Removal and Replacement of SHF Filter/Detector Module A5 (fig. 5-14).

(1) On the upconverter front panel, place the power circuit breaker to the OFF position.

(2) Remove cables from the following front panel connectors: SHF OUT, 700 MHz IF, 70 MHz IF, 5 'MHz IN, and 5 MHz OUT.

(3) Loosen the four captive screws on the front panel and open the upconverter drawer.

(4) On the SHF filter/detector module A5, remove the semirigid cable W7 from coaxial connector DC2 (SHF output). Remove semirigid cable W3 from coaxial connector FL1 (SHF input).

(5) Loosen the captive screws which secure module A5 to the chassis and remove the module.

(6) Replace the module by performing steps (1) through (5) above in reverse order. Replace the semirigid cables and tighten the connectors with the torque wrench provided.

(7) After replacement, perform the gain adjustment procedure of paragraph 5-24 above.

f. Removal and Replacement of Power Supply Module PS1 (fig. 5-14).

(1) On the upconverter front panel, place the power circuit breaker to the OFF position.

(2) Remove cables from the following front panel connectors: SHF OUT, 700 MHz IF, 70 MHz IF, 5 MHz IN and 5 MHz OUT.

(3) Loosen the four captive screws on the front panel and open the upconverter drawer.

(4) On module PS1, remove chassis cable connector P1 from module connector J1 by loosening the retaining ring and pulling out connector.

(5) On the module PS1, remove chassis cable connector P2 from module connector J2 by loosening the two captive screws and lifting out connector.

(6) Under the upconverter chassis, remove the six nuts and washers which secure the module and remove the module from the chassis.

(7) Replace the power supply module by performing steps (1) through (6) above in reverse order.

5-26. Removal and Replacement of Submodules from the Frequency Synthesizer Module

NOTE

These procedures are performed with the frequency synthesizer module in the unit chassis except where noted otherwise.

a. Removal and Replacement of Fixed Frequency Generator Module (fig. 5-15).

(1) Turn the POWER switch to the OFF position, remove the coaxial cables from the front panel, and loosen the eight captive screws on the converter drawer.

(2) Pull on the two front panel handles and extend the drawer to its open position.

(3) Remove two coaxial cables (W1 and W2)from the front of the module at location A1 Z1 J2 and A1 Z1 J3.

(4) In the center of the module remove coaxial cable to converter at A1 Z2 J2.

(5) Loosen the four captive screws which secure the module to the chassis and remove the module.

(6) Replace the module by repeating steps (1) through (5) above in reverse order except replace cables and tighten screws.

b. Removal and Replacement of Gunn Oscillator Module (fig. 5-15).

(1) Turn the POWER switch to the OFF position and remove the coaxial cables from the front panel and loosen the eight captive screws on the converter drawer.

(2) Pull on the two front panel handles and extend the drawer to its open position.

(3) Loosen the two captive screws on the module cable connector P1 and remove it from the chassis connector XY2.

(4) Loosen and disconnect cable W4 at Y2 J1 on the Gunn Oscillator module and remove module carefully from synthesizer.

(5) On the Gunn Oscillator module mounting brackets, loosen the four captive screws which secure the module brackets to the frame.

(6) Prior to installing the new Gunn Oscillator, it is necessary to transfer the module mounting brackets from the old module to the new module.

(7) On both sides of the module, note the position of the mounting screws relative to the slotted holes in the mounting brackets. Remove the mounting brackets and install them on the new replacement module in the same relative position.

(8) Place the module in the small frame, engage the four captive screws, and secure the module in place.

(9) Check that the clearance between the frame front of the module tuning shaft and the retaining nut in the frame front panel knob assembly is approximately 1/8 inch.

10. Push in on the front panel tuning knob. Check that the tuning knob shaft blade engages smoothly with the module tuning shaft in both the horizontal and vertical orientations.

(11) If the tuning shafts engage properly, proceed to step (14) below. If the tuning shafts do not engage properly, check if the problem is caused by improper clearance (proceed to step (12)) below or by improper shaft orientation (proceed to step (13) below).

(12) Recheck the clearance. Remove the module and reposition the mounting brackets. Move the brackets towards the front of the module to increase the clearance or towards the rear to decrease the clearance. Repeat steps (8), (9) and (10) above as necessary.

(13) Check the horizontal and vertical orientations. Remove the module. On the rear of the synthesizer front panel, loosen the retaining nut and reposition the tuning knob shaft in the horizontal and/or vertical planes, as necessary, to obtain proper shaft engagement. Repeat steps (8), (9) and (10) above as necessary.

(14) Connect P1 to chassis connector XY2 and engage the two captive screws.

(15) Connect coaxial cable W4 and at Y2 J1 tightening with the torque wrench provided.

(16) Close converter drawer and tighten the eight captive screws.

(17) Replace front panel coaxial cables.

(18) Turn Power switch to ON.

c. Removal and Replacement of Main Loop Module (fig. 5-15).

(1) Turn the POWER switch to the OFF position, remove the coaxial cable from the front panel and loosen the eight captive screws on the converter drawer.

(2) Pull on the two front panel handles to extend the drawer to its open position.

(3) Disconnect coaxial cable W4 from A4 Z1 J1, coaxial cable W3 from A4 Z1 J3, and coaxial cable from UPCONVERTER to A4 Z1 J2.

(4) Loosen the four captive screws which secure the module to the chassis and remove the module from the chassis by pulling it upward.

(5) Replace the module by performing steps (1) through (4) above in reverse order.

d. Removal and Replacement of YIG Filter Module (fig. 5-15).

(1) Turn the POWER switch to the OFF position, remove the coaxial cables from the front panel, and loosen the eight coaxial screws on the converter drawer.

(2) Pull on the two front panel handles and extend the drawer to its open position.

(3) Remove the coaxial cable from the input (J1) and the output (J2) on the YIG filter module.

(4) Remove the four screws retaining the module to the chassis and remove the YIG filter module.

(5) Replace the YIG filter module by repeating steps (1) through (4) above in reverse order except replace cables and connectors and tighten screws. Use the torque wrench supplied for proper assembly.

e. Removal and Replacement of Frequency Standard Module (fig. 5-15).

(1) Turn the POWER switch to the OFF position, and remove the coaxial cables from the front panel, and loosen the eight captive screws on the converter drawer.

(2) Pull on the two front panel handles and extend the drawer to its open position.

(3) Loosen the four captive screws which secure the Y1 module to the chassis and remove the module.

(4) Replace the module by performing steps (1), (2) and (3) above in reverse order.

f. Removal and Replacement of 1 MHz Step Module or 1 kHz Step Module (fig. 5-15).

NOTE

Either or both of these modules may be removed by the following procedure.

(1) Turn the POWER switch to the OFF position, remove the coaxial cables on the front panel, and loosen the eight captive screws on the converter drawer.

(2) Pull on the two front panel handles and extend the drawer to its open position.

(3) Loosen the four captive screws which secure the modules to the chassis and pull upward on the module to remove it from the drawer.

(4) Replace the module by performing steps (1) (2) and (3) above in reverse order.

5-27. Removal and Replacement of Upconverter

a. On the upconverter, place the power circuit breaker to the OFF position.

b. Remove cables from SHF OUT, 700 MHz IF, 70 MHz IF, 5 MHz IN, and 5 MHz OUT front panel connectors.

c. Loosen the four captive screws on the front panel and open the upconverter drawer.

d. On the rear panel, remove the power cable from connector J1 and the ground wire from terminal E2 (fig. 5-16).

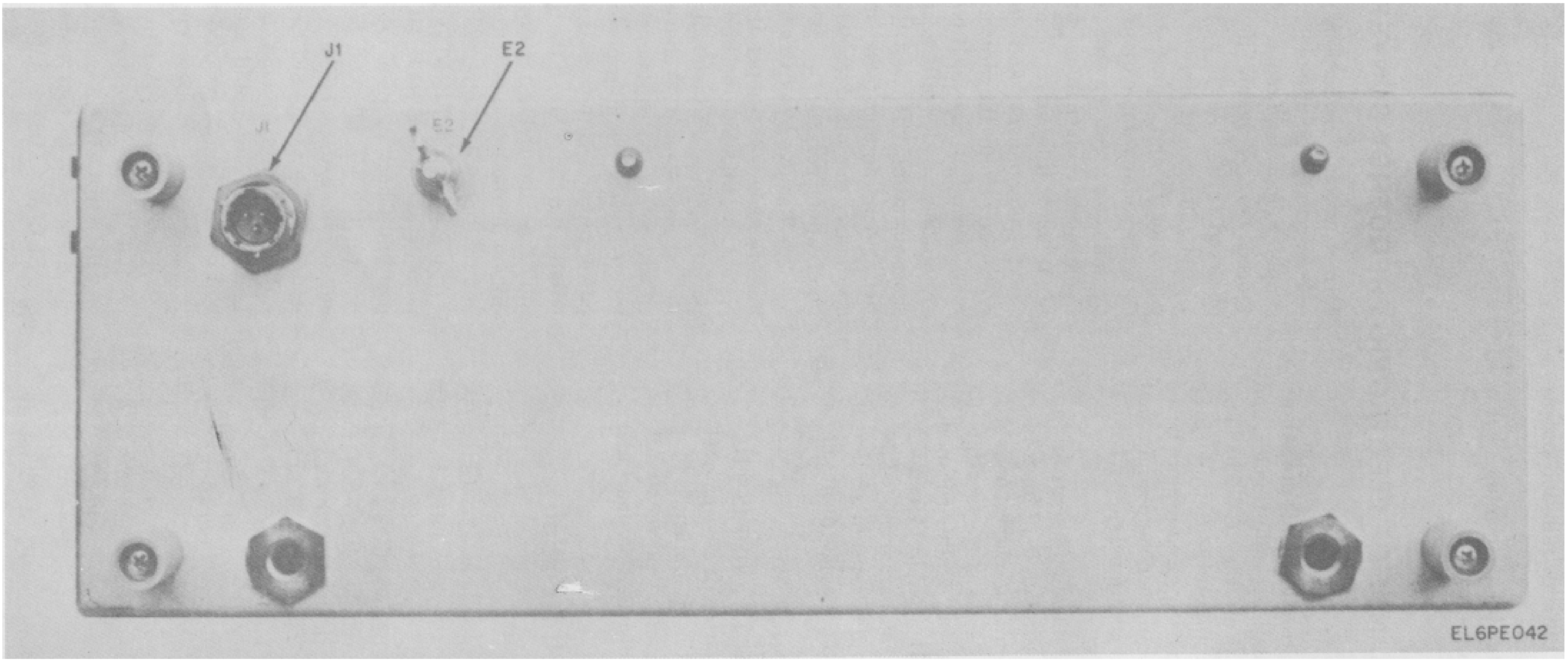

Figure 5-16. Upconverter Rear Panel

e. Release the latches on the slide rails and remove the upconverter from the rack.

f. Replace the upconverter by performing steps *a* through *e* above in reverse order.

Section IX. MAINTENANCE OF ELECTRONIC FREQUENCY CONVERTER CV-3200/TSC

5-28. Scope

a. This section covers instructions and procedures for testing and fault isolation, adjustment, and removal and replacement of the CV-3200/TSC frequency converter, commonly called SHF downconverter drawer. The test procedures are based on the use of built-in-test equipment and equipment available in the terminal. No additional support or test equipment is required.

b. See figure 3-3 for location controls and indicators. See figures 5-17 through 5-19 for location of downconverter adjustments, modules, and other components. See figure 5-15 for location of submodules within the frequency synthesizer module. Refer to paragraph 5-31 for replacement of downconverter modules, to paragraph 5-26 for replacement of frequency synthesizer submodules, and to paragraph 5-33 for the replacement of the downconverter drawer.

WARNING

DANGEROUS VOLTAGES EXIST IN THE EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a nonoperating condition and all power circuit breakers on the power distribution panel are in the OFF position.

5-29. Testing and Fault Isolation

a. Testing the Downconverter.

(1) Place the POWER circuit breaker to the ON position and observe that the associated POWER indicator is illuminated.

(2) Place the MONITOR switch to each of the following positions and observe the MONITOR meter for a correct indication. If an incorrect indication is observed, proceed to step (3) below. If a correct indication is observed at all positions, proceed to step (7) below.

Position	*Indication*
+24 V X1	22 to 26
+ 15 V X 0.5	28 to 32
- 15 V X 0.5	28 to 32
+6 V X 0.2	28 to 32
-6 V X 0.2	28 to 32

(3) Disconnect drawer harness P3 at A2 module connector J5 and repeat steps (1) and (2) above. If correct voltage indications are observed with A2 disconnected, A2 module is short-circuiting power supply. Remove and replace A2 module, (para 5-31*b*). Proceed to (4) below if incorrect observation is observed.

(4) Disconnect drawer harness P4 at A3 module connector J5 and repeat steps (1) and (2) above. If correct voltage indications are observed with A3 disconnected, A3 module is short-circuiting PS1. Remove and replace A3 module, (para 5-31*c*). Proceed to (5) below if incorrect observation is observed.

(5) Disconnect and remove A1 frequency synthesizer from the drawer, (para 5-25*a*). Repeat steps (1) and (2) above. If correct voltage indications ate observed with synthesizer removed, synthesizer is short-circuiting PS1. Test the frequency synthesizer. Refer to paragraph 5-23*d* for testing the frequency synthesizer module. Proceed to (6) below if incorrect observations persist.

(6) Remove PS1 (para 5-31*d*) and replace it with a working power supply from upconverter drawer. Note that upconverter and downconverter drawer power supplies are identical and may be exchanged. Repeat steps (1) and (2) above with upconverter power supply connected to downconverter harness, P1 and P2. If correct readings are observed, downconverter power supply PS1 (just replaced), is faulty and shall be tested separately. Also if the upconverter power supply indicates incorrect readings, the downconverter drawer harness is short-circuiting the power supply and shall be tested separately.

(7) Place the MONITOR switch to the SYNTH position and the SYNTH MON switch to the 0 ERR position. Check status of OUT OF LOCK indicator.

(8) IT OUT OF LOCK indicator is illuminated, adjust the FREQ TUNE control to the frequency setting on the FREQ SELECT MHz switches setting. As the correct frequency is reached, the OUT OF LOCK indicator should extinguish. If the indicator will not extinguish, proceed to step (14 below.

NOTE

Care should be taken to ensure that the OUT OF LOCK indicator is extinguished when the FREQ TUNE control is reading the same frequency as that indicated by the FREQ SELECT MHz switches.

(9) Check status of indicator bulbs for RCVR FAULT, OUT OF LOCK, 1 MHz LOP, and 1 kHz LOOP FAULT lights by pressing in light housing.

Light shall illuminate when pressed in. Note that all BITE lights are operated from a + 24 Vdc PS1 line.

(10) Fine tune the FREQ TUNE control to obtain a midscale indication on the MONITOR meter.

(11) If midscale indication cannot be obtained, proceed to step (14) below.

(12) Place SYNTH MON switch to each of the following positions and observe MONITOR meter for a correct indication.

Position	*Indication (Meter Units)*
∅ Err	15-35
SHF LO	15-35
630 MHz	15-35
SP Gen	15-45
1 MHz	15-42
1 kHz	15-35
125 kHz	15-35
10 kHz	15-35
Freq. Std	15-35
IF	10-45

(13) If any indication in step (12) above is incorrect, proceed to step (14) below. If all indications are correct, proceed to step (15) below.

(14) Test the frequency synthesizer module A1. Refer to paragraph 5-23*d* (upconverter section) for testing of the frequency synthesizer module.

(15) Remove the SHF cable from the SHF IN connector and connect low-loss (SM-C-937321) cable between SHF IN and TEST SIGNAL connectors.

(16) Tune the frequency synthesizer FREQ SELECT MHz and FREQ TUNE controls to a frequency within +20 MHz (IF passband) of 7500 MHz.

(17) Place the RCVR FAULT switch in 700 position and place the MONITOR switch to the TEST position. Observe that the MONITOR meter indicates greater than 17 and the RCVR FAULT indicator is extinguished.

(18) If either or both indications are incorrect, remove and replace the downconverter module A3 (para 5-31). After replacement, proceed to paragraph 5-30 and perform the gain adjustment. Proceed to step (19) below if indication is normal.

NOTE

A3 module provides SHF MX/IF preamp sections also for the 70 MHz channel. If these sections develop faults, both A3 and A3 BITE indicators will show incorrect readings. Only A3 module has to be investigated further, however.

(19) Place the RCVR FAULT switch in 70 position and place the MONITOR switch to the TEST position. Observe that the MONITOR meter indicates greater than 17 and the RCVR FAULT indicator is extinguished.

(20) If either or both indications are incorrect, remove and replace the downconverter module A2 (para 5-31). After replacement, proceed to paragraph 5-30 and perform the gain adjustment.

(21) Remove the low-loss jumper cable from the front panel connector and replace the SHF cable before performing the gain adjustment.

b. Testing the Frequency Synthesizer Module. Refer to paragraph 5-23*d* (upconverter section) for testing of the frequency synthesizer module.

5-30. Downconverter, Receiver Gain Adjustment

NOTE

The receiver gain is calibrated using signal sources within the terminal in conjunction with precision attenuators and a low level SHF hard limiter as shown in figure 5-17. A signal at the local receiver frequency is obtained from the SHF local oscillator output of the frequency synthesizer in the upconverter drawer. The output level of this signal is between the limits of + 6 and + 12 dBm and is passed through the SHF hard limiter and attenuator to provide a -52 dBm signal at the 20 dB coupler on the AME subassembly, which gives a nominal -72 dBm signal at the LNA input.

(1) Remove the feed-tube from the antenna center section and replace it with a dust cap or aim the antenna at a quiet spot in the sky.

(2) Loosen the screw fasteners on the front panel of the upconverter drawer and pull the drawer forward on its slides.

(3) Disconnect cable W5 going to J2 of the upconverter A4 module and connect the input of the hard limiter test assembly (SM-A-934943) through test cable assembly (SM-C-935488-1) and the SMA adapter provided in the test kit.

(4) Loossen the screw fasteners on the front panel of the LNA control/translator drawer, and pull the drawer forward on its slides.

(5) Disconnect the connector A2P53 going to receptacle J8 (SHF OUT) at the rear of the LNA control/translator drawer and connect it to the output of the hard limiter test assembly, SM-A-934943.

(6) At the antenna mounted assembly, disconnect the terminal loop test cable from the LOOP TEST coupler and connect the cable to the RF power meter and low power head HP-8484A using a UG-29B/U adapter.

(7) Configure the shelter for normal operation and turn the power ON.

The power amplifiers are left on standby.

(8) Set the sythesizer to 8399 MHz and measure and record the signal level.

(9) Repeat step (8) above at 8200 MHz.

(10) Repeat step (8) above at 7950 MHz.

(11) Disconnect the loop test cable from the power meter and connect it through the 14 dB attenuator to the LOOP TEST coupler.

(12) Calculate and record the input levels for each frequency by subtracting 14 dB from the measured levels of steps (8), (9), and (10) above.

(13) Connect the power meter with the HP8481A head to the 70 MHz OUTPUT (J4) of the downconverter to be measured.

(14) Read and record, the measured level. The level should be at least 50 dB above the level calculated in step (12) above.

(15) The overall receive gain may be measured for receive frequencies of 7270 MHz and 7699 MHz by tuning the upconverter synthesizer to 7970 MHz and 8399 MHz respectively. Output levels should be at least 50 dB above input to 20 dB coupler.

(16) The output level of the 70 MHz may be adjusted if necessary at the 700/70 MHz mixer assembly A2A1 in the downconverter drawer, with the receiver gain adjustment control R5 or MDL gain control R6. Follow procedure in step (18) below.

(17) The output level of the 700 MHz may be adjusted if necessary at the 700 MHz preamp assembly A3A2 in the downconverter drawer with pots R8 and R9. Follow procedure in step (19) below.

NOTE

During this procedure, units are extended from the rack. As necessary, open the adjacent cable trough access doors to relieve strain on the terminal cables.

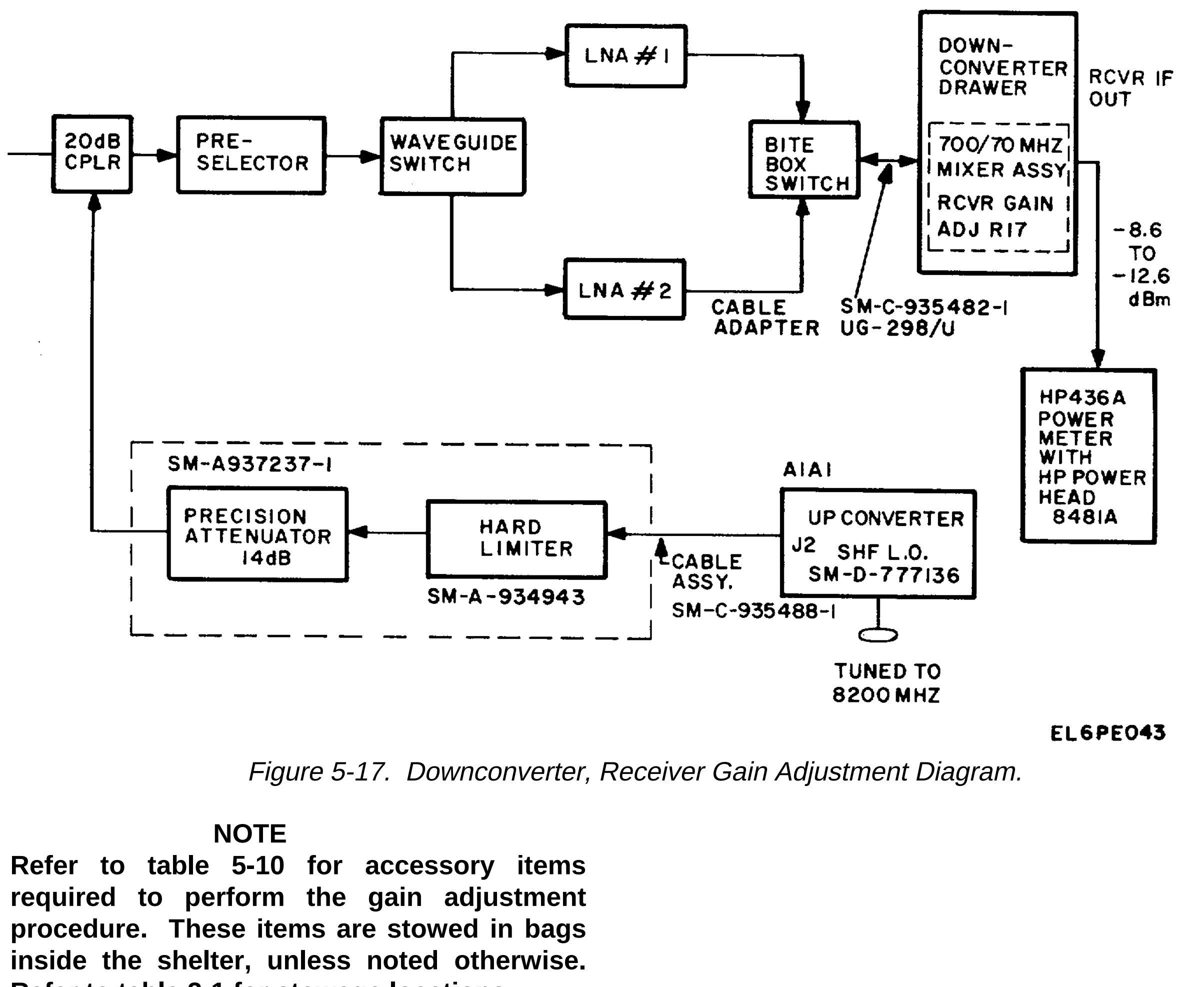

Figure 5-17. Downconverter, Receiver Gain Adjustment Diagram.

NOTE

Refer to table 5-10 for accessory items required to perform the gain adjustment procedure. These items are stowed in bags inside the shelter, unless noted otherwise. Refer to table 2-1 for stowage locations.

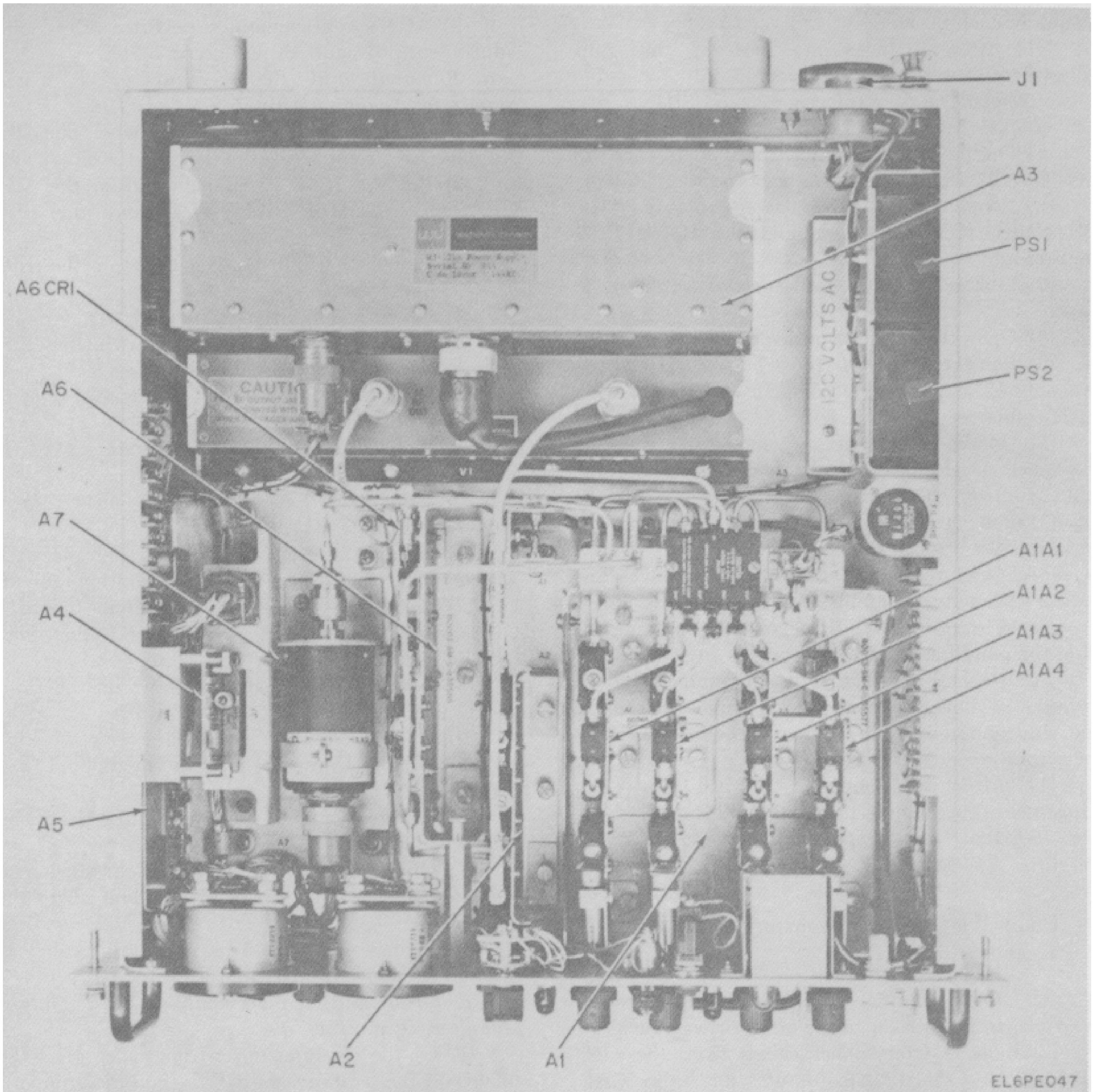

Figure 5-18. Downconverter, Adjustment Controls and Module Locations.

Table 5-10. Accessory Items Required for Downconverter Receiver Gain Adjustment

No	Item	Comments
1	Power Meter	HP 436A
2	Adapter, UG-29	Type N adapter
3	Limiter Assy	P/n SM-A-934943
4	Test cable W401 6 feet, low loss	P/n SM-C-935488-1
5	Test cable W403 4 dB, 6 feet	P/n SM-C-935481-1
6	Adapter test cable W404, 12 inches	P/n SM-C-935482-1
7	Power Sensor	HP-8481A
8	Power Sensor	HP-8484A
9	Attenuator 6 dB	SM-A-937237-3
10	Adapter, BNC/N	UG-349 A/U
11	Adapter, SMA (female-to-female)	P/n SM-A-937679

(18) See figure 5-18 for the downconverter adjustment control locations. Observe the power meter. On downconverter module A2, adjust gain control R5 and R6 to obtain 10.6 dBm of output or 50 dB above level measured in step (12) above. The controls are interacting. It is suggested, therefore, that one control (R5) be set to approximately midrange and the other (R6) adjusted to obtain the reference level. Try to keep the settings away from the extreme ends of rotation.

(19) Connect the HP 436A power meter with the HP8481A power head to the 700 MHz IF output J3 of downconverter.

(20) Read and record the 700 MHz output level of the downconverter. The output level now may or may not indicate the reference level of step (18) above. Regardless of the indication, proceed to step (21) below and adjust the gain controls.

(21) See figure 5-18, downconverter adjustment control locations. Observe the power meter. On downconverter module A3, adjust gain controls R8 and R9 to obtain step (18) above level. The controls are interacting. It is suggested, therefore, that one control (R8) be set to approximately midrange and the other (R9) adjusted to obtain the reference level. Try to keep the settings away from the extreme ends of rotation.

(22) Remove all special test cables and devices from the downconverter, upconverter, and LNA control/translator. On the latter two units, restore the normal module and rear panel cable connections, respectively.

(23) Close and secure all four of the above unit drawers except do not secure the captive fasteners on the downconverter.

(24) Check that the downconverter is tuned to 7500 MHz. (Refer to the above steps in this paragraph.)

(25) Restore the normal terminal cabling to the unit front panel connectors. Return the special test cables and devices to their respective stowage areas.

(26) On the downconverter, remove the terminal cable from the front panel SHF IN connector.

(27) Connect the male end of the 4 dB test cable W403 to the downconverter SHF IN connector. Connect the cable W404 to the loose end of cable W403 and the downconverter TEST SIGNAL connector.

(28) Place the downconverter MONITOR switch to the TEST position and extend the unit from the rack. See figure 5-18, downconverter adjustment control locations. Place RCVR FAULT switch to 70.

(29) Observe the RCVR FAULT indicator. On downconverter module A2, adjust control R3 (spectrum test) until the indicator just illuminates from an off condition. The MONITOR meter should indicate approximately 15 units.

(30) Place RCVR FAULT switch in 700 position and observe the RCVR FAULT indicator. On downconverter module A3, adjust control R2 (spectrum test) until the indicator just illuminates from an off condition. The MONITOR meter should indicate approximately 15 units.

(31) Disconnect the adapter test cable W404 from the 4 dB test cable W403 and the TEST SIGNAL connector.

(32) Connect the loose end of the 4 dB test cable W403 to the terminal SHF input cable.

(33) Place the downconverter MONITOR switch to the IF OUT position and RCVR FAULT switch to 70.

NOTE

The terminal antenna shall be pointed toward a quiet place in the sky during the next adjustment steps.

(34) Observe the RCVR FAULT indicator. On downconverter module A2, adjust control R2 (operating noise) until the indicator just illuminates from an off condition.

(35) Place RCVR FAULT switch in 700 position and observe the RCVR FAULT indicator. On downconverter module A3, adjust control R1 (operating noise) until the indicator just illuminates from an off condition.

(36) Disconnect the test cable from the downconverter and the terminal SHF input cable. Return both test cables to their respective stowage areas.

(37) Close and secure the downconverter drawer. Connect the terminal SHF input cable to the front panel SHF IN connector. If necessary, dress and secure loose terminal cables in the rack cable troughs.

5-31. Removal and Replacement of Downconverter Modules (fig. 5-18)

a. Removal and Replacement of Frequency Snythesizer Module A1.

(1) On the downconverter front panel, place the POWER circuit breaker to the OFF position.

(2) Remove cables from front panel connectors SHF IN, TRACK IF, 70 MHz IF and 5 MHz IN.

(3) Loosen the four captive screws on the front panel and open the downconverter drawer.

(4) At synthesizer subassembly AiA2, disconnect the downconverter coaxial cable W10 from the 630 MHz OUT connector J2.

(5) At the synthesizer subassembly A4Z1 disconnect the downconverter coaxial cable W9 from the SHF LO OUT connector J2.

(6) Loosen the eight captive screws on the front panel of the synthesizer, lift the red retaining LATCH button at the rear of the synthesizer, and slide out the module from the chassis by pulling on the front panel handle.

(7) Replace the synthesizer by performing steps (1) through (6) above in reverse order. Reconnect the two coaxial cables and tighten the connectors with the torque wrench provided.

b. Removal and Replacement of Downconverter Module A2.

(1) On the downconverter front panel, place the POWER circuit breaker to the OFF position.

(2) Remove cables from the following front panel connectors: SHF IN, TRACK IF, and 70 MHz IF.

(3) Loosen the four captive screws on the front panel, open the downconverter drawer, and remove coaxial cable W10 from the 630 IN connector A2J2.

(4) On module A2, remove coaxial cable W7 from the RCV IF connector J3, coaxial cable W8 from the TRK IF connector J4, and coaxial cable W6 from the 700 IN connector J1.

(5) At the rear of the module, loosen the two captive screws on chassis cable connector P3 and remove the connector from module connector J5.

(6) Loosen the six captive screws which secure the module to the chassis. Carefully remove the module.

(7) Replace the module by performing steps (1) through (6) above in reverse order.

(8) Reconnect the cables and tighten the connectors with the torque wrench provided.

(9) After replacement, perform the gain adjustment procedure of paragraph 5-30.

c. Removal and Replacement of Downconverter Module A3.

(1) On the downconverter front panel, place the POWER circuit breaker to the OFF position.

(2) Remove front panel connectors SHF IN, TRACK IF, 70 MHz IFF, and 5 MHz IN.

(3) Loosen the four captive screws on the front panel and open the downconverter drawer.

(4) On downconverter module A3 remove the downconverter coaxial cable W5 from the DC1 connector J2.

(5) On module A3, remove. coaxial cable W3 from the WB700 IN connector J3, and coaxial cable W4 from the NB700 OUT connector J2.

NOTE

To the left of 700 IN WB connector J3, remove coaxial cable W9 from the J3 LO IN connector.

(6) At the front of module A3 remove semirigid cable WI from the FLI connector.

(7) At the rear of module, on the Al subassembly remove coaxial cable W2 from connector IF OUT J2.

(8) At the rear of the module, loosen the two captive screws on chassis cable connector P4 and remove the connector from module connector J5.

(9) Loosen the six captive screws which secure the module to the chassis.

CAUTION

Carefully remove the module while tilting it slightly to the right to avoid any undue bending of semirigid cable W1.

(10) Replace the module by performing steps (1) through (9) above in reverse order.

(11) Reconnect the cables and tighten the connectors with the torque wrench provided.

(12) After replacement, perform the 700 MHz channel gain adjustment procedure of paragraph 5-30.

d. Removal and Replacement of Power Supply Module PSI.

(1) On the downconverter front panel, place the POWER circuit breaker to the OFF position.

(2) Remove cables from the SHF IN, TRACK IF, and 70 MHz IF front panel connectors.

(3) Loosen the four captive screws on the front panel and open the downconverter drawer.

(4) On the PS1 module remove chassis cable connector P1 from module connector J1 by loosening the retaining ring and pulling out connector P1.

(5) On the module, remove chassis cable connector P2 from module connector J2 by loosening the two captive screws and lifting out connector P2.

(6) Under the downconverter chassis, remove the six nuts and washers which secure the PS1 module.

(7) Remove the PS1 module from the chassis and replace it by performing steps (1) through (6) above in reverse order.

5-32. Removal and Replacement of Submodules on the Frequency Synthesizer Module.

Refer to paragraph 5-26 (upconverter section) for removal and replacement of submodules within the frequency synthesizer module (A1).

5-33. Removal and Replacement of Downconverter

a. On the downconverter front panel, place the POWER circuit breaker to the OFF position.

b. Remove cables from the SHF IN, TRACK IF, and 70 MHz front panel connectors 5 MHz IN.

c. Loosen the four captive screws on the front panel and open the downconverter drawer.

d. On the rear panel, remove the power cable from connector J1 and the ground wire from terminal E1 (fig. 5-19).

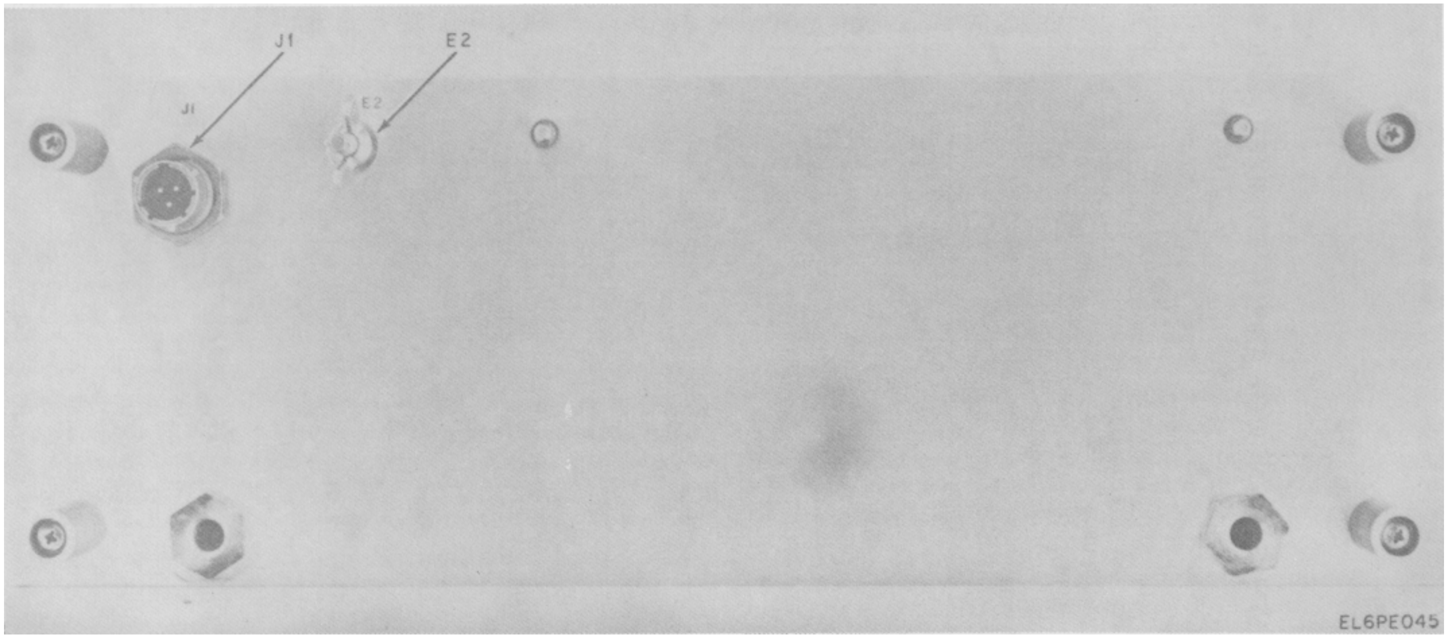

Figure 5-19. Downconverter, Rear Panel.

e. Release slide rail latches and remove downconverter from rack.

f. Replace the downconverter by performing steps a through e above in reverse order.

g. After replacement, perform the gain adjustment procedure of paragraph 5-30.

Section X. MAINTENANCE OF AMPLIFIER/MIXER AM-6704/TSC

5-34. Scope

a. This section covers instructions and procedures for testing and fault isolation, adjustment, and removal and replacement. The test procedures are based on the use of built-in-test equipment (BITE) and the associated electronic frequency converter CV3199/TSC as a signal source, and no additional suppoort or test equipment is required.

b. See figure 3-5 for location ocf controls and indicators. See figures 5-20 and 5-21 for location of amplifier/mixer adjustments, modules, and other components. Refer to paragraph 5-37 for replacement of the amplifier/mixer modules, to paragraph 5-36 for the gain adjustments, and to paragraph 5-38 for replacement of the amplifier/mixer drawer.

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

5-35. Testing and Fault Isolation

a. Testing the Amplifier/Mixer.

NOTE

The SHF amplifier in this unit may be an FET or TWT. These procedures reflect the use of either item and the replacement by either item.

(1) If necessary, interconnect a modem, upconverter and power amplifier with the amplifier/mixer suspected of being faulty and place in normal operation.

(2) Observe the indication on the PA MONITOR meter on the power amplifier. If the PA MONITOR meter is indicating a normal output power level and the FAULT lamp is illuminated on the amplifier/mixer, the fault or metering circuit in the amplifier/mixer is giving an erroneous indication; perform steps b(10) through b(16) below. If the indication on the PA MONITOR meter is abnormal, proceed to step (3) below.

(3) Place the STATUS MONITOR switch to each of the following positions and observe the STATUS MONITOR meter for a correct indication. If an incorrect indication is observed, proceed to step (4) below. If a correct indication is observed, proceed to step (5) below.

Position	*Indication*
+ 30 V	28-32
+ 15 V	13-17
- 15 V	13-17

(4) Replace power supply module PS2 for the +30 volts and PS1 for the + 15 or -15 volts (para 5-37*e*).

(5) Place the STATUS MONITOR switch in the IPA MA position.

(6) If an FET amplifier is being used proceed to step (7) below. If a TWT is being used operate and hold the FAULT RESET switch to ON (up) until the STATUS MONITOR meter starts up scale and release the switch. If the meter does not move up scale, replace TWT amplifier A3 (para 5-37*c*). After replacement of A3 proceed to paragraph 5-36 and perform the gain adjustments.

(7) Observe the STATUS MONITOR meter for an indication of 16 to 32 ma. If the indication is normal, proceed to step (8) below. If the indication is abnormal, replace the amplifier A3 (para 5-37*c*). After replacement of A3 proceed to paragraph 5-36 and perform the gain adjustments.

(8) Place the SHF MONITOR switch to the X10 position.

(9) Place the SHF MONITOR channel selector switch to each of the channels that have a CV3199/TSC upconverter cable connected to them.

(10) Observe the SHF MONITOR meter for an indication of 7.5 to 8.5 for each channel selected. If the indication is correct, proceed to step (12) below. If the indication is incorrect, proceed to step (11) below.

(11) Disconnect the cable from the SHF channel which does not give a correct indication, and connect the cable to another channel on the SHF combiner module. Place the SHF monitor channel selector switch to the selected channel, if the indication is incorrect, disconnect. If the indication is still incorrect, the problem is with the upconverter or interconnecting cable.

Return the cable to the proper channel. No action required at the amplifier/mixer. If the indication is correct when the cable is connected to a different channel or to power amplifier, the problem is in the SHF combiner module. Replace the SHF combiner module Al (para 5-37*a*). After replacement of A1, proceed to paragraph 5-36 and perform the gain adjustments.

(12) Place the SHF MONITOR channel selector switch to the SHF OUT position.

(13) Observe the SHF MONITOR meter for a reading of 14 to 18. If the indication is incorrect, the operator may adjust A2AT1 to obtain the correct reading. If the correct reading cannot be obtained by adjusting A2AT1, perform steps b(l) through b(9) below.

b. Troubleshooting the Amplifier/Mixer.

(1) If the indication in step a(13) above is not correct but the FAULT lamp is not illuminated proceed to step (2) below to correct the SHF output fault, and then attempt to adjust the fault threshold in accordance with paragraph 5-36*j* If still not adjustable, replace A6CR1 and then repeat the adjustment.

(2) If the fault still exists, replace A3 module (para 5-37*c*), perform the gain adjustments step (para 5-36), and return to step a(1l) above.

(3) If the indication in step a(13) above is incorrect and the fault indication is illuminated, turn off POWER switch and disconnect all drive cables to the inputs of the SHF channel combiner.

(4) Turn off drawer. Disconnect output cable W6 from the FET/TWT amplifier, select one of the input cables to the amplifier/mixer drawer, and connect this cable (via the appropriate adapter) to output cable W6. Terminate the TWT amplifier with a 50-ohm load. Turn on POWER switch.

(5) If the SHF MONITOR meter now indicates power is present at the SHF output position, (approximately 5 to 10), the problem is most likely in the A2 module or A3 module.

(6) Replace module A3, perform the gain adjustment (para 5-36). Repeat paragraph 5-35.

(7) If fault remains, replace module A2 and perform the gain adjustment (para 5-36). Then repeat paragraph 5-35 for proper operation.

(8) If fault still remains, replace the amplifier/mixer drawer (para 5-38) and repeat paragraph 5-35.

(9) If no output power is indicated in the SHF output position of the SHF MONITOR meter, replace module A6. Perform the gain adjustment steps in paragraph 5-36 and repeat paragraph 5-35.

NOTE

After replacement of module A1, A2, A3, or A6, proceed to paragraph 5-36 and perform the gain adjustment steps associated with the replaced module.

(10) On the amplifier mixer, place the STATUS MONITOR switch to the following positions and observe the STATUS MONITOR meter for a correct indication. If an indication cannot be read in any position proceed to step (11) below. If an indication cannot be read in the IPA MA position only, proceed to step (12) below. If all indications are normal, proceed to step (13) below.

Position	*Indication*
+ 30 V	28-32
+ 15 V	13-17
- 15 V	13-17
IPA MA	16-32 ma.

(11) Disconnect the leads from the rear of the STATUS MONITOR meter. Set the multimeter to the 200 ohm range. Observe polarity and connect the multimeter to the STATUS MONITOR meter terminals and observe for deflection on the STATUS MONITOR meter. If there is no deflection, replace the STATUS MONITOR meter. If there is deflection replace the amplifier/mixer drawer and refer it to the next higher level of maintenance. Return to step a(l) above.

(12) Replace the transient suppressor module A4. Return to step *a*(1) above.

(13) On the amplifier/mixer, place the SHF MONITOR switch to the X10 position and set the SHF MONITOR channel selector to each of its positions while observing for an indication. Each (channel) position that has an upconverter input applied as well as the SHF OUT position, should give an indication on the SHF MONITOR meter. If no readings can be obtained, proceed to step (14) below. If readings can be obtained only in certain individual positions of the SHF MONITOR channel selector replace the amplifier/mixer drawer and return it to the next higher level of maintenance. If all indications can be read, proceed to step (16) below.

(14) Replace the power head A7 in the amplifier/mixer and observe for indications on the SHF MONITOR meter. If indications return, return to step *a*(1) above. If indications still cannot be read, proceed to step (15) below.

(15) Disconnect the leads from the rear of the SHF MONITOR meter. Set the multimeter to the 200 ohm range. Observe polarity and connect the multimeter to the SHF MONITOR meter terminals and observe for deflection on the SHF MONITOR meter. If there is no deflection, replace the SHF MONITOR meter.

If there is deflection, replace the amplifier/mixer drawer and refer it to the next higher level of maintenance. Return to step a(1) above.

(16) If the MONITOR meter on the PA and the SHF MONITOR meter on the amplifier/mixer have a normal indication, but the amplifier/mixer FAULT lamp is on, attempt to adjust the fault threshold as in paragraph 5-36*f* below. If not adjustable, replace the A5 module and repeat the fault threshold adjustment. If still not adjustable, replace A6CR1 and then perform the fault threshold adjustment in paragraph 5-36*f* below. Return to step a(1) above.

5-36. Amplifier/Mixer Adjustments

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a nonoperating condition and all power circuit breakers on the power distribution panel are in the OFF position.

The gain of the amplifier/mixer must be adjusted upon replacement of the SHF channel assembly Al, SHF drive assembly A2, FET/TWT amplifier A3, or the SHF output assembly A6. This is necessary to accommodate individual module gain variation. It is assumed here that a module has just been replaced, the front panel cables are disconnected, the amplifier/mixer is extended from the rack, and the AC POWER is turned off. Proceed as follows:

a. Preliminary.

(1) Connect the SHF OUTPUT cable to the amplifier/mixer drawer. It may be necessary to loosen the captive screws and open the cable access covers to obtain enough cable slack to make the necessary connection with the drawer extended.

(2) Place the front panel AC POWER circuit breaker to the ON position.

(3) Place the STATUS MONITOR switch in the IPA position. If using a TWT, operate and hold the FAULT RESET switch to the ON position until the STATUS MONITOR meter starts reading up scale and then release the FAULT RESET switch. Observe the STATUS MONITOR meter for an indication of 16 to 32 ma.

b. Adjustments to Perform when SHF Combiner Assembly A1 is Replaced.

(1) Check that the input level adjustment AT1 for each of the four channels on the SHF channel combiner are turned fully clockwise (fig. 5-20).

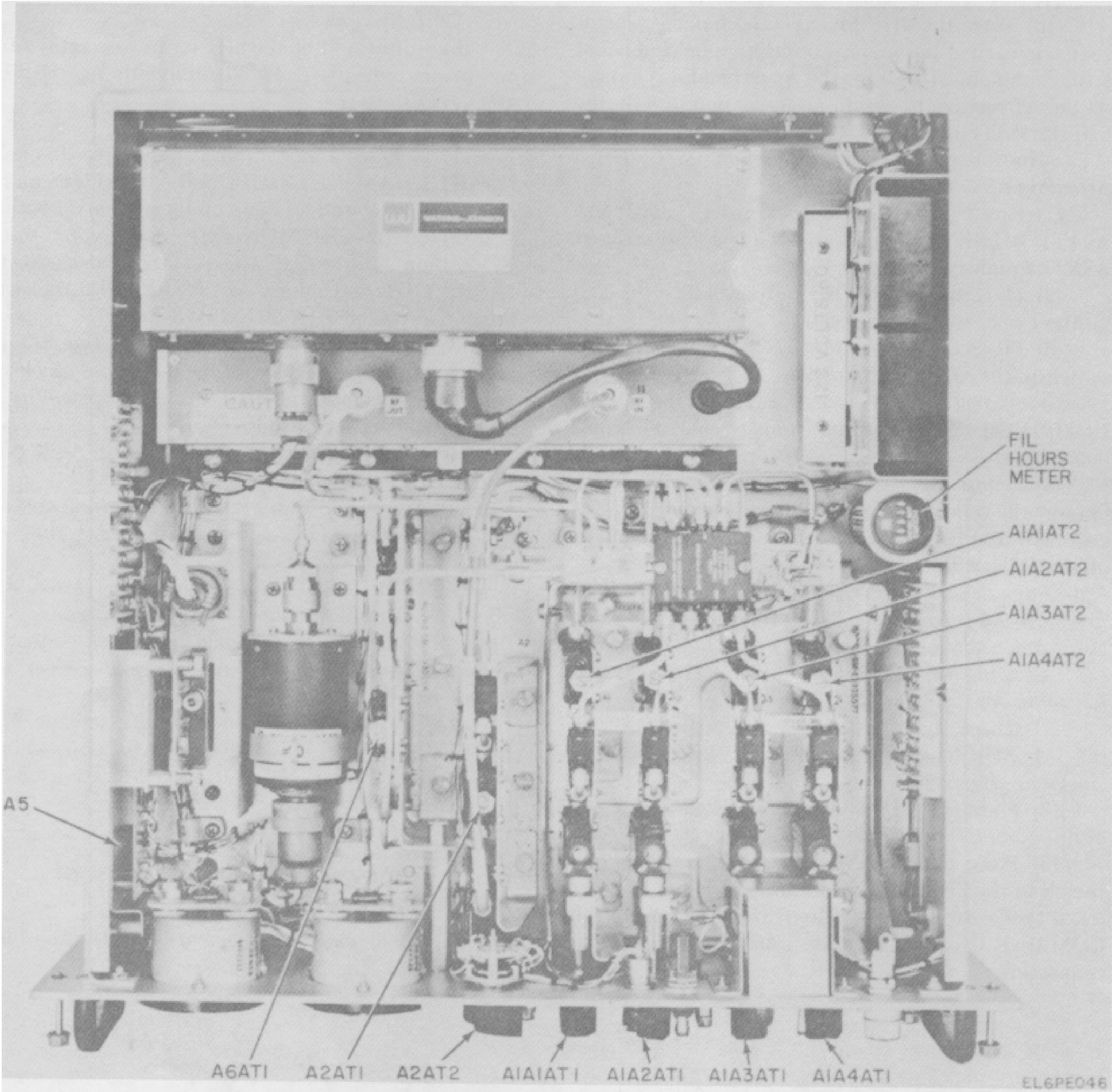

Figure 5-20. Amplifier/Mixer Module and Rear Panel Connectors Location.

(2) Place the SHF MONITOR switch to the X10 position.

(3) Place the SHF MONITOR channel selector switch to SHF OUT position.

(4) Connect the input cable to CHI of the SHF channel combiner and note the reading on the SHF MONITOR meter.

(5) Remove the input cable from CH1 of the SHF CHANNEL COMBINER and repeat step (4) above for each of the remaining three SHF inputs one channel at a time.

(6) Select the lowest reading obtained from each of the SHF input channels measured and use it as a reference.

(7) Connect the remaining three channel SHF inputs, one channel at a time, and adjust the input level control AT1 to obtain the reference reading of step (6) above. Lock the attenuators when completed.

(8) Connect all the SHF CHANNEL COMBINER cables to the proper channel input connectors.

(9) Adjust AT1 on the SHF drive assembly A2 as per *c*(1) through (5) below.

(10) Place the SHF MONITOR channel selector switch in each of the channel positions, one channel at a time, and adjust AT2 for the corresponding channel on the Al module to obtain an indication of 8 on the SHF MONITOR meter.

c. Adjustments to Perform when SHF Drive Assembly A2 is Replaced.

(1) Check that the output level adjustment A2AT1 is fully clockwise and the gain adjustment A2AT1 to midrange (fig. 5-20).

(2) Place the SHF MONITOR switch to the X10 position.

(3) Place the SHF MONITOR channel selector switch to the SHF OUT position.

(4) Connect all the SHF CHANNEL COMBINER cables to the proper channel input connectors.

(5) Adjust AT1 on the SHF drive assembly A2 to obtain the correct output power reading. (It is assumed 180 mw is the correct reading unless otherwise specified.)

d. Adjustments to Perform when the FET/TWT Assembly A3 is Replaced. This procedure is the same as for step c above. Repeat steps (1) through (5) above.

e. Adjustments to Perform When SHF Output Assembly A6 is Replaced.

(1) Check that the variable attenuator AT1 on the Al SHF channel combiner is adjusted fully clockwise (fig. 5-20).

(2) Place the SHF MONITOR switch to the X10 position.

(3) Place the SHF MONITOR channel selector switch to the SHF OUT position.

(4) Connect all the SHF CHANNEL COMBINER cables to the proper channel input connectors.

(5) Adjust the OUTPUT LEVEL control (A2AT2) fully clockwise.

(6) Adjust AT1 on the SHF output assembly A6 to obtain an indication of 180 milliwatts on the SHF MONITOR meter.

f. Fault Threshold Adjustment.

(1) Connect a modem and upconverter to one of the SHF CHANNEL COMBINER CH INPUTS on the amplifier/mixer and set them up for normal operation.

(2) Set the SHF MONITOR meter switch to the X1 position and the SHF MONITOR channel selector to SHF OUT and adjust A2AT2 for a 9.6 milliwatt indication on the SHF MONITOR meter.

(3) Observe the FAULT lamp. If the FAULT lamp is on, adjust A4R3 until the lamp goes off. If not possible to accomplish the adjustment, replace the A5 module and repeat this procedure.

(4) With the FAULT lamp off, adjust A4R3 until the FAULT lamp comes on.

(5) Adjust A2AT2 for a 12 milliwatt indication on the SHF MONITOR meter and observe that the FAULT lamp is off.

(6) If the FAULT lamp is not off, reattempt to obtain a normal indication by repeating steps (2) through (5) above. If a normal indication cannot be obtained, replace the A5 module and repeat this procedure.

(7) If the FAULT lamp is off, set the SHF MONITOR meter switch to the X10 position and adjust A2AT2 for a 160 milliwatt indication on the SHF MONITOR meter.

5-37. Removal and Replacement of Amplifier/Mixer Modules

a. Removal and Replacement of SHF Combiner Assembly A2 (fig. 5-21).

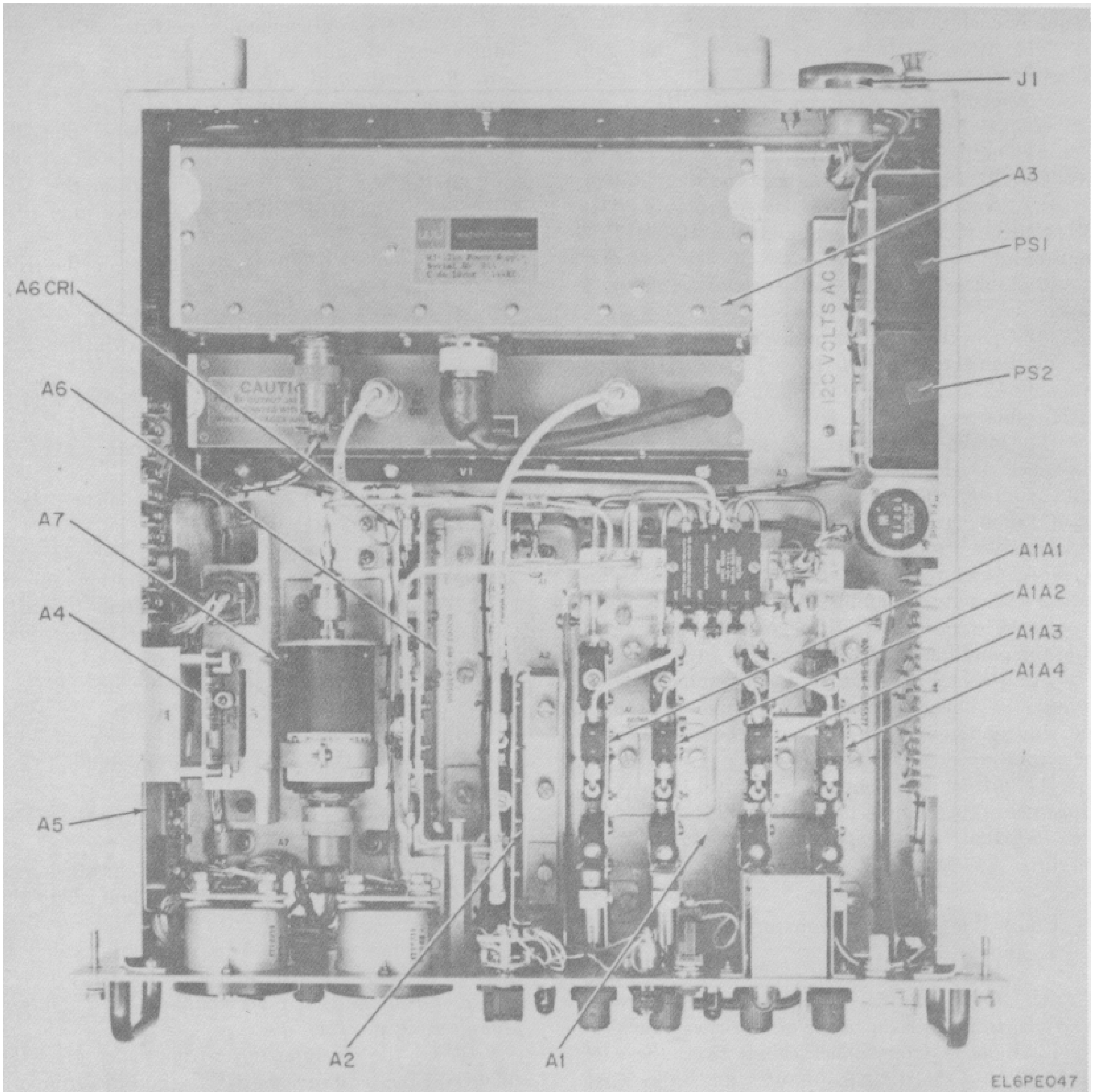

Figure 5-21. Amplifier/Mixer Module and Rear Panel Connectors Location.

(1) On the amplifier/mixer front panel, place the POWER circuit breaker to the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER inputs and the SHF OUTPUT connector.

(3) Loosen the four captive screws on the front panel.

(4) Open the amplifier/mixer drawer.

(5) Loosen the two screws which secure chassis cable connector P1 to module connector J1. Remove connector P1.

(6) On module A1, remove cable from connector J5, cable W3 from CP2, and cable W4 from CP1.

(7) Loosen the five captive screws (on the front panel) and two captive screws (inside chassis) which secure the Al module to the amplifier/mixer drawer chassis.

(8) Remove SHF channel combiner module A1 from the amplifier/mixer drawer.

(9) Replace the module by performing steps (1) through (8) above in reverse order. Replace the semirigid cables and tighten the connectors with the torque wrench provided.

(10) After replacement, perform the gain adjustment procedure of paragraph 5-36.

b. Removal and Replacement of SHF Drive Assembly A2 (fig. 5-21)

(1) On the amplifier/mixer front panel, place the AC POWER circuit breaker to the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER input and the SHF OUTPUT connector.

(3) Loosen the four captive screws on the front panel.

(4) Open the amplifier/mixer drawer.

(5) Remove cable W1 from J1 on the SHF drive assembly A2, remove cable W5 from AT3, and remove cable connector P4 from CR1.

(6) On the front panel, loosen the set screw on the output level adjustment knob; remove knob and knob lock from the front panel.

(7) Remove the hex nut securing the output level adjustment control to the front panel.

(8) Loosen the three captive screws which secure the A2 module to the amplifier/mixer drawer chassis.

(9) Remove the SHF drive assembly module A2 from the amplifier/mixer drawer.

(10) Replace the module by performing steps (1) through (9) above in reverse order. Replace the coaxial and semirigid cables and tighten the connectors with the torque wrench provided.

(11) After replacement, perform the gain adjustment procedure of paragraph 5-36*c*.

c. Removal and Replacement of FET/TWT Amplifier A3 (fig. 5-21).

NOTE

Cable W5 with its attenuator is a part of assembly A3.

(1) On the amplifier/mixer front panel, place the POWER circuit breaker to the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER inputs and the SHF OUTPUT connectors.

(3) Loosen the four captive screws on the front panel.

(4) Open the amplifier/mixer drawer.

(5) On module A3, remove cable W5 (with attenuator) from A2J1, cable W6 from A3J2 and power cable from A3J1.

(6) Loosen the eight captive screws which secure the A3 module to the amplifier/mixer drawer chassis.

(7) Remove module A3 from the amplifier/mixer drawer.

(8) Replace the module by performing steps (1) through (7) above in reverse order. Replace the coaxial cables and the power cable.

(9) After replacement, perform the gain adjustment procedure of paragraph 5-36*d*.

d. Removal and Replacement of Transient Suppressor Module A4 (fig. 5-21).

(1) On the amplifier/mixer front panel, place the AC POWER circuit breaker to the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER INPUT and the SHF OUTPUT jacks.

(3) Loosen the four captive screws on the front panel of the drawer.

(4) Open the amplifier/mixer drawer.

(5) Loosen two captive screws which secure module A4 to the mounting bracket.

(6) Unplug module A4 from chassis connector J7 and remove the module from the drawer.

(7) Replace module A4 by performing steps (1) through (6) above in reverse order.

e. Removal and Replacement of Power Alarm Module A5 (fig. 5-21).

(1) On the amplifier/mixer front panel, place the AC POWER circuit breaker to the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER INPUT and the SHF OUTPUT jacks.

(3) the four captive screws on the front panel of the drawer.

(4) Open the amplifier/mixer drawer.

(5) Remove transient suppressor module A4 (step *d* above).

(6) Remove module A5 cable plug P1 from chassis connector J8.

(7) On the outside left side of the chassis, loosen four captive screws which secure module A5 to the drawer.

(8) Replace module A5 by performing steps (1) through (7) above in reverse order.

f. Removal and Replacement of SHF Output Module A6 (fig. 5-21).

(1) On the amplifier/mixer front panel, place the AC POWER circuit breaker to the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER INPUT and the SHF OUTPUT jacks.

(3) Loosen the four captive screws on the front panel of the drawer.

(4) Open the amplifier/mixer drawer.

(5) On module A6 remove cable W6 from J1, cable W2 from FL1, cable W4 from AT1, and cable connector P5 from CR1.

(6) Loosen the four captive screws which secure module A6 to the amplifier/mixer drawer chassis.

(7) Remove module A6 from the amplifier/mixer drawer.

(8) Replace module A6 by performing steps (1) through (7) above in reverse order. Replace the coaxial and semirigid cables and tighten the connectors with the torque wrench.

(9) After replacement, perform the gain adjustment procedure of paragraph 5.36.

g. Removal and Replacement of Power Monitor Head A7 (fig. 5-21).

(1) On the amplifier/mixer front panel, place the AC POWER circuit breaker to the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER INPUT and the SHF OUTPUT jacks.

3. Loosen the four captive screws on the front panel of the drawer.

(4) Open the amplifier/mixer drawer.

(5) Remove two cable connectors from module A7 (one from each end of module).

(6) Remove two screws and lockwashers which secure the module A7 mounting bracket to the top of the chassis shelf.

(7) From the underside of the chassis remove two screws and lockwashers which secure the module A7 clamp to the chassis shelf.

(8) Remove the module from the drawer.

(9) Remove the mounting brackets from the removed module and install them on the replacement module.

(10) Replace module A7 by performing steps (1) through (8) above in reverse order.

h. Removal and Replacement of Power Supply Module PSI or PS2 (fig. 5-21)

(1) On the amplifier/mixer front panel, place the AC POWER circuit breaker tQ the off position (down).

(2) Remove front panel cables from the SHF CHANNEL COMBINER INPUT and the SHF OUTPUT jacks.

(3) Loosen the four captive screws on the front panel of the drawer.

(4) Open the amplifier/mixer drawer.

(5) Remove the four U bracket mounting screws holding PS1 and PS2 to the side wall of the amplifier/mixer drawer.

(6) Unplug the defective power supply from the U bracket.

(7) Replace the module by performing steps (1) through (6) above in reverse order.

i Removal and Replacement of A6CR1.

(1) Using a torque wrench, disconnect the coaxial cable connected to A6CR1.

(2) Using a torque wrench, disconnect A6CR1 from A6DC1.

(3) Replace A6CR1 by performing steps (1) and (2) above using the torque wrench.

5-38. Removal and Replacement of the Amplifier Mixer.

a. On the amplifier/mixer front panel, place the AC POWER circuit breaker to the OFF position (down).

b. Remove front panel cables from the SHF CHANNEL COMBINER input cables, and the SHF OUTPUT connectors.

c. Loosen the four captive screws on the front panel.

d. Open the amplifier/mixer drawer.

e. On the rear panel, remove the power cable from connector J6 and the ground wire from terminal E1 (fig. 5-21).

f. Release the latches on the slide rails and remove the amplifer/mixer from the rack.

g. Replace the amplifier/mixer drawer by performing steps *a* through *f* above in reverse order.

Section XI. MAINTENANCE OF LNA CONTROL/TRANSLATOR

5-39. Scope

a. This section covers instructions and procedures for testing and isolation, and removal and replacement. The test procedures are based on the use of built-in-test-equipment (BITE) and no additional support or test equipment is required.

b. See figure 3-5 for location of controls and indicators and figures 5-22 and 5-23 for location of modules and other components. Refer to paragraph 5-41 for replacement of LNA control/translator modules and to paragraph 5-42 for replacement of the LNA control/translator.

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a nonoperating condition and all power circuit breakers on the power distribution panel are in the OFF position.

5-40. Testing Fault Isolation.

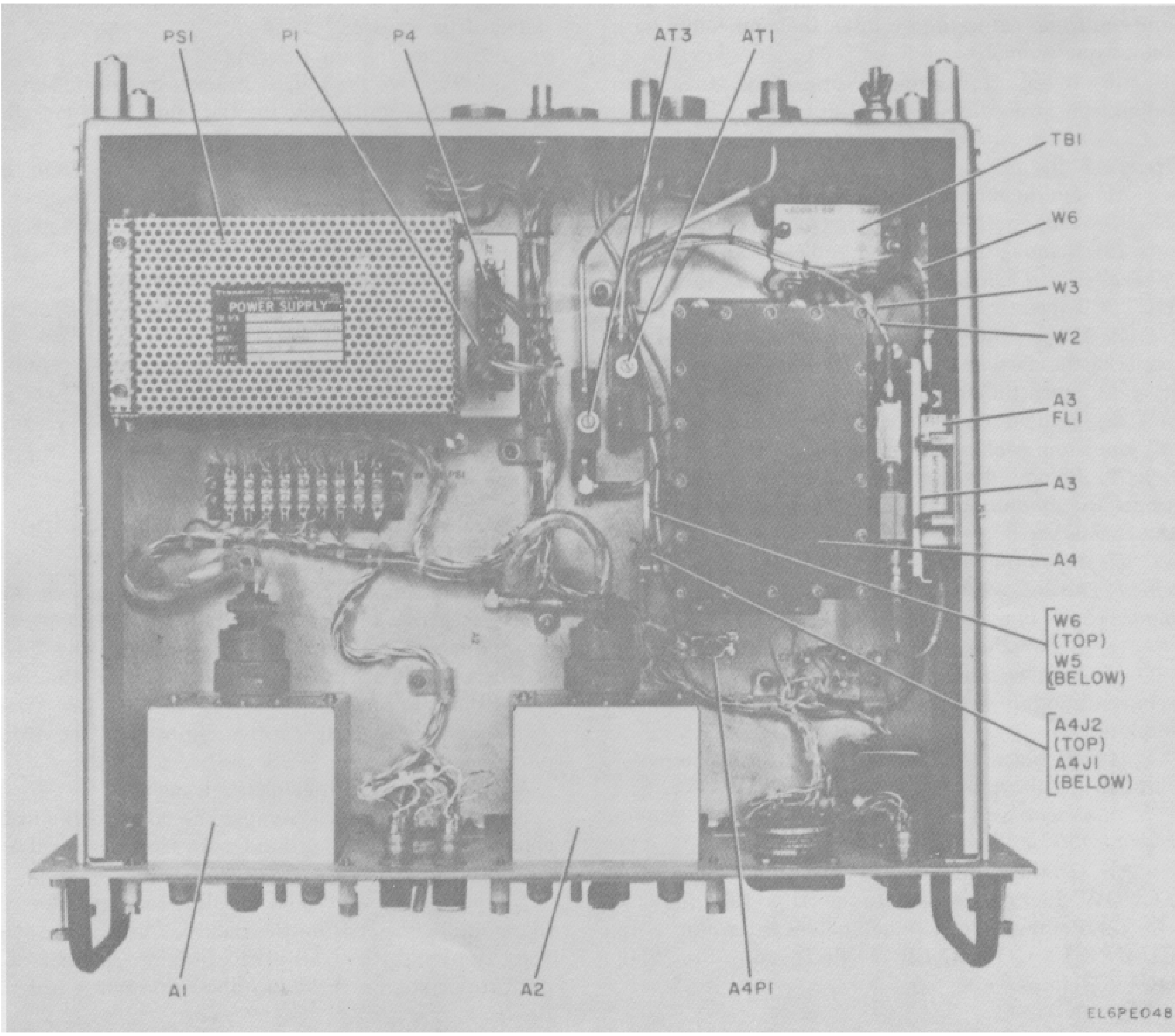

Figure 5-22. LNA Control/Translator, Module Location.

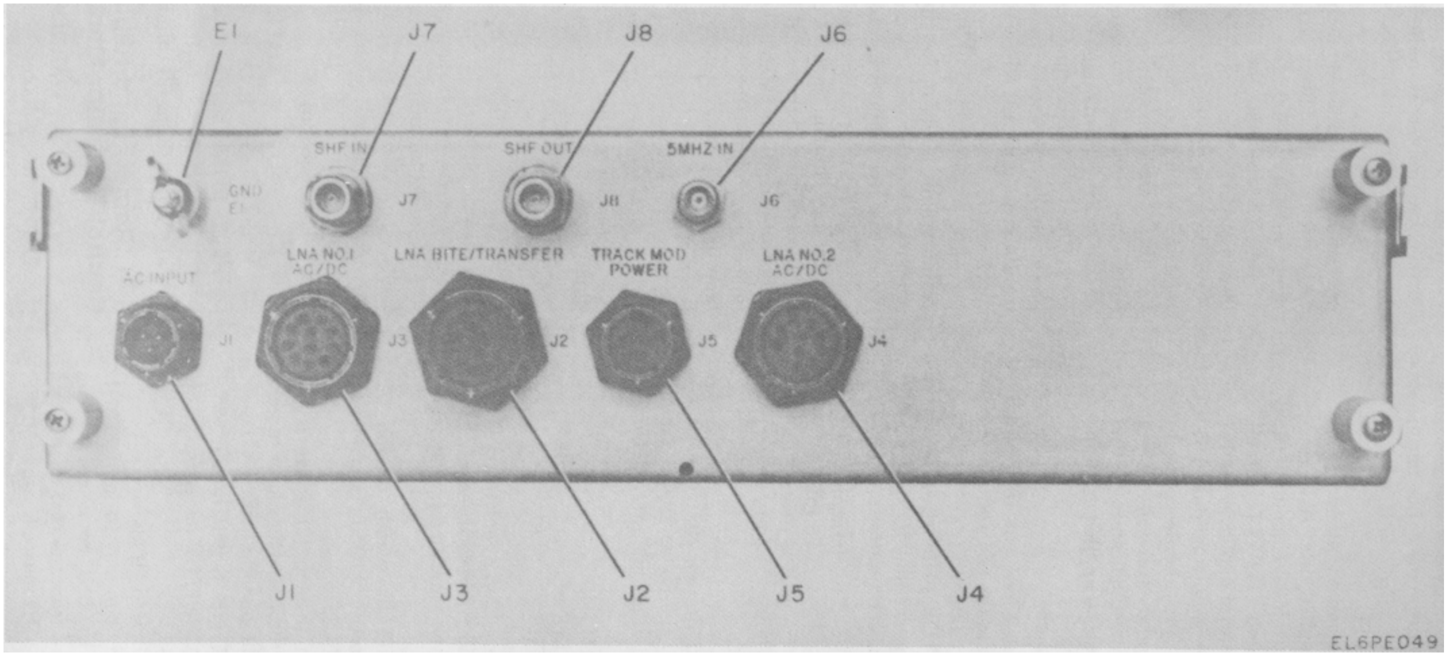

Figure 5-23. LNA Control/Translator, Rear Panel.

The following procedures are divided into functional groups since the procedures may be performed independently.

NOTE

The LNA modules (A1 and A2) are identical. Prime ac power is applied directly to each control module and is independent of the operation of the unit POWER circuit breaker. The latter control applies ac power to the drawer power supply module PS1. Module PS1, in turn, provides dc power to the LNA BITE unit and the transfer switches for LNA standby testing and on-line selection. Also, dc power is applied up to the TRANSLATOR switch.

a. Power Supply Tests.

(1) Check that the LNA control/translator POWER circuit breaker is in the ON position and the POWER indicator is illuminated.

(2) Place the MONITOR switch to each of the following positions and observe the MONITOR meter for a correct indication at each position.

Position	*Indication*
+28 V X1	25 to 50
+24 V XI	21 to 27
+ 15 V X0.5	27
-15 V X0.5	27 to 33

(3) If any indication in step (2) above is not correct, the problem is in the power supply module PS1; remove and replace the module (para 5-41).

b. Translator Tests.

NOTE

A warm-up time of 5 to 8 minutes is required to correct operation.

(1) Check that the LNA control/translator TRANSLATOR and POWER circuit breakers are in the ON position and that the associated indicators are illuminated.

(2) Place the MONITOR switch to the 725 LEVEL position and observe the MONITOR meter for an indication of from 15 to 35.

(3) If the indication in step (2) above is not correct, the problem is in the 725 MHz source module A4; remove and replace the module (para 5-41).

(4) Place the MONITOR switch to the 725 ϕ position and observe the MONITOR meter for an onscale steady indication.

(5) If the indication in step (4) above is wavering (around midrange) the problem may be in the 5 MHz input circuit. Check that the BNC connector on both ends of the interconnection from the rear of the LNA control/translator to the 5 MHz source is tight and that the 5 MHz source in the upconverter is operational. If 5 MHz is present, proceed to step (6) below.

(6) If the indication in step (4) above is not correct, the problem is in the 725 MHz source module A4; remove and replace the module (para 5-41).

(7) Check that the power amplifier (PA) is operational and adjusted for the specified output. The PA (upconverter) output frequency must be in the range of 7975 to 8400 MHz.

(8) Check that the receive path (LNA and downconverter) is operational and that the downconverter is tuned to a frequency which is 725 MHz below the transmitter (upconverter) frequency.

(9) Visually check the SHF cable and connectors from the antenna mounted electronics to the downconverter for damage or loose connections.

(10) If the preceeding tests and checks and the power supply tests are all correct, the problem is in the translator module A3; remove and replace the module (para 5-41).

c. LNA Tests. The following procedure will perform fault isolation for the standby LNA on the antenna. The standby LNA must have power applied for at least five minutes before starting this test.

(1) Place the power circuit breaker on each LNA control panel and on the LNA control/translator to the ON position and observe that the associated POWER indicators are illuminated. The LNA control FAULT indicators should extinguish after the warmup period (approximately 5 to 8 minutes), otherwise a valid fault is indicated.

(2) Hold the STBY LNA TEST/TEST switch in the ON position for a minimum of 5 seconds.

(3) Observe that the TEST OSC indicator is illuminated.

(4) Observe that the LNA NORMAL indicator is illuminated.

(5) If the indicator in step (4) above is not illuminated, check the LNA BITE unit adjustment (refer to para 5-54). If the indicator of step (4) above still does not illuminate, the standby LNA is probably faulty (the associated FAULT indicator may or may not be illuminated). Refer to paragraph 5-49 for procedures for fault isolation with LNA (LNA maintenance section).

NOTE

If the standby LNA is not faulty and you desire to test the operational LNA, place the ON LINE switch to the LNA just checked and repeat steps (2) through (5) above.

5-41. Removal and Replacement of LNA Control/Translator Modules (fig. 5-22)

WARNING

Dangerous voltages exist in the LNA control/translator that may cause death or injury to personnel even when the unit POWER circuit breaker is in the OFF position.

This voltage exists at TB1 (fig. 5-23). Exert caution if removing the 725 MHz source module A4; especially when loosening the rear captive screws. It is highly desirable to keep the receiver (on-line LNA) on the air. However, if the tactical situation permits otherwise, the AC power cable then can be disconnected from J1 on the rear panel.

a. LNA Control Modules A1 and A2. These modules are identical and interchangeable. This procedure, therefore, applies to both modules. Proceed as follows:

(1) On the front panel of the module to be removed, place the POWER circuit breaker to the OFF position.

(2) On the module front panel, loosen the four captive screws.

(3) Pull on the handle to withdraw the module far enough out of the unit chassis to reach the connector on the rear of the module.

(4) Remove the chassis cable connector from the module connector.

(5) Remove the module completely.

(6) Replace the module by performing steps (1) through (5) in reverse order.

b. Translator Module A3.

(1) Observe the warning notice at the start of these procedures.

(2) On the LNA control/translator, place the power circuit breaker to the OFF position.

(3) Loosen the four captive screws on the front panel.

(4) Open the LNA control/translator drawer.

(5) On the module, remove coaxial cable W6 from the FL1 coaxial connector (right-rear top).

(6) On the module atop FL1, loosen the two captive screws that secure the module to the right-side chassis panel.

(7) At the bottom of the module, loosen the front and rear captive screws (two).

(8) Lift the module out of the chassis to gain access to the two left-rear coaxial connectors.

(9) Remove coaxial cable W2 from the left-rear top coaxial connector (SHF input from variable attenuator AT1).

(10) Remove coaxial cable W3 from the left-rear bottom coaxial connector (SHF output to variable attenuator AT3). Remove the module.

(11) Replace the module by performing steps (2) through (10) above in reverse order.

c. 725 MHz Source Module A4.

(1) Observe the warning notice at the start of paragraph 5-41.

(2) On the LNA control/translator; place the POWER circuit breaker to the OFF position.

(3) Loosen the four captive screws on the front panel of the unit.

(4) Open the LNA control/translator drawer.

(5) On the chassis in front of the module, remove module connector (A4) P1 from chassis connector J9 by loosening the two captive screws on (A4) P1.

(6) On the module, remove coaxial cable W6 from the RF OUT connector J2 (left side top).

(7) On the module, remove coaxial cable W5 from the RF IN connector J1 (below J2).

(8) Loosen the four captive screws which secure the module to the chassis. Remove the module.

(9) Replace the module by performing steps (2) through (8) above in reverse order.

d. Power Supply Module PS1.

(1) Observe the warning notice at the start of these procedures.

(2) On the LNA control/translator, place the POWER circuit breaker to the OFF position.

(3) Loosen the four captive screws on the front panel.

(4) Open the LNA control/translator drawer.

(5) On the module, loosen the two captive screws on chassis cable connector P4 and then remove it from module connector (PS1)J2.

(6) On the module, remove chassis cable connector P1 from module connector (PS1)J1.

(7) Loosen the four captive screws which secure the module to the chassis. Remove the module.

(8) Replace the module by performing steps (3) through (7) above in reverse order.

5-42. Removal and Replacement of LNA Control/Translator

a. On the LNA control/translator place all POWER circuit breakers to the OFF position.

b. Loosen the four captive screws on the front panel.

c. Open the LNA control/translator drawer.

d. On the rear panel disconnect all rack cables from the connectors. Remove the ground wire from terminal E1 (fig. 5-23).

e. Release the latches on the slide rails and remove the LNA control/translator from the rack.

f. Replace the LNA control/translator by performing steps *a* through *e* in reverse order.

Section XII. MAINTENANCE OF ALARM MONITOR BZ-236/TSC

5-43. Scope.

a. This section contains instructions and procedures for testing, fault isolation, removal and replacement. The fault isolation procedures are based on the observation of front panel indicators and no additional support or test equipment is required.

b. See figure 3-9 for location of controls and indicators and figures 5-24 and 5-25 for location of modules and other components. Refer to paragraph 5-45 for removal and replacement of modules and paragraph 5-46 for removal and replacement of the alarm monitor.

WARNING

Dangerous voltages exist in this equipment. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

5-44. Testing and Fault Isolation

a. Power Supply Check.

(1) Place the POWER circuit breaker to the ON position. Check that the AC indicator is illuminated.

(2) Check that the DC indicator is illuminated.

(3) If the DC indicator is not illuminated, replace the bulb. If still not illuminated, the problem is in the power supply module PS1; proceed to step (4) below. If the indication is correct, proceed to step *b* below.

(4) Remove and replace the power supply module PS1 (para 5-45*a*). If the indicator is still not illuminated, remove and replace the fault/safety gate module A1 (para 5-45*b*). If the fault is still present when module A1 is replaced, replace the alarm monitor and return it to the next higher level of maintenance (para 5-46). If replacement of the power supply PS1 or fault/safety gate module A1 removes the fault, the suspected assembly (PS1 or A1) is to be returned to general support maintenance (chapter 8).

b. System Check.

(1) During system operation, a SYSTEM FAULT/CSS or RSS indicator may become illuminated. If this occurs, place one or more of the fault switches (under the front access cover) to the OVERRIDE position to isolate the fault and clear the CSS or RSS fault indication.

(2) If any of the SAFETY ALERT alarms are illuminated, it is necessary to open the alarm monitor drawer to test the override circuit. Loosen the four captive screws on the front panel.

(3) Open the alarm monitor drawer. The SAFETY ALERT switch is located just behind the front panel indicators.

(4) Operate the SAFETY ALERT switch to the OVERRIDE position; the SAFETY ALERT indicators should turn off. Release the switch. (5) If the indicators do not turn off in either steps (1) or (4) above, the problem is in the fault/safety gate module A1; remove and replace the module (para 5-45*b*). Return the suspect module A1 to general support maintenance (chapter 8).

5-45. Removal and Replacement of Alarm Monitors Modules. (fig. 5-24)

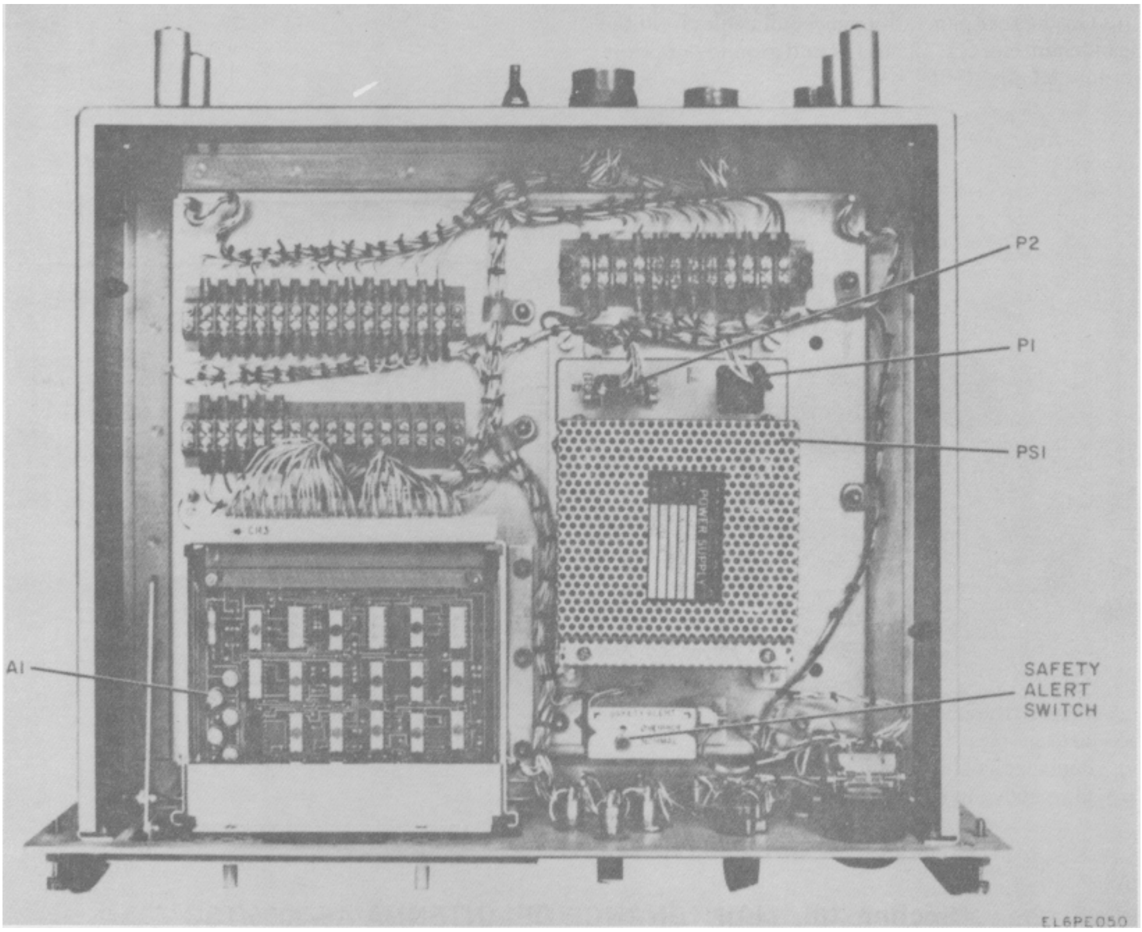

Figure 5-24. Alarm Monitor, Module Locations.

a. Removal and Replacement of Power Supply Module PS1.

(1) On the alarm monitor, place the POWER circuit breaker to the OFF position.

(2) Loosen the four captive screws on the front panel.

(3) Open the alarm monitor drawer.

(4) On the module, remove chassis cable connector P1 from module connector (PS1)J1.

(5) On the module, loosen the two captive screws which secure chassis cable connector P2 and remove it from module connector (PS1) J2.

(6) From the top of the chassis, loosen and remove the four captive screws that secure the module to the chassis. Remove the module.

(7) Replace the power supply module by performing steps (1) through (6) above in reverse order.

b. Removal and Replacement of Fault/Safety Gate A1.

(1) On the alarm monitor, open the FAULT OVERRIDE/MODULE ACCESS cover.

(2) Grasp the two ejector handles on the front of the board, pull the handles outward to unplug the board and then pull out the board.

(3) Remove the board through the front panel access cover.

(4) Replace the board by performing steps (1), (2) and (3) above in reverse order.

5-46. Removal and Replacement of Alarm Monitor

a. On the alarm monitor front panel, place the POWER circuit breaker to the OFF positions.

b. Loosen the four captive screws on the front panel.

c. Open the alarm monitor drawer.

d. On the rear panel, disconnect all cables from the chassis connectors J1, J2, and J3 and ground wire from terminal E7 (fig. 5-25).

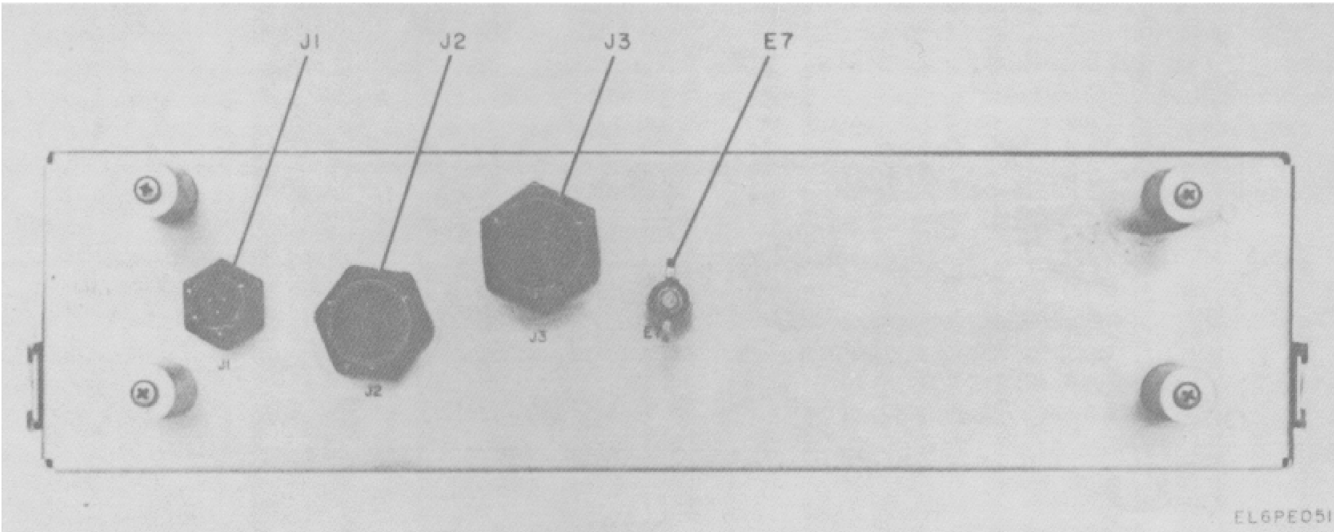

Figure 5-25. Alarm Monitor, Rear Panel.

e. Release the latches on the slide rails and remove the alarm monitor from the rack.

f. Replace the alarm monitor by performing steps through *e* above in reverse order.

Section XIII. MAINTENANCE OF ANTENNA AS-3036/TSC

5-47. Scope

This section contains instructions and procedures for removal and replacement of the actuators, motor- brake tachometers, reflector petals, and the feed tube assembly. Refer to paragraphs 4-9, 4-10, and 4-11 for operator/crew maintenance and paragraphs 5-2 and 5-5 for painting and lubrication instruction, respectively.

5-48. Removal and Replacement

WARNING

Do not attempt any removal or replacement unless the equipment is in a nonoperating condition and all power circuit breakers on the power distribution panel are in the OFF position.

a. Removal of Elevation Actuator (fig. 5-26).

WARNING

Use two persons for this task, otherwise personal injury and/or damage to the equipment may result. Do not attempt this task if winds exceed 40 mph (64 km/h).

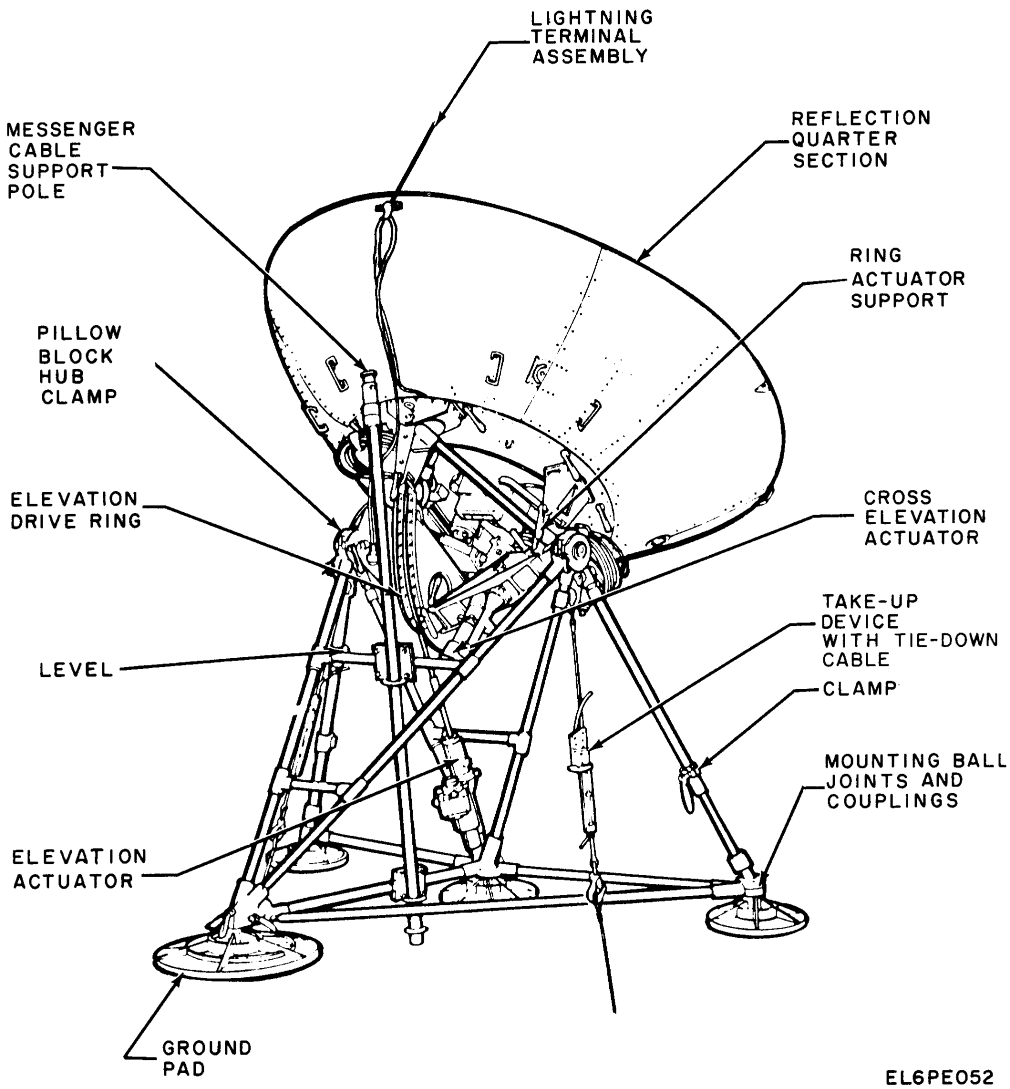

Figure 5-26. Antenna, Location of Components.

(1) Disconnect the cable from the actuator.

(2) Slightly rock the antenna to relieve strain on the actuator rod end.

(3) Unlock, release, and remove the quick-release pin which holds the actuator rod end to the elevation drive ring. Maintain control of both the actuator and the antenna.

NOTE

The quick-release pins are equipped with automatic locking pins to hold the handles in a closed position. Exercise care to release the locking pins before attempting to raise the handles.

(4) Allow the antenna to rotate downward (slowly) until it comes to rest against the bumper on the leg assembly.

(5) Unlock, release, and remove the quick-release pins which hold the lower end of the actuator to the front leg assembly. Remove the actuator.

(6) Replace the actuator by performing steps (1) through (5) above in the reverse order.

b. Removal of the Cross-Elevation Actuator (fig. 5-26).

WARNING

Use two persons for this task, otherwise, personal injury and/or damage to the equipment may result. Do not attempt this task if winds exceed 40 mph (64 km/h).

(1) Disconnect the cable from the actuator.

(2) Relieve any strain on the actuator by slightly moving the antenna.

(3) Unlock, release, and remove the quick-release pin which holds the actuator rod end to the antenna center section. Maintain control of both the actuator and the antenna.

NOTE

The quick-release pins are equipped with automatic locking pins to hold the handles in a closed position. Exercise care to release the locking pins before attempting to raise the handles.

(4) Unlock, release, and remove the quick-release pin which secures the actuator support trailing arm to the elevation drive ring.

CAUTION

Maintain control of the antenna and actuator during this procedure to prevent damage to the equipment.

(5) Remove the quick-release pin which secures the other end of the actuator support trailing arm to the inside of the right elevation gimbal shaft assembly.

(6) Remove the actuator (with attached support trailing arm).

(7) Install the stow bar by attaching one end of it (using quick-release pin) to the bracket on the inside of the right elevation gimbal shaft assembly.

(8) Replace the actuator by performing steps (1) through (7) above in reverse order.

c. Motor-Brake Tachometer Removal (fig. 5-27). To remove the motor-brake-tachometer from either actuator it will be necessary to remove the actuator from the antenna (refer to para a or b above). After the actuator is removed proceed as follows to remove the motor-brake-tachometer:

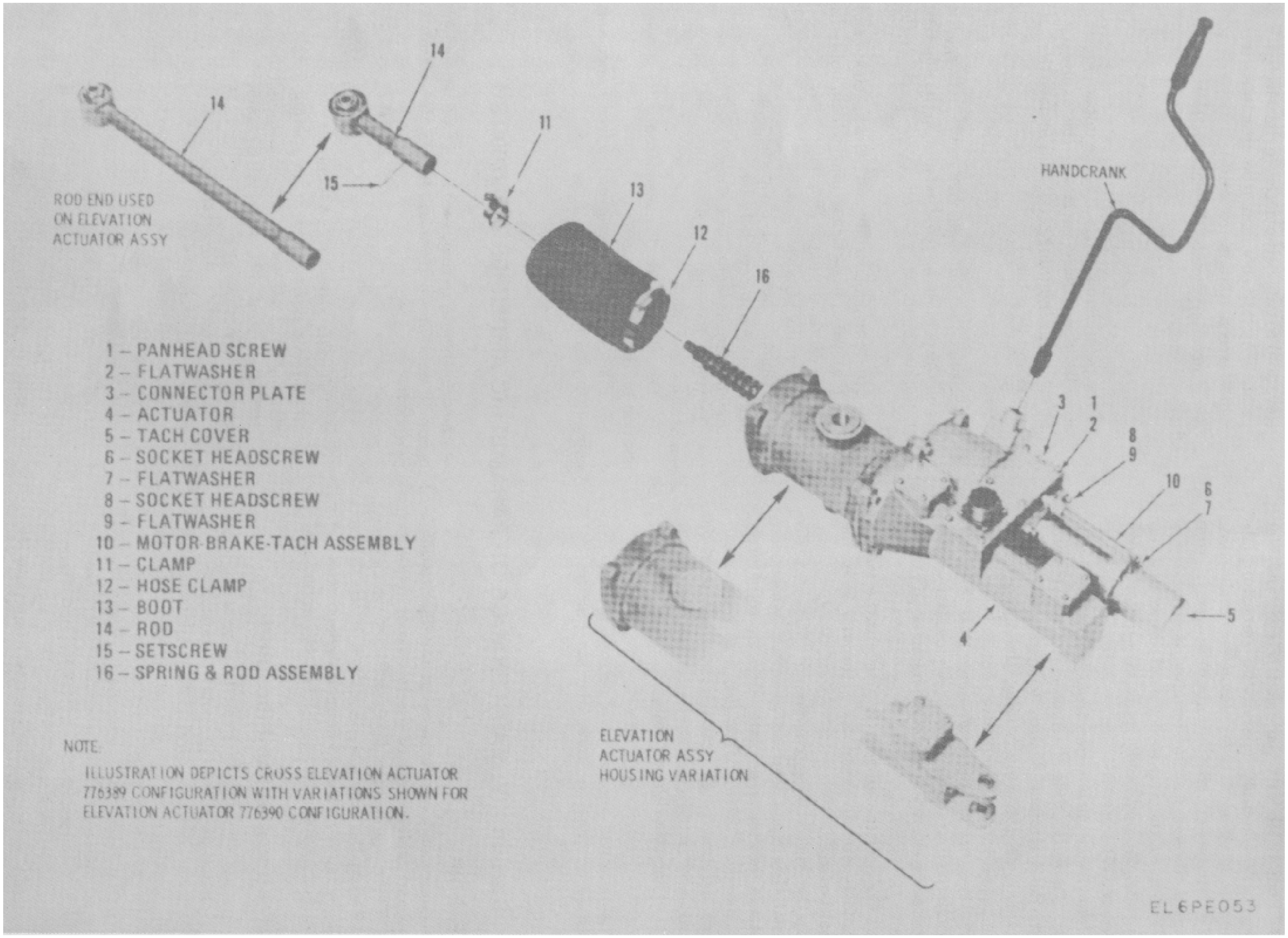

Figure 5-27. Antenna Actuator, Disassembly View Showing the Motor-Brake-Tachometer.

(1) Remove the six pan-head screws and flat washers (1, 2). Carefully separate the connector plate (3) from the actuator (4) to expose the terminal board.

(2) Disconnect the numbered wires from terminals 1 through 7 on the terminal board.

(3) Remove the four socket head screws and flat washer (8, 9) and slide out the motor-brake-tachometer (10).

d. Motor-Brake Tachometer Replacement (fig. 5-27).

(1) Carefully guide the motor and brake wires toward the terminal board located under the connector plate (3) while sliding the motor-brake tachometer (10) into the actuator (4).

(2) Use the locking-compound (MIL-S-22473) and install the four socket head screws and flat washer (8, 9) to secure the motor-brake-tachometer (10) to the actuator (4).

(3) Connect the numbered wires for the motor-brake tachometer to terminals 1 through 7 on the terminal board.

(4) Use the locking compound (MIL-S-22473) and install the six pan head screws and flat washers (1, 2) to secure the connector plate (3) to the actuator.

e. Removal of Antenna Petal (fig. 5-26). Any one of the four antenna petals (quarter sections) may be removed and replaced on the antenna without removal of the other three petals.

CAUTION

The task will require two persons if it is desired to raise or lower the antenna (in elevation) to gain better access to the selected petal. This task should not be attempted if winds exceed 40 mph (64 km/h).

(1) If necessary, place the antenna in the zenith position.

NOTE

If the petal being removed is the upper one, it will be necessary to loosen the captive screw on the lightning probe and remove the probe and its cable.

(2) Using the 5/8-inch hex tool, release the latches on the petal to be removed and on the adjacent panel. Rotate the tool 3/4 turn clockwise to release the latch.

(3) Hold the petal firmly and unlock; release and remove the two quick-release pins which hold the petal to the center section.

(4) Carefully remove the petal.

(5) Replace the petal by performing step (1) through (4) above in reverse order.

f. Removal of Antenna Feed Tube Assembly.

(1) While holding the feed tube, unscrew and remove the feed tube.

(2) Detach the feed cover from its stowed position on the feed flange.

(3) Place the feed cover over the feed flange and screw it in place.

Section XIV. MAINTENANCE OF PARAMETRIC AMPLIFIER AM-6700/TSC

5-49. Scope

This section contains instructions for the testing, removal and replacement of the low noise amplifier (LNA). There are no modules in the LNA which can be removed at the organizational level. If an LNA is found to be faulty, it should be removed and replaced and returned to the next higher level of maintenance.

5-50. Testing and Fault Isolation

The following procedures are based on use of built-in-test-equipment at the LNA control/translator, the downconverter, and the LNA BITE; no additional test equipment is required. It must be assumed here that these units are known to be in good operating order (an LNA-related fault may cause the downconverter to indicate a unit fault). Test procedures are described for both the on-line and standby LNA. The GO, NO- GO testing of a suspected faulty LNA is performed with the LNA in the standby position using the LNA BITE test oscillator. The suspect LNA must be fully warmed up before testing; erroneous indications will occur if tests are performed during the warm-up period.

NOTE

The FAULT indicator on the LNA CONTROL panel (LNA control) will be illuminated during the warmup period (5 to 8 minutes). After warmup (and assuming the indicator turns off), the FAULT indicator then serves to signal a fault in the LNA. An unusual power-failure type of fault could occur that would be indicated by no illumination of the LNA control FAULT and POWER indicators (unit faults probably will be indicated on the downconverter, modem, and MUX). If so, transpose the position of the two LNA controls (para 5-41). If the fault moves with the module, that module is defective. If the fault moves in the unit module position, the chassis cabling in the LNA control/translator drawer is probably defective; refer the unit to higher level maintenance.

a. Preliminary Checks.

(1) Check that the POWER circuit breaker is in the ON position and the associated POWER indicator is illuminated on the LNA control/translator, the LNA control (of the LNA under test), and the downconverter.

NOTE

The FAULT indicator on the LNA control will be illuminated when ac power is applied to a cold LNA. Allow approximately 5 to 8 minutes for the LNA to reach operating temperature and become stabilized. The HI HEAT switch may be placed to the ON position to help speed up the warmup period, if desired.

(2) If the LNA control FAULT indicator does not turn off at the end of the warmup period, proceed to step *b* below. If the FAULT indicator does turn off at the end of the warmup period, proceed to the appropriate fault indication of step c, d, and e below.

b. LNA Control FAULT Indicator and Downconverter RCVR FAULT Indicator both Illuminated.

(1) The LNA is probably defective. Switch the LNA to STBY and test it according to paragraph *e* below. If the test shows the performance of the LNA to be satisfactory, replace the LNA control module (para 5-42) and proceed to step (2) below.

(2) If the downconverter frequency synthesizer OUT OF LOCK indicator is illuminated, test the downconverter in accordance with the procedures in paragraph 5-29 above.

(3) If the operation of the frequency synthesizer is normal, place the MONITOR switch on the downconverter to the IF OUT position and note the MONITOR meter reading. If the reading is less than 20, test the downconverter in accordance with the procedures in paragraph 5-29.

c. RCVR FAULT Indication at Downconverter, No FAULT Indication at LNA Control (On-line LNA Testing).

(1) Test the downconverter in accordance with the procedures in paragraph 5-29.

(2) If the performance of the downconverter is found to be satisfactory in step (1) above, and the fault appears to be due to low RF level at the downconverter input, (see note below) switch the LNA to the STBY position and test according to *e* below. If the LNA is satisfactory, visually inspect the SHF coaxial cabling from the SHF output of the LNA (on the antenna) to the SHF input of the downconverter.

NOTE

Under normal operating conditions, the amplified RF noise alone from the LNA will cause a mid-scale indication on the downconverter IF OUT position of the MONITOR meter. A downconverter RCVR FAULT indication will occur if the IF OUT level drops below 1/4 scale on the MONITOR meter.

d. Receive Signal Level Too Low at Modem, but No Fault Indication at LNA Control or Downconverter.

(1) Check for antenna pointing error.

(2) If a received carrier level as indicated by the modem MONITOR meter is low or absent, check the interconnecting 70 MHz signal cable between the downconverter and the modem.

e. Faulty On-Line LNA Indication (Standby LNA Testing).

NOTE

The standby LNA may be tested at any time using the test controls on the LNA control/translator unit.

(1) After sufficient standby LNA warm-up time (15 minutes desirable), hold the STBY LNA TEST/TEST switch to the ON position.

(2) Observe that the TEST OSC indicator is illuminated.

(3) Observe that the LNA NORMAL indicator is illuminated; if illuminated, the standby LNA gain is correct at the LNA BITE test oscillator frequency. Testing at other frequencies may be accomplished, if desired, by tuning the LNA BITE oscillator as described in paragraph 5-54.

(4) If the LNA NORMAL indicator does not illuminate when testing one LNA, but does when testing the second LNA, the first LNA is probably defective and should be replaced. BITE adjustment checkout should be made at the antenna (as described in para 5-54) prior to removing the suspect LNA.

(5) If the LNA NORMAL indicator does not illuminate when testing either LNA, and other LNA control/translator indications are normal, the LNA BITE adjustment should be checked as described in paragraph 5-54. The LNAs may be good and the LNA BITE may be faulty.

5-51. Removal and Replacement of Low Noise Amplifiers.

WARNING
ELECTROMAGNETIC RADIATION
DO NOT STAND IN THE DIRECT PATH OF THE ANTENNA WHEN THE POWER IS ONI DO NOT WORK ON THE WAVE-GUIDES WHILE THE POWER IS ONI High Frequency electromagnetic radiation can cause fatal internal burns. If you feel the slightest warming effect while near this equipment, MOVE AWAY QUICKLY!

CAUTION
The LNA is mounted on the center section of the antenna. Use extreme care during this procedure to avoid damage to the LNA and the other mounted electronic units. The LNA weights approximately 13 pounds.

NOTE
When waveguide flanges are opened to expose the interior of the waveguides, it is very important to ensure that no moisture, dirt or other contamination enters the waveguides.

a. Disconnect the SHF OUTPUT type N connector.

b. Loosen the six socket-head captive screws around the RF input waveguide. The screws are fully loosened when the heads are extended under spring pressure.

c. Disconnect the power connector.

d. Hold the LN in place and loosen the four captive screws which secure the LNA to the center section of the antenna.

e. Remove the LNA, taking care not to damage the input waveguide.

f. Remove the three sunshields and their standoff supports from the faulty LNA, noting their positions.

g. Install the standoff supports and the three sunshields on the replacement LNA in the same positions as on the faulty LNA.

h. Install the replacement LNA by performing steps *a* through *e* in reverse order.

Section XV. MAINTENANCE OF LNA BITE

5-52. Scope

This section contains instructions for the operational checkout and adjustment of the LNA BITE and for removal and replacement. The LNA BITE also includes a coaxial transfer switch to provide LNA output switching. If this switch fails, the LNA BITE must be replaced and then returned to the next higher level of maintenance.

5-53. Operation

a. The LNA BITE receives power from, and is controlled by, the LNA control/translator. It also serves as an interface between the LNA control/ translator and the waveguide switch. When the ON LINE switch on the LNA control/translator is placed to the LNA NO. 1 position, the control signal passes through the LNA BITE to the LNA waveguide switch, which connects the antenna to the input of (on-line) LNA 1.

b. The LNA waveguide switch also connects the LNA BITE test output cable to the input of (standby) LNA 2. An auxiliary set of contacts in the LNA waveguide switch provides for the ON LINE indicator on the LNA control/translator and also for the coaxial transfer switch in the LNA BITE. The coaxial transfer switch connects the output of (on-line) LNA 1 to the downconverter inputs and the output of (standby) LNA 2 into the LNA BITE for testing. When the ON LINE switch is placed to the LNA NO. 2 position, then LNA 2 is connected (on-line) between the antenna and the downconverter and LNA 1 is connected (in standby) to the LNA BITE for test.

5-54. Adjustment (fig. 5-28)

WARNING
ELECTROMAGNETIC RADIATION
DO NOT STAND IN THE DIRECT PATH OF THE ANTENNA WHEN THE POWER IS ONI DO NOT WORK ON THE WAVE-GUIDES WHILE THE POWER IS ONI High frequency electromagnetic radiation can cause fatal internal burns. If you feel the slightest warming effect while near this equipment, MOVE AWAY QUICKLY!

The LNA BITE should be adjusted whenever the Gunn oscillator in the LNA BITE is tuned to a different frequency. Whenever the standby LNA test shows a fault on both LNAs, the LNA BITE adjustment should be checked and the LNAs retested, in standby, to help determine if the LNA BITE is faulty before replacing the LNA.

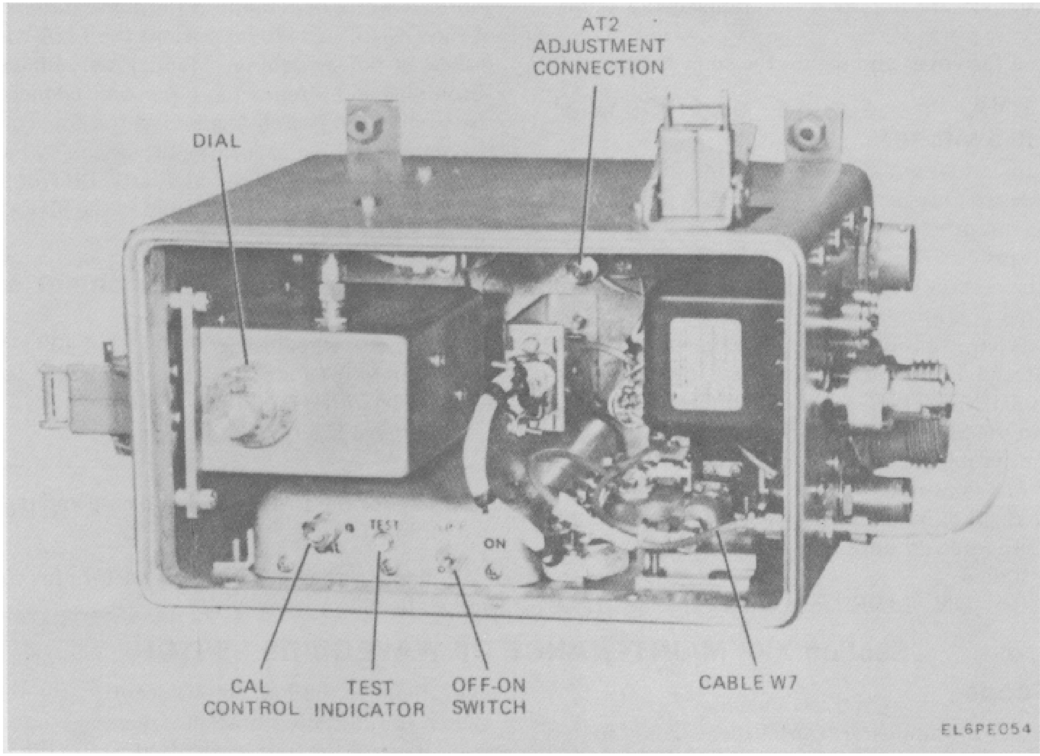

Figure 5-28. LNA BITE, Adjustment Items.

a. At the LNA control/translator check that the POWER circuit breaker is in the ON position and all power supply voltages are normal.

WARNING

To perform the following procedures, it is necessary to have access to the LNA BITE mounted on the antenna center section. Be careful not to disturb the cabling or the other mounted electronics. Avoid any radiation exposure; do NOT go in front of the antenna.

CAUTION

Never operate the STBY LNA TEST/TEST switch to the ON position while the adjustment is being performed. This could cause damage to the indicator lamp in the LNA BITE.

b. Release the two snap fasteners which secure the cover on the LNA BITE and open the cover.

c. Remove cable W7 from its operational position (inside of STANDBY LNA RETURN connector) and connect it to the adjustment connection at AT2.

d. Refer to the calibration chart in the top cover. The three digit number next to a frequency indicates the dial setting for that frequency. The frequency used for test should be one that will not interfere with the communications channel. A good practice would be to keep the test frequency at 7510 MHz as long as the communications channel is not operating in this range.

e. Loosen the jam nut on the CAL control.

f. Place the OFF-ON switch to the ON position and hold it in that position while completing the adjustment of steps g and h below.

g. Adjust the CAL control until the TEST indicator is illuminated.

h. Slowly readjust the CAL control until the TEST indicator is just extinguished.

i. If steps *g* and *h* above cannot be performed, the LNA BITE should be replaced (para 5-56) and returned to the next higher level of maintenance.

j. Tighten the jam nut on the CAL control. Do not change the adjustment when tightening the nut.

k. Return cable W7 to its operational position using the torque wrench.

l. The standby LNA may now be tested at the LNA BITE utilizing the switch and indicator lamp.

m. If a faulty LNA is indicated, switch to the other LNA and test it. If only one LNA shows a fault check that you can get receive signals. If good signals are received, check the coaxial tranfer switch (para 5-55).

If good signals are not received, replace the faulty LNA.

n. Close the cover and secure the snap fasteners.

5-55. LNA Waveguide and Coaxial Transfer Switches.

If communications signals are not getting through and there is reason to believe that the LNA is functioning properly, the problem may be in one or both of the X-Band transfer switches.

a. If the correct ON LINE indicator is illuminated on the LNA control/translator, the problem could be in the coaxial transfer switch located in the LNA BITE. At the LNA BITE, disconnect the RF cable from the SHF OUTPUT jack and connect this cable directly to the SHF output of the on-line LNA. If this solves the problem, replace the LNA BITE (para 5-56). If this does not solve the problem, replace the faulty LNA (para 5-50). The system may be operated in this configuration until a replacement LNA BITE can be installed.

b. If the ON LINE indicators at the LNA control/translator remain in the same state regardless of the ON LINE switch position, the LNA waveguide switch is not switching. Manual switching may be accomplished by removing the power connector from the waveguide switch, removing the top cover from the manual knob and turning the switch by hand. The RF cable connector to the SHF OUTPUT of the LNA BITE must be connected directly to the SHF output of the desired LNA.

5-56. Removal and Replacement of LNA BITE

a. Remove all cables from the LNA BITE.

b. Loosen the four captive screws which secure the LNA BITE to the mounting plate.

c. Remove the LNA BITE.

CAUTION

Remove the LNA BITE with care and do not drop it.

d. Replace the LNA BITE by performing steps *a, b,* and *c* above in reverse order.

Section XVI. MAINTENANCE OF WAVEGUIDE SWITCH

5-57. Scope

Maintenance of the shelter transmit waveguide switch (HY2) is limited to removal and replacement of the unit.

5-58. Removal and Replacement of Waveguide Switch

The switch is located inside the shelter (roadside) in the top of rack 3 over the power amplifier unit.

a. On the RF and waveguide switch feed-through panel; loosen the waveguide captive fastener and ten Phillips head screws.

b. Disconnect the waveguide interlock connector, remove the PA selector knob and four captive panel screws, and remove the panel from the rack.

c. Inside of panel opening, remove the connector from the waveguide switch and four hex screws and washers from each of the three ports (left, bottom, and top).

d. Remove the four screws securing the rear of the switch to the ceiling bracket.

e. Remove the four screws that secure the right port and the switch to the waveguide support bracket (behind the switch).

CAUTION

Exercise care not to scratch the waveguide or the switch port mating surfaces when performing step f below. Be sure that the recessed gasket between mating surfaces is not damaged.

f. Remove the switch slowly while providing clearance for the gasket and mating surfaces.

NOTE

When replaceing the switch, be sure not to dislodge the gasket on the waveguide ends.

g. To replace the switch, perform steps a through *f* above in reverse order.

Section XVII. MAINTENANCE OF COMMUNICATIONS SYBSYSTEM

5-59. Scope

This section contains instructions for removal and replacement of communications subsystem units.

5-60. Removal and Replacement (fig. 1-6)

a. Removal and Replacement of C/N Test Set, A1(TS-3580).

(1) Turn the power switch to OFF.

(2) Loosen all captive screws securing front panel to rack and pull on edges of front panel to extend the drawer to its maximum open position (as allowed by the opening stops on the drawer slide assembly).

(3) Remove input and output cables from rear of unit.

(4) Disconnect all associated cabling from ac outlets located at rear of rack.

(5) Depress slide stop tabs and slide unit outward until clear of slide tracks.

(6) Reinstall unit following steps (1) through (5) above in reverse order.

b. Removal and Replacement of IF Patch Panel. (A2).

(1) Remove all external cabling from front panel.

(2) Loosen all captive screws securing front panel to rack and pull on the two front panel handles to extend the drawer to its maximum open position (as allowed by the opening stops on the drawer slide assembly).

(3) Disconnect all associated cabling from connectors on rear chassis panel.

(4) Depress slide stop tabs and slide unit outward until clear of slide tracks.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

c. Removal and Replacement of Modem A3 and A6 (MD-1002).

(1) Turn RACK 5 power switch on power distribution panel OFF.

(2) Turn the POWER switch to the OFF position.

(3) Loosen all captive screws securing front panel to rack and pull on the two front panel handles to extend the drawer to its maximum open position (as allowed by the opening stops on the drawer slide assembly).

CAUTION

Because of unit weight, two persons are required for removal purposes.

(4) Remove all cabling from connectors on the rear of unit.

NOTE

Disengage two cable harness support clamps from modem.

(5) Disconnect two ground wires (ring-type connections) from ground studs located on rear of chassis.

(6) Depress slide stop buttons and carefully slide unit outward until clear of slide tracks.

(7) Reinstall unit following steps (1) through (5) above in the reversed order.

d. Removal and Replacement of Encoder-Decoder A4 and A5 (KY-801).

(1) Turn RACK 5 power switch on power distribution panel to OFF and turn the power switch on unit to the off position.

NOTE

Both units (A4 and A5) are located in the same housing assembly and may be replaced as a pair or independently as required.

(2) Loosen all captive screws securing front panel of the main housing assembly of the rack and pull on the two main housing handles to extend the drawer to its maximum open position (as allowed by the opening stops on the housing slide assembly).

(3) Remove all cabling from connectors on the rear of unit being replaced.

(4) Loosen and rotate captive retaining tabs securing unit to main housing and slide unit outward until clear of housing.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

e. Removal and Replacement of Spectrum Analyzer A7 (HP-141T).

(1) Turn the power switch to the OFF position.

(2) Remove all external cables from front panel.

(3) Loosen all captive screws securing front panel to rack and pull on front panel handles to extend the drawer to its maximum open position (as allowed by the opening stops on the drawer slide assembly).

CAUTION

Because of unit weight and contents two persons are required for removal purposes. Extra precautions should be observed when handling, so as not to damage CRT in main frame assembly.

(4) Remove power cord from its connector at rear of unit.

(5) Depress slide stop buttons and carefully slide unit outward until clear of slide tracks.

(6) Reinstall unit following steps (1) through (5) above in reverse order.

f. Removal and Replacement of Digital Test Set A9 (TS-3642).

(1) Turn the power switch to the off position.

(2) Remove all external cables from front panel.

(3) Loosen all captive screws' securing front panel to rack and pull on the two front panel handles to extend the drawer to its maximum open positon (as allowed by the opening stops on the drawer slide assembly).

CAUTION

Because of unit weight, two persons are required for removal purposes.

(4) Remove power cable from rear of unit.

(5) Depress slide stop buttons, and carefully slide unit outward until clear of slide tracks.

(6) Reinstall unit following steps (1) through (5) above in reverse order.

g. Removal and Replacement of Orderwire Shelf, A10.

(1) AC power to this shelf may be turned off by pulling out power plug after gaining access (located on rear of shelf).

(2) Remove module retention bar from front assembly.

(3) Loosen all captive screws securing front of shelf to rack and pull edge of shelf carefully outward nearly all the way.

CAUTION

Unit All directly beneath this unit must be installed at this time in order to prevent the rear of the orderwire shelf from falling downwards as the unit is pulled past the short rear support rails. In the event that unit All cannot be installed at this time, extra precaution should be given to pulling the unit from the rack.

(4) Disconnect all cables from connectors mounted on rear of shelf.

(5) Carefully pull unit out past front rail supports.

(6) Reinstall unit following steps (1) through (5) above in reverse order. (Carefully guide unit into rack on support rails.)

h. Removal and Replacement of Analog/Digital Converter, All and A12 (CV-3034).

(1) Place the POWER switch located on the unit to the OFF position.

NOTE

Because of vertical clearances between the two units and the support system, unit All may be removed independently from the rack. If unit A12 is to be removed, unit All should first be removed before any attempts are made to remove unit A12.

(2) Remove the four, cross-recess head captive screws from the front panel of rack.

(3) Carefully pull unit out of rack just far enough to disconnect all cables from rear mounted connectors.

(4) Remove cabling and withdraw unit from rack.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

i. Removal and Replacement of Multiplexer A13 (AN/FCC-98).

NOTE

Front cover on unit may be left in place during removal of unit.

(1) Turn the power switch for rack No. 6 (located on the power distribution panel) to the OFF position. This disables all primary power to the rack.

(2.) Remove units A9 through A12 above the multiplexer following procedures previously outlined.

(3) Remove all loose hardware retaining front panel to rack.

(4) Carefully slide unit on support rails approximately ten inches out of rack.

CAUTION

Because of unit weight two persons are required for removal purposes.

(5) Remove all cabling from connectors on rear of unit.

(6) Carefully pull unit completely out of rack.

(7) Reinstall unit following steps(l) through (6) above in reverse order.

NOTE

During step (7) above, observe the following cable reinstallation sequence:

(a) Working from operator's right to left, reinstall rectangular connectors with captivated screws.

(b) Reinstall large rectanglar connector with captivated screws.

(c) Reinstall eight twin-axial plugs.

(d) Reinstall eight circular connectors (work from bottom to top).

(e) Reinstall power connector at top.

j. Removal and Replacement of LIU Shelf, A14.

(1) Remove units A15 and A14. Follow this procedure as outlined for the applicable unit.

NOTE

The blank panel positioned between units A14 and A15 does not have to be removed.

(2) Turn the three power switches located on modular unit to the OFF position.

(3) Remove all plugs from front of modules. (Note their proper location for reinstallation.)

(4) Remove loose hardware retaining front panel to rack and pull on edges of panel in-order that unit may be pulled approximately half way out of rack.

(5) From underneath unit, disconnect all circular connectors.

(6) Reinstall unit following steps (1) athrough (5) above in reverse order.

k. Removal and Replacement of TTY/Low Level Patch Panel, A15.

(1) Remove all external cables from front panel.

(2) Loosen all captive screws securing front panel to rack and pull on edges of front panel to extend the drawer to its maximum open position (as allowed by the opening stops on the drawer slide assembly).

(3) Disconnect all cabling from connectors located on rear of chassis.

(4) Depress slide stop tabs, and slide unit outward until clear of slide tracks.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

l. Removal and Replacement of Transmission Test Set, A16.

(1) Turn the power switch to the OFF position on the unit.

(2) Loosen all captive screws securing the front panel to rack. (While carefully supporting unit, pull partially out of rack).

(3) Disconnect power cords from rear of unit.

(4) Remove unit from rack.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

m. Removal and Replacement of the TTY Loop Monitor, Al 7.

(1) Remove unit A16 following the procedure as outlined in step *l* above.

(2) Loosen all captive screws securing front panel to rack and pull drawer partially out of rack to enable access to rear connectors.

(3) Remove rear connectors and completely withdraw unit from rack.

(4) Reinstall unit following steps (1), (2), and (3) above in reverse order.

n. Removal and Replacement of TTY/FSK Patch Panel, A18.

(1) Remove all external cables from front panel.

(2) Remove unit A17 following the procedure as outlined in step m above.

(3) Remove loose screws securing front panel to rack.

(4) Pull unit slightly out of rack to gain access to connectors on rear of chassis.

(5) Working above unit, remove circular connectors on rear of chassis and completely withdraw unit from rack.

(6) Reinstall unit following steps (1) through (5) above in reverse order.

NOTE

Reinstall connectors in the following sequence: J5, J4, J1, J2, and J3.

o. Removal and Replacement of the Keyer/Converter Shelf, A19.

(1) Remove units A16, A17, A18, A34, A35, and A36 following the procedures as outlined in steps *l, m, n, ae, af* and *ag.*

NOTE

Units A34, A35, and A36 are located behind units A16, A17, and A18.

(2) Remove loose screws securing front of shelf to rack.

(3) Working above unit, remove connectors from rear of chassis.

(4) Remove plug-in units A1 through A8.

(5) Remove a screw on each side of the chassis near the rear.

(6) Slide unit along the side rails and withdraw it completely from the rack.

(7) Reinstall unit following steps (1) through (6) above in reverse order.

p. Removal and Replacement of the Filter Bridge Shelf, A20.

(1) Repeat steps *l* through *o* above.

(2) Remove loose screws securing front of shelf to rack.

(3) Working above unit, remove connectors from rear of chassis.

(4) Slide unit along the side rails and withdraw it completely from the rack.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

q. Removal and Replacement of KG-81 Shelf, A21.

(1) Repeat steps *l* through *p* above.

(2) Remove combination lock from locking bar and remove locking bar.

(3) Remove two KG-81 units from shelf after loosening captivated screws securing units to shelf.

(4) From inside of shelf, remove two loose screws retaining unit to KG-81 power supply support.

(5) Pull drawer partially out of rack for access to rear connectors.

(6) Remove one circular and 10 triaxial connectors from top apron on chassis and remove the ten triaxial connectors located at rear.

(7) Reinstall unit following steps (1) through (6) above in reverse order.

r. Removal and Replacement of KG-81 Power Supply No. 1, A22.

(1) Turn the power switch to the OFF position on the unit.

(2) Remove loose hardware securing front panel to rack.

(3) Pull on the two front panel handles to extend the drawer to its maximum open position, as allowed by the opening stops on the drawer slide assembly.

CAUTION

Because of unit weight, two persons are required for removal purposes.

(4) Disconnect two circular connectors and spade lug at ground stud connection on rear of unit.

(5) Depress slide stop tabs and slide unit outward until clear of slide tracks.

(6) Reinstall unit following steps (1) through (5) above in reverse order.

s. Removal and Replacement of KG-81 Power Supply No. 2, A23. Same as step *r* above.

t. Removal and Replacement of the Echo Suppressor Unit, A24 (ES-3B).

(1) Turn the power switch on the unit to the OFF position.

(2) Remove the top access panel from the side of rack 8 (located above the central distribution frame A30).

(3) Through access panel opening, remove eight circular connectors from rear of chassis.

(4) Remove captivated screws securing front of unit to rack; and while depressing slide stop tabs, slide unit outward until clear of slide tracks.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

u. Removal and Replacement of VF Patching Panel, A25.

(1) Remove the top access panel from the side of rack 8 (located above the central distribution frame A30).

(2) Loosen captivated screws securing front panel to rack and pull unit out of rack approximately four inches to gain access to rear connectors.

(3) Starting with the bottom row and working upwards, remove 12 circular connectors from rear of unit.

(4) Slide unit out of rack while depressing slide stop tabs until clear of slide tracks.

CAUTION

Because of unit weight two persons are required.

(5) Reinstall unit, following steps (1) through (4) above in reverse order.

v. Removal and Replacement of the Line Conditioning. Unit No. 2, A26.

(1) Repeat step u above.

(2) Remove all modules from front of unit to gain access to retaining hardware.

(3) Remove two loose screws retaining unit to side of support rails from inside of shelf and remove loose hardware retaining front of unit to rack.

(4) Working from above unit, remove six circular connectors from rear of unit.

(5) Remove unit by sliding unit out of rack along the support rails.

(6) Reinstall unit by following steps (1) through (5) above in reverse order.

w. Removal and Replacement of the Line Conditioning Unit No. 1, A27.

(1) Repeat steps u and v above.

(2) Remove all modules from front of unit to gain access to retaining hardware.

(3) Remove two loose screws retaining unit to side of support rails (from inside of shelf), and remove loose hardware retaining front of unit to rack.

(4) Working from above unit, remove six circular connectors from the rear panel.

(5) Remove unit by sliding unit out of rack along the support rails.

(6) Reinstall unit by following step (1) through (5) above in reverse order.

x. Removal and Replacement of the Controller Signaling Shelf, A28.

(1) Repeat steps *u, v,* and *w* above.

(2) Loosen the captivated screws securing retaining bar across shelf and remove bar.

(3) Pull out the control monitor panel from the front of the shelf.

NOTE

Two flying leads are attached to this panel and must be removed from the connectors mounted inside the shelf before the panel can be totally withdrawn from the shelf.

(4) Remove all remaining module boards from shelf.

(5) Remove loose hardware retaining front of shelf to rack and work from inside of shelf to remove two retaining screws on the sides.

(6) Remove two jam nuts on connectors J16 and J17 from inside of shelf which allows the two connectors to be pushed out of rear apron on unit.

(7) Working from above unit, remove three circular connectors from rear and slide unit along the support rails until clear of rack.

(8) Reinstall unit by following steps (1) through (7) above in reverse order.

y. Removal and Replacement of Multiplexer, A29 (AN/FCC-98.)

NOTE

Front cover on unit may be left in place during removal of unit.

(1) Turn the power switch for rack 8 (located on the power distribution panel) to the OFF position.

(2) Remove the bottom access panel from the side of rack 8 (located below the central distribution frame, A30).

(3) Remove all loose hardware retaining front panel to rack.

(4) Carefully slide unit on support rails (approximately ten inches) out of rack.

CAUTION

Because of unit weight, two persons are required for removal purposes.

(5) Remove all cabling from connector on rear of unit.

(6) Carefully pull unit completely out of rack.

(7) Reinstall following steps (1) through (6) above in reverse order.

NOTE

During step (7) above, observe the following cable reinstallation sequence:

(a) Working from operator's right to left, reinstall rectangular connectors with captivated screws.

(b) Reinstall large rectangular connector with captivated screws.

(c) Reinstall eight twin-axial plugs.

(d) Reinstall eight circular connectors working from bottom to top.

(e) Reinstall power connector at top.

z. Removal and Replacement of the Central Distribution Frame (CDF), A30.

CAUTION

Because of unit weight, two persons are required for removal or installation purposes.

(1) Remove four circular connectors from top of frame and one from back.

(2) Remove four circular connectors from bottom of frame.

(3) Remove the plexiglass terminal block protective cover from upper region of unit, and remove all ring-type ground lugs with wires attached from terminal block. Reinstall all loose hardware.

(4) Remove five captivated screws from bottom flange on unit and the five captivated screws from the top flange (being careful and support unit).

CAUTION

Do not use the folding handle on the front surface of the unit for either supporting or lifting purpose.

(5) Reinstall unit by following steps (1) through (4) above in reverse order.

aa. Removal and Replacement of the Oscilloscope, A31 (R-7704).

(1) Turn the power switch on the unit to the OFF position.

(2) Remove the loose hardware retaining front of unit to rack and pull unit out to the first stop.

(3) From underneath the scope (above the teletype machine), remove the power plug from the wall mounted receptacle.

(4) While depressing the slide stop tabs, carefully withdraw the unit from the rack until clear of slide tracks.

CAUTION

Because of unit weight, two persons are required for removal purposes. Observe extra caution while handling the fragile cathode-ray-tube.

(5) Reinstall unit following steps (1) through (4) above in reverse order.

ab. Removal and Replacement of the Teletype Machine, A32.

WARNING

The teletype weighs 100 pounds. Two persons are required to lift it.

(1) Turn the POWER switch on the unit to the OFF position.

(2) Loosen captive screws securing front of tray to rack.

(3) Pull the tray out of the rack as far as the slide stop buttons enable the slides to extend.

(4) Remove slide stops by removing Phillips screw.

(5) Carefully extend drawer to obtain access to two connectors on rear of unit.

(6) Remove two circular connectors from rear of unit.

(7) Working from underneath the unit, remove the six bolts retaining the teletype machine to the tray.

(8) Carefully lift unit off of tray.

(9) Reinstall unit following steps (1) through (8) above in reverse order.

ac. Removal and Replacement of the AC Regulator Monitor Panel, A33.

(1) After opening hinged front panel of the data patch panel (A8), remove the power plug from the right-hand side of the AC voltage regulator (located inside the rack). This procedure disables power to the monitor panel.

(2) Being careful to keep the monitor panel from dropping, remove the captivated screws securing the front panel to the rack.

(3) Remove the plexiglass protective terminal board cover from TB1 and ring-type lug connections. (Replace all loose hardware on terminal board.)

(4) Remove the panel from the rack.

NOTE

If emergency operation of the terminal is required in the absence of the monitor panel, carefully tape lugs on ends of all six wires left exposed.

(5) Reinstall panel by following steps (1) through (4) above in reverse order.

ad. Removal and Replacement of the AC Voltage Regulator, VR1.

NOTE

This unit is located behind the data patch panel, A8.

(1) Repeat step f above.

(2) After loosening the captivated screws for unit A8, swing the hinged cover open.

(3) Remove the six screws from underneath the unit.

(4) Repeat step e above to enable this unit to be pulled out from the rack for enough to allow removal of the AC voltage regulator power plug from the wall mounted receptacle.

(5) Remove the AC power plug from the connection on the right-hand side of regulator.

(6) Carefully lift unit out of rack.

(7) Reinstall unit following steps (1) through (6) above in reverse order.

ae. Removal and Replacement of the 48V Power Supply No. 1, A34.

NOTE

This unit is located behind the transmission test set A16.

(1) Turn off the power to the unit by placing the proper toggle switch in the OFF position (located on the control monitor panel, A28.

(2) Remove unit A16 following the procedure as outlined in step *l* above.

(3) Loosen the two front horizontally mounted captivated screws securing the unit to its support frame.

(4) Remove the two top-mounted circular connectors.

(5) Carefully lift the unit from the rack.

CAUTION

Because of unit weight, two persons are required for lifting purposes.

(6) Reinstall unit following steps (1) through (5) above in reverse order.

af. Removal and Replacement of the 48 V Power Suply No. 2, A35. Same as step *ae* above.

ag. Removal and Replacement of the 20 Hz Ringing Generator, A36.

(1) Turn off the power to the unit by placing the proper two toggle switches located on the control monitor panel (A28) in the OFF position.

(2) Remove units A16, A17, A18, A34, and A35 following procedures outlined in steps *l, m, n, ae*, and *af* above.

(3) Remove the two vertically mounted captivated screws from the front of the unit. Using a long screwdriver, remove the two horizontally mounted captivated screws from the rear of the unit.

(4) Remove one multipin connector on front of unit, and the spade-type connection from ground stud.

(5) Carefully slide unit along support rails from the rack.

(6) Reinstall unit following steps (1) through (5) above in reverse order.

CHAPTER 6
FUNCTIONING OF EQUIPMENT

Section I. GENERAL

6-1. Scope.

The following paragraphs describe Satellite Communications Terminal AN/TSC-86 on a functional basis. For more complete understanding of the information presented, refer to the functional block diagram, figure FO-4.

Section II. ELECTROMECHANICAL FUNCTIONAL DESCRIPTION

6-2. Terminal.

a. The high performance Satellite Communications Terminal AN/TSC-86 specifically developed for trunking applications includes a number of significant features such as:

(1) Ground mobility via M832 transporter in addition to M35 truck.

(2) Dual antenna capability-eight-foot ground mounted antenna AS-3036/TSC or 20 foot, high gain, AS-3199/TSC.

(3) Multiple IF capability of up and down converters-70 $\pm$ 20 MHz or 700 $\pm$ 62.5 MHz.

(4) Optional satellite tracking capability-beacon or communications signal.

(5) High degree of unit level commonality with AN/TSC-85 ( ), AN/TSC-93 ( ) and AN/TSC-94 ( ) terminals.

(6) Full complement of up and down converters included to support four carrier transmit and receive operations.

(7) On-board teletype terminal.

(8) Mission orderwire circuit included.

(9) Multiple carrier service with low intermodulation product levels when used with antenna type AS-3199/TSC.

(10) Independent subsystem design concept.

(11) Eight foot parabolic ground mounted antenna, AS-3036/TSC.

b. The AN/TSC-86 terminal is illustrated in a deployed configuration in figure 6-1. The companion power pallet with redundant 30 kW diesel generators provides primary power when commercial service is unavailable. Transferal of the total AC load from one generator to the standby unit is accomplished without terminal shutdown. The S-280 shelter and power pallet are shown in the ground transport mode via M-832 transporters in figure 6-2. Provisions are included for transportation of this equipment group via rail and sea in addition to fixed and rotary wing aircraft.

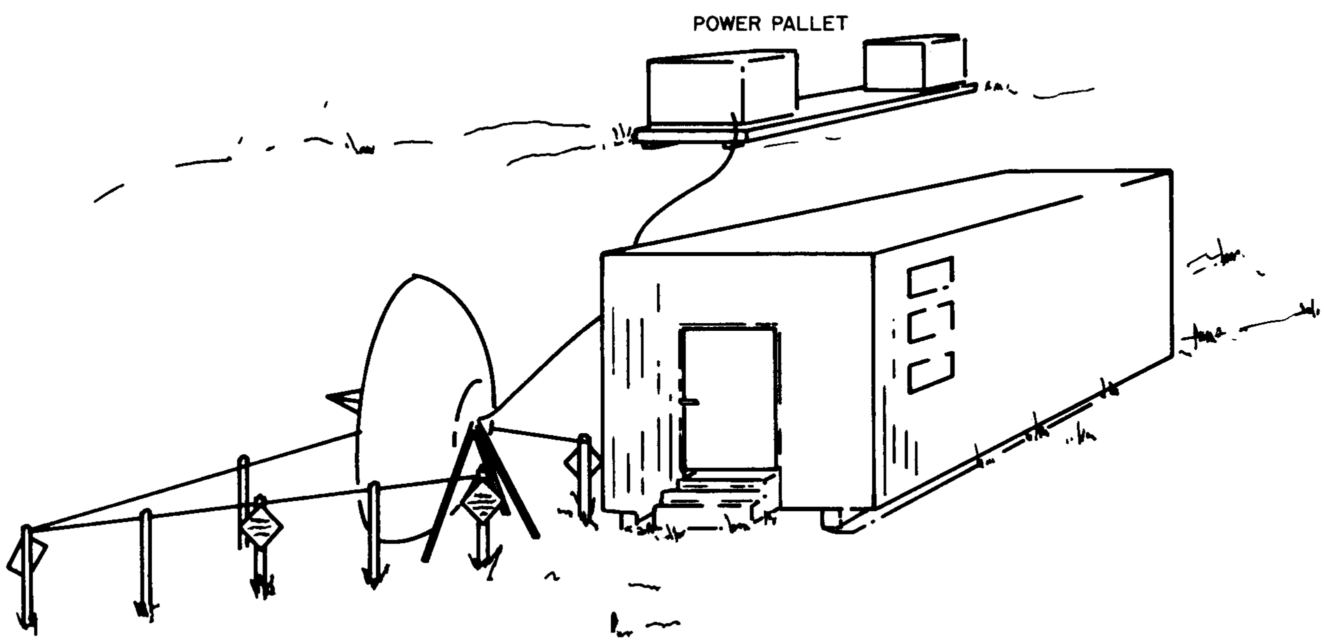

Figure 6-1. AN/TSC-86 Satellite Communications Terminal Deployed Less Transporters.

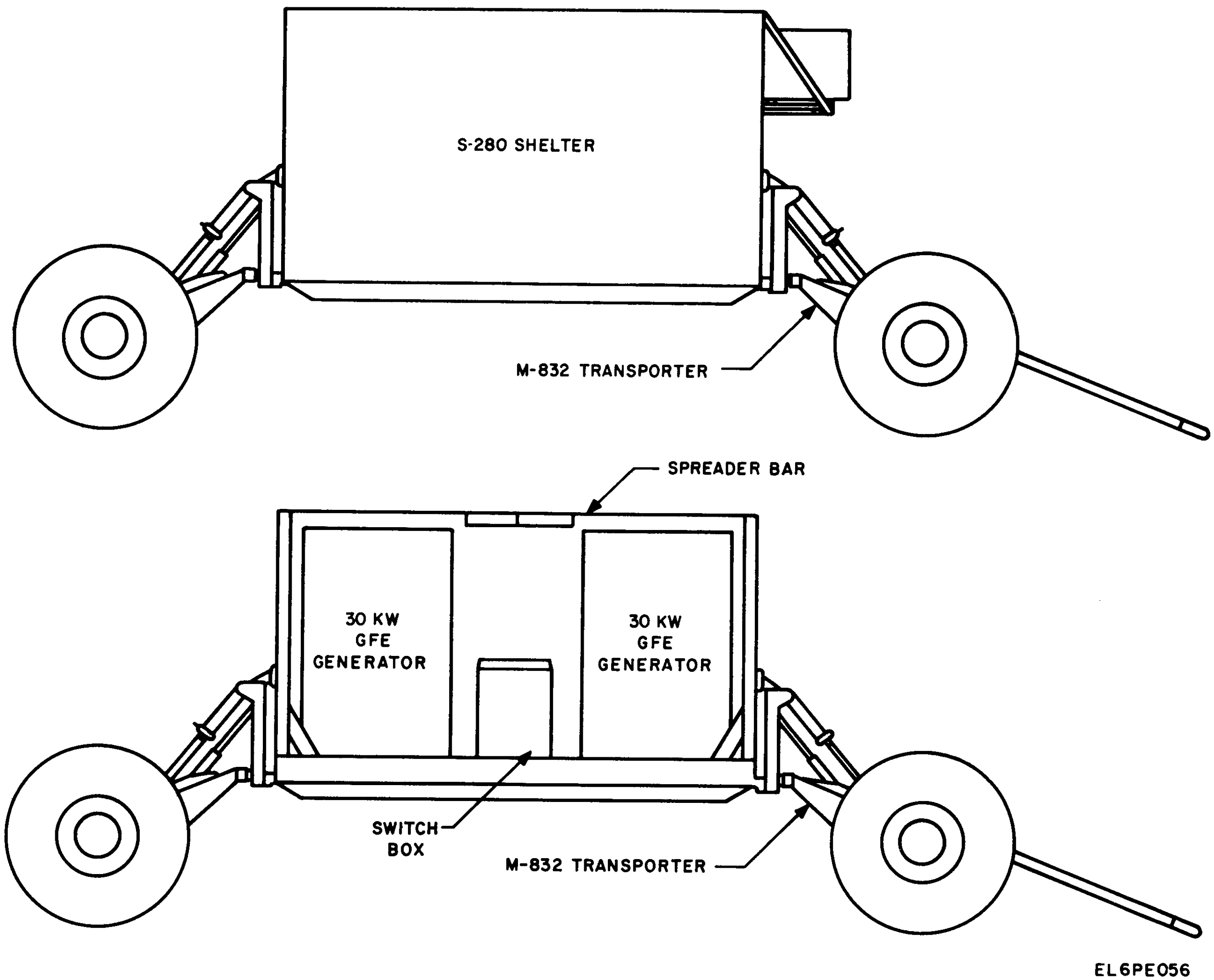

Figure 6-2. AN/TSC-86 Satellite Terminal Ground Transport Mode..

c. The terminal group is composed of three major subsections. These include an S-280 type shelter housing all terminal electronics (except the receiver low noise amplifier), an eight foot ground mounted parabolic antenna and primary power support pallet. The latter mounts two redundant 30 kW diesel generators for terminal excitation. Mobility is provided by two M-832 transporters. In the transport mode, all antenna sections and associated ground system are housed within the shelter. The terminal, readied for transport, is therefore reduced to two independent packages mounted on individual dolly assemblies. Terminal compatibility with the M35 truck permits transport by this vehicle if desired. The antenna interface permits replacement of the eight foot antenna with the AS-3199/TSC (20-foot) high gain antenna group for operation under multicarrier service. Operation with the latter requires the transfer of certain antenna mounted electronic items from the eight foot antenna to the larger unit. These elements consist of the receiver low noise front end and is limited to LNA devices. Compatible dimensions between the two antenna types have been maintained for easy substitution.

d. The shelter electronics complement is divided into two subsystems. These include:

(1) RF Subsystem (RSS).

(2) Communications Subsystems (CSS).

e. The RF subsystem (RSS) is configured to provide single SHF carrier transmission and reception from 70 ± 20 MHz IF ports supported by the communications sub-system. An auxiliary 700 MHz IF input/output capability is provided by the up/down converters with a ± 62.5 MHz bandwidth. Utilization of this larger bandwidth capability is presently restricted, however, by the limited bandwidth of the high power klystron amplifier which forms the output stage of the transmitter. Multicarrier performance is also included in the AN/TSC-86. Multiple up/down converters and associated combiner assembly are included in the equipment complement permitting transmission and reception of up to four carriers. Many of the design features implemented in the tactical equipment are included in this larger terminal. Commonality at the module and component levels between tactical and, contingency terminals optimize logistics support requirements for these systems.

f. The communications subsystem (CSS) provides the interface and signal processing functions between the individual field user lines and the RF subsytem of the AN/TSC-86 terminal. Baseband and signal conditioning equipment included in the CSS provides processing of user VF, teletype and digital signals into a single PCM signal. Bulk encryption of this signal is provided by the TSEC/KG-81 prior to application to the QPSK/BPSK digital data modem. The 70 MHz output from the latter equipment is applied to the transmitter section of the RF subsystem. An on-board AN/UGC-129 teletype terminal and orderwire facility permits drop/insert of local comm-signals into the system. Modems, multiplexers, crypto devices and numerous other baseband equipments are redundant for reliability enhancement. Patching facilities are included to select the desired signal path through the equipment complement.

g. A central distribution frame (CDF) included as a portion of the CSS houses a matrix programming board which provides a traffic path reconfiguration capability. Thus the individual user lines terminating at the shelter entrance panel can be routed to specific channels of line conditioning equipment. The shelter side of the signal entry panel forms the main distribution frame (MDF). VF/TTY signal lines entering the terminal are terminated at EMP protection devices included in the MDF prior to routing to the CDF. Shielded data lines are terminated in lightning arrestors compatible with system requirements. Several analog and digital test sets are included in the CSS to provide instrumentation of VF/data circuits for monitor/maintenance purposes.

h. A plan view of the shelter entry panels and ports is shown in figure 6-3, and the roadside and curbside elevation views are shown in figure 6-4.

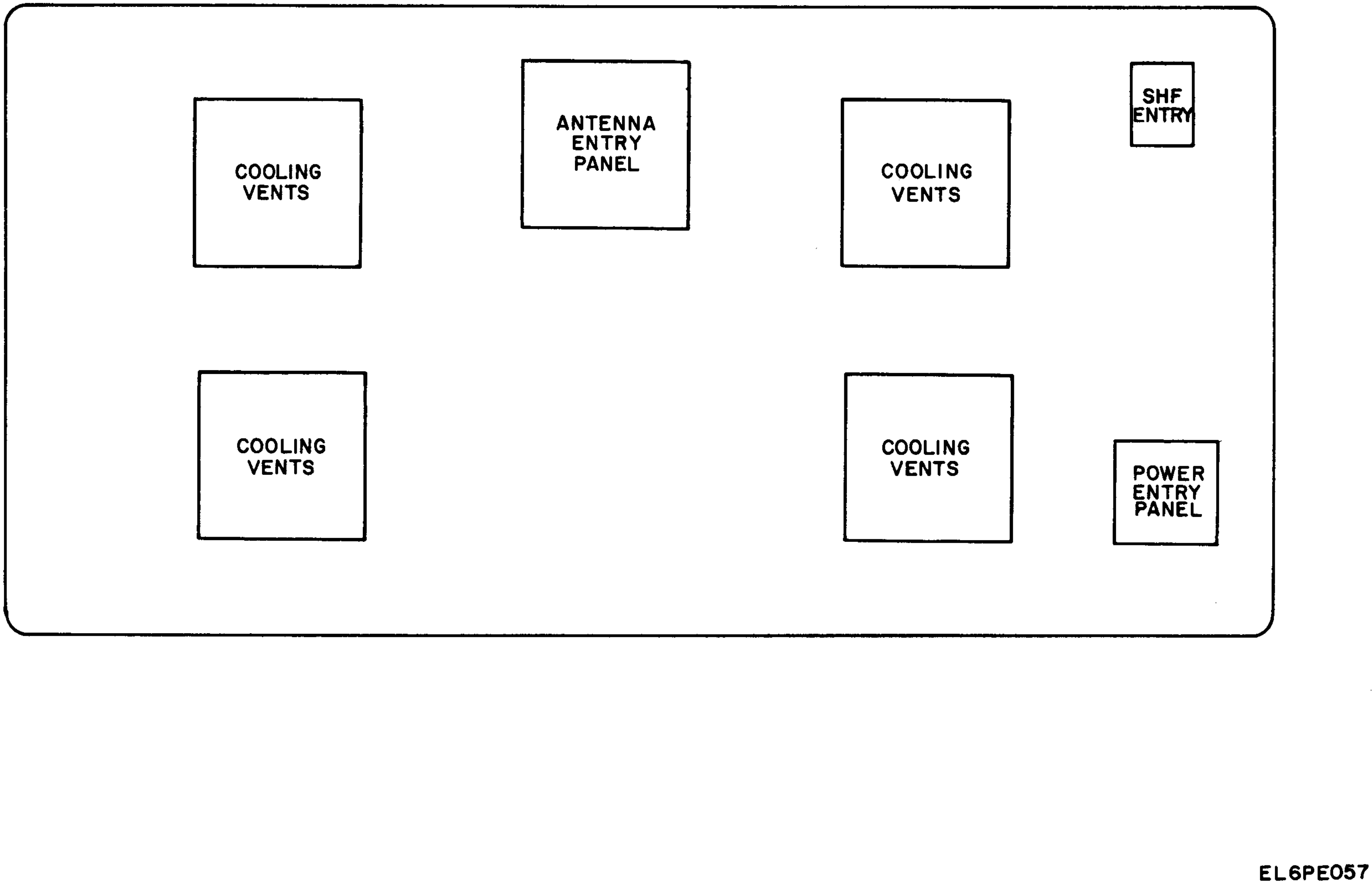

Figure 6-3. Shelter, Plan View of Entry Panels and cooling Parts.

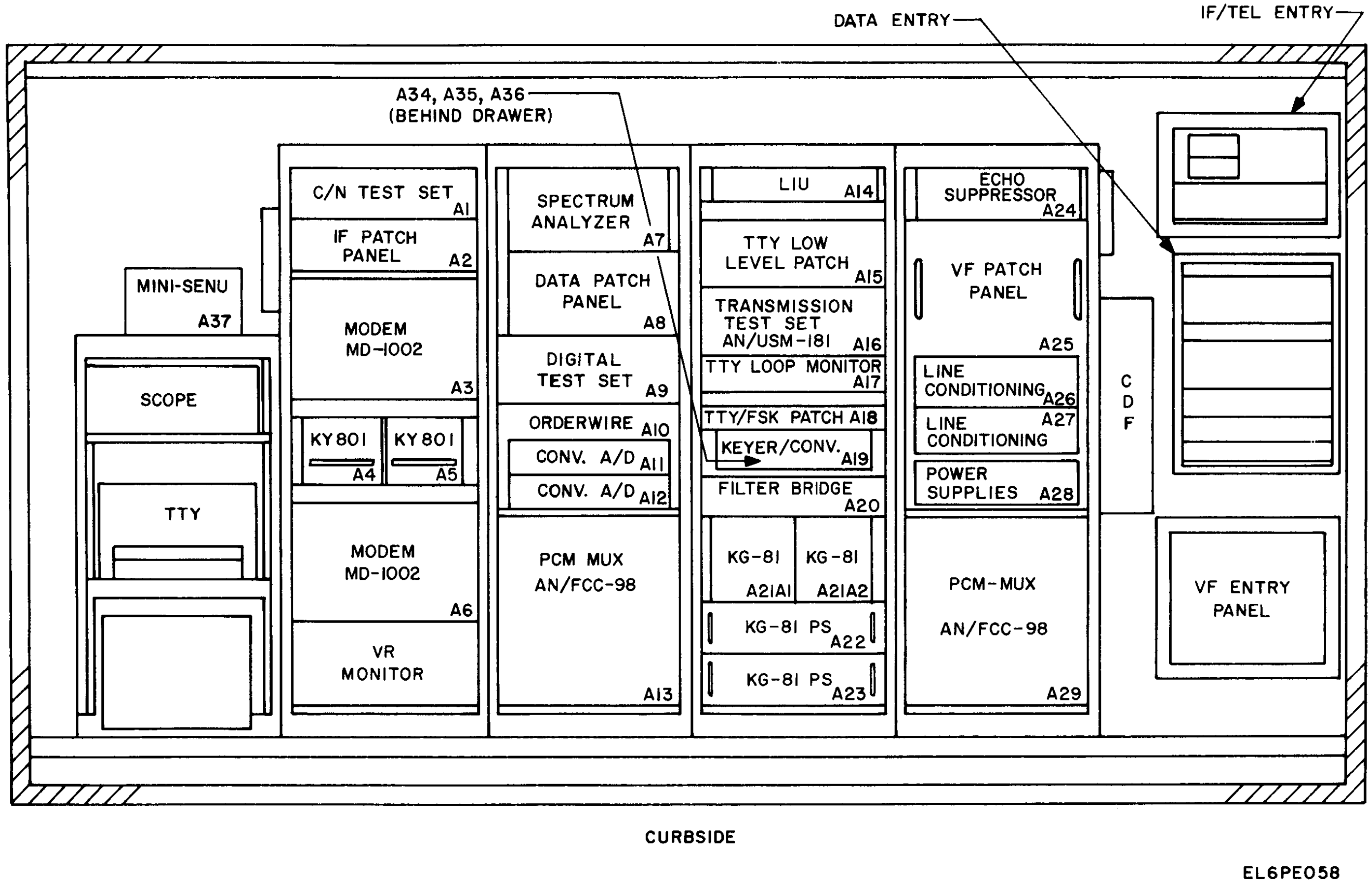

Figure 6-4. AN/TSC-86 Shelter Rack Elevation (Sheet 1 of 2).

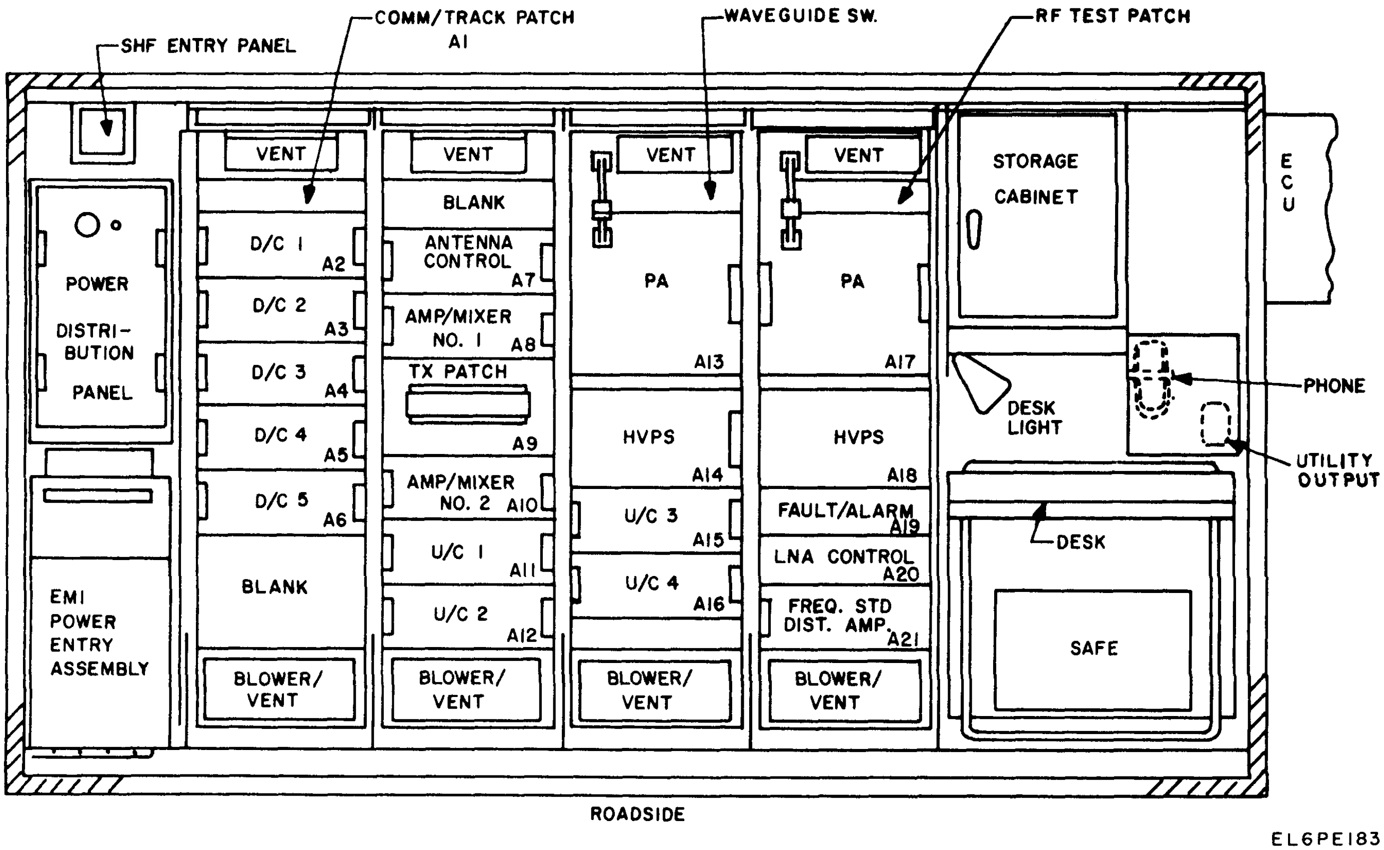

Figure 6-4. ANTSC-86 Shelter Rack Elevation (Sheet 2 of 2).

6-3. Terminal/User Interface

a. The AN/TSC-86 terminal accepts user voice/data/TTY traffic for processing and transmission on a full duplex basis. Individual user lines enter the terminal through three weatherproof entry panels located on the curb side of the shelter. These dedicated entry panels include:

(1) VF/TTY/entry.

(2) Data entry.

(3) IF frequency standard telephone entry.

b. Multiple RF carrier operation is available using four upconverters and associated amplifier/mixer, and four downconverters. This includes the capability of interfacing auxiliary IF signals of 70 ± 20 MHz or 700 ± 20 MHz directly with the transmitter upconverters and receiver downconverters on a full duplex basis.

6-4. Terminal Subsystems.

Functionally, the terminal is divided into a radio subsystem (RSS), a communications subsystem (CSS), and a power pallet. Each of these is briefly described in the following paragraphs.

6-5. Radio Subsystem

The radio subsystem (RSS) consists of the antenna group and the equipment that receives SHF satellite signals and converts them to either 70 - MHz IF signals for processing by baseband equipment or 700 - MHz IF signals for direct routing to users, and converts 70 - MHz IF signals from baseband equipment or 700 -MHz external IF signals to SHF high-ower signals and transmits them to the satellite. The RSS includes antenna tracking controls built in.

a. Antenna Group.

(1) The 8 foot antenna group consists of the reflector, mounting structure, feed assemblies, low noise amplifiers and associated BITE box, drives, and controls. The reflector consists of a center section and four quarter-section panels (or petals). The antenna contains both elevation and cross-elevation actuators for driving the reflector. The actuators are electrically connected by cables to an antenna control assembly mounted within the shelter. A remote control unit may also be connected to allow antenna control from outside the shelter.

(2) The antenna system has a limited tracking motion on each axis of ± 12.5 degrees. However, sector orientation to any point in space can be accomplished by initially pointing the front of the antenna structure to the satellite heading and by setting the antenna elevation between 0 and +90 degrees. Final positioning of the antenna during its setup is accomplished through the use of the antenna linear actuators. This orientation procedure provides the capability for full hemispheric coverage.

(3) Satellite acquisition is effected by an openloop scan through the area of uncertainty while observing the carrier level on the antenna control (or remote control). This is normally accomplished with the receiver tuned to the beacon signal and by manually controlling the antenna scan. (A remote antenna control box with a signal level meter and drive switches provides acquisition or tracking capabilities from outside the shelter.) A threshold circuit automatically stops the acquisition scan when the signal strength exceeds a set level. After acquisition, the tracking loop is closed and the antenna periodically scans through a random pattern about each axis.

(4) The antenna control unit interfaces the receiver with the servo system. The antenna control, track patch panel and downconverter combination permits the option of satellite tracking by means of the satellite beacon signal or a communications channel signal. A communication tracking module located within the antenna control unit accepts a beacon or communications signal from the designated tracking downconverter through the track patch panel for conversion into antenna tracking drive signals. Tracking by beacon or communications signal is determined by selection of the proper signal patch originating at the track patch panel. This patching and the resetting of the communications tracking module gain are the only operations needed to make the transfer between these sources.

b. Receiver Group. The AN/TSC-86 SHF receiver includes the communications and tracking signal receiving system composed of an antenna-mounted low-noise front end and multiple downconverters. The two low-noise amplifiers (LNA) with associated selector switch, wideband preselector, and BITE assembly are mounted as a subassembly of the antenna structure. Signals from the on-line LNA enter the shelter and are distributed to the five downconverters. Antenna tracking via satellite beacon or communications signal is selectable at the track patch panel. All downconverter communications channel output ports terminate at the IF patch panel for routing to CSS modems.

(1) *Low-noise front end*. The low-noise front end is contained in an antenna-mounted electronics (AME) assembly as shown in figure 6-5. It consists of a directional coupler, a wideband filter, a waveguide input transfer switch, two low-noise amplifiers (LNA), and an output coaxial switch (located in the LNA BITE assy). The transfer switches select one LNA as the on-line unit and connect the other to a BITE unit, which contains a test oscillator and detector for testing the off-line LNA. The transfer switches are controlled from the LNA control/translator inside the shelter. This dual LNA arrangement provides redundancy.

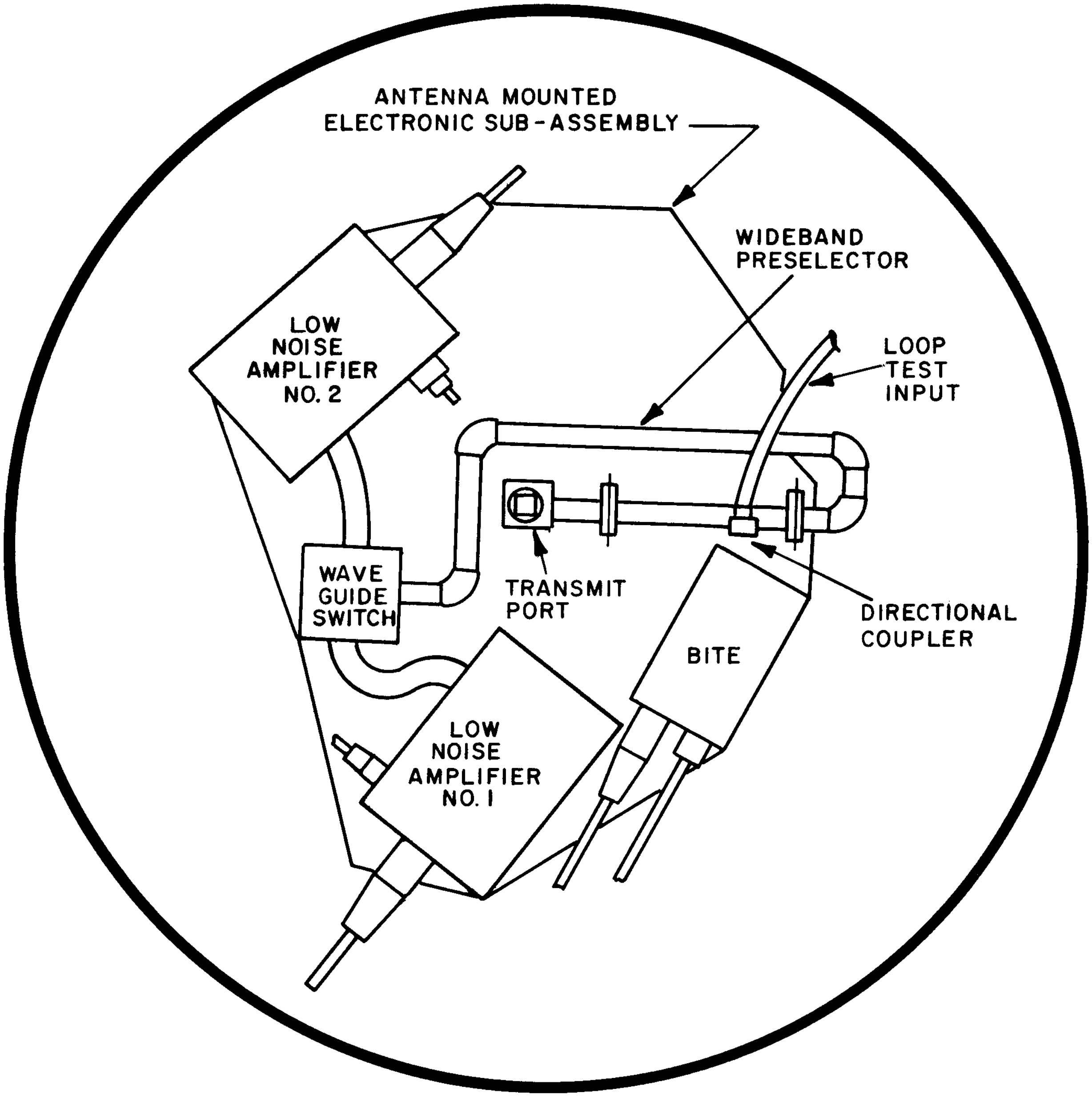

Figure 6-5. Antenna Mounted Electronics

(a) Low-noise amplifiers. The low-noise amplifiers (LNA) are SHF preamplifiers which provide sufficient gain to meet the receive system noise temperature requirements and adequate input to the downconverters in the shelter. Each LNA is contained in a weatherproof, temperature-controlled case mounted at the rear of the antenna center section. The LNA contains a parametric amplifier to assure stable operation, a bandpass filter, and an isolator. Each LNA also contains dc power supply, fault detection circuits, and amplifier test circuits. AC power is supplied from the LNA control unit located in the LNA control/translator. The unit is maintained at a constant temperature of + 75° C by a dual heater system. A 130-watt, thermostatically-controlled heater is on whenever the LNA is operating. Under low temperature conditions, an additional 300-watt element can be used to bring the LNA to operating temperature more quickly. Each LNA has a corresponding LNA control panel in the LNA control/translator.

This panel allows control of ac power, selection of normal or high heat, and control of the parametric amplifier and FET stages during testing of the LNA when it is in standby condition. Fault circuitry in the LNA is connected to a FAULT lamp on the LNA control panel to indicate failure of the unit out-of-tolerance voltages or temperature.

(b) LNA BITE assembly. The LNA BITE assembly switches the output of either LNA to the receiving equipment in the shelter. A second function of the unit is to generate and detect a test signal for testing the off-line LNA. When energized by a switch on the LNA control/translator, an SHF oscillator in the BITE assembly generates a test signal. This signal is routed through the standby LNA and re-enters the LNA BITE assembly, where is detected. If the gain of the LNA is at least 37 dB, the detected output causes the LNA NORMAL lamp on the LNA control/translator panel to light.

(2) *Received signal distribution*. After entering the shelter at the receive antenna entry panel, the SHF signals pass through a directional coupler having a minus 8 dB secondary port. Output from the secondary port is routed to downconverter No. 5, while signals exiting the through-port pass to a 4-way power divider which provides equal signal distribution to downconverters 1 through 4. Downconverter No. 5 receives approximately the same signal level as the other four. A second directional coupler is placed between the 4-way divider and downconverter No. 1. The secondary port of this coupler provides a test signal which appears at the RF test patch panel. Antenna tracking through satellite beacon or communications signal is selectable at the track patch panel. Beacon signal tracking requires the exclusive use of one downconverter, leaving the balance to support the multiple carrier requirement. All downconverters include both communications channel and tracking channel output ports. Each of the former ports terminate at the IF patch panel for routing to the CSS modems, while the latter from downconverters No. 1 and No. 5 feed the track patch panel for distribution to the tracking system.

(3) *Downconverter*. The downconverter uses a dual or single downconversion technique to convert the input SHF frequency (7250-MHz to 7750-MHz) to an IF frequency of 70 MHz or 700 MHz. The downconverter can be tuned through the receive frequency range in l-kHz increments by direct- reading front-panel switches.

(a) The downconverter contains a frequency synthesizer, a power supply, a downconverter mixer module, and BITE circuits.

(b) There are five downconverters in the terminal complement. Normally, four downconverters are on line and provide four independent 70-MHz or 700-MHz IF output signals. The fifth downconverter (No. 1 or No. 5) is used for tracking or is in standby condition.

c. Transmitter Group. The transmitter group receives 70-MHz IF signals from the CSS or 700-MHz IF signals from an external source by way of the IF patch panel. The IF signals are converted to a transmit frequency between 7900 MHz and 8400 MHz. The transmitter group may be operated in either the single carrier mode or in multicarrier modes using up to four carriers. However, the multicarrier modes may be used only with the 20-foot Antenna AS-3199/TSC, since the 8-foot antenna is not controlled for intermodulation product suppression. In the single carrier mode, either antenna type may be employed. The RF output from the power amplifier is routed through a manual waveguide switch to the antenna feed waveguide, or to a dummy load for test purposes. At the antenna, the RF output is applied directly to the antenna feed horn assembly.

(1) *Upconverter.* The upconverter is the first unit in the transmit chain of the radio subsystem. It accepts a 70-MHz IF signal from the communications subsystem (CSS) or from an external source, and translates it to a transmit frequency between 7900 MHz and 8400 MHz using double conversion techniques. It can also accept a 700-MHz IF and convert it to SHF by single conversion. The output of a single upconverter may be fed directly to a power amplifier (PA) for single carrier operation. For multicarrier operation, the outputs of up to four upconverters are combined in the amplifier/mixer drawer for application to a single PA.

(2) *Amplifier/mixer.* The amplifier/mixer drawer combines the SHF out-puts of two, three, or four upconverters onto one single lead and amplifies the combined signal. The combined output is connected through the transmit patch panel to the input of one of the two power amplifiers. The amplifier/mixer drawer provides isolation between the circuits to be combined, amplification of the combined signal, input and output level setting controls, and power monitoring and alarm functions. There are two amplifier/mixer units in the terminals.

(3) *Power amplifier high voltage power supply.* The power amplifier (PA) and its power supply (HVPS) are individually packaged units which are interconnected by the required cabling. Although physically separate, the PA and HVPS operate in the terminal as one functional unit, and are not capable of independent operation. There are two PA/HVPS combinations in the terminal.

(a) Power amplifier. The PA amplifies SHF output of either an upconverter or an amplifier/mixer to a power level sufficient to provide 1000 watts (single carrier case) at the antenna. Amplification in the PA is accomplished by a five-cavity, tuneable klystron. The cavities are tuned by presetting counter dials to numbers read from a drumtype tuning chart built into the klystron front. Both the dials and tuning chart are accessible through a door on the PA front panel. The PA design includes circuitry for protection against high load VSWR, power monitoring and low power alarm functions, and an output level control.

(b) High voltage power supply. The HVPS provides all necessary voltages for the PA, and sequences turn-on power to prevent surge damage. The front panel of the power supply contains status and fault indicators, as well as power, test, and monitor controls and indicators. The unit is powered by three-phase, 50/60 Hz from the power distribution panel.

(c) Waveguide switch. The output of each PA is routed to a manually operated waveguide transfer switch that serves to direct the power from a PA to the antenna, while routing the output of the other PA to a dummy load mounted at the upper rear part of rack 4. The switch is mounted in rack number 3. Actuation of the switch interchanges the role of each PA between being the on-line and off-line unit. With this switching system, the off-line PA (connected to the dummy load) may be operated for test or diagnostic purposes, or may be entirely removed from the shelter without affecting the communications functions of the terminal.

d. Patch Panels.

(1) *Comm track patch panel*. The comm track patch panel is used to select the track IF output of either downconverter No. 1 or No. 5 for input to the antenna control unit. The panel is also used to select either the comm track or beacon tracks modes. Beacon signal tracking requires that one downconverter be dedicated to tracking only.

(2) *Transmit patch panel*. The transmit patch panel is used to configure the transmit chain. The SHF outputs of the upconverters, the RF inputs and outputs of the amplifier/mixers, and the RF inputs of the power amplifiers appear on this panel.

(3) *RF test patch panel.* The RF test patch panel is used, in conjunction with the LNA control/translator, in testing the entire transmit/receive chain. Upconverters No. 1 and No. 2 each provide a 5-MHz output for use in the LNA control/translator. These 5-MHz outputs appear on the RF test patch panel, together with attenuated SHF outputs from the PA's, and the SHF and 5-MHz inputs to the LNA control/translator. In addition, a sample of the received RF signal is available at this panel for analysis.

6-6. Commmunications Subsystem

The communications subsystem (CSS) comprises equipment for processing voice, teletype, and data signals. For transmission, these signals are sent to the radio subsystem, normally as a phase-modulated, 70-MHz IF. In reception, a 70-MHz IF from the radio subsystem is demodulated, decoded, and otherwise prepared for use by the DCS/field user. Voice and teletype circuits are transmitted and received through four junction boxes, each box having 100 feet of cable attached. Two boxes are utilized for 12 voice circuits and five teletype (FSK) circuits. The third box is utilized for three high-level or four low-level teletype circuits. The fourth box is available for miscellaneous use through the CDF and VF patch panel.

a. Voice Frequency Circuit. User VF circuits are processed through line conditioning units which are configured for only the following traffic modes.

(1) 4-wire circuits employing either 1600 or 2600 Hz in-band signalling.

(2) 2-wire circuits employing 20 Hz ringdown line conditioning units can be configured to handle any of these traffic modes in any combination. Each signalling mode is converted to E & M signalling for proper MUX processing. Variations of user voice frequency levels are compensated by adjustable line amplifiers. The VF patch panel provides facilities for emergency patching and circuit monitoring on both line and equipment side of each processing unit. Each of the 12, full duplex circuits is routed through the echo suppressor included in the line conditioning equipment.

b. Teletype Circuits. The four keyers change the low-level teletype electrical impulses into frequency shift keying (FSK) and the four converters do the converse. Inputs from the five FSK teletype inputs plus the four internally-keyed teletype lines are fed to the TTY/FSK patch panel so they may be inserted into any of the nine channel inputs of the TTY filter bridge. A composite signal from the filter bridge will be fed to one channel of the multiplexer. Conversely, the received signal is fed through the filter bridge and the converters to the junction boxes.

c. Data Circuits. There are six synchronized data inputs, two asynchronous 75-ohm inputs, two asynchronous 50-ohm inputs, and two asynchronous user encrypted inputs that are 50 kb/s each. All data rates up to 512 kb/s are fed through the multiplexer. The two asynchronous, 50 kb/s circuits are fed through the CV-3034 analog-to-digital converters which make the signals compatible with the multiplexer. All data circuits enter or leave the shelter through data and clock connectors.

d. Auxiliary IF Circuits. Four auxiliary IF circuits are accessible at the outside wall of the shelter. These circuits may be used at either 70-MHz or 700-MHz and are routed to the IF patch panel where they may be patched to the up or down converters directly.

e. Orderwire. The orderwire unit is coupled through the VF patch to the multiplexer. The orderwire requires one VF channel in the multiplexer.

f. Signal Distribution. The baseband equipment provides the subscriber with the following possible communications circuits:

(1) 12 duplex voice-frequency circuits.
(2) 9 duplex teletype circuits.
(3) 4 duplex 0 to 20-kb/s synchronous circuits.
(4) 2 duplex 50-kb/s synchronous circuits.
(5) 2 duplex 56-kb/s synchronous circuits.
(6) 2 duplex 64-kb/s synchronous circuits.
(7) 2 duplex 128-kb/s synchronous circuits.
(8) 2 duplex 256-kb/s synchronous circuits.
(9) 1 duplex 512-kb/s synchronous circuit.
(10) 1 duplex 512-kb/s synchronous circuit.

The VF and TTY (except high-level TTY) circuits are routed within the terminal by a central distribution frame (a manually-programmed crosspoint matrix) and four panels. These units provide great flexibility in configuring the terminal to meet mission requirements, in connecting test equipment, and in emergency routing around a malfunctioning unit.

g. Central Distribution Frame. The central distribution frame (CDF) is a terminating device electrically located between the VF/TTY signal entry panel-MDF assembly and the VF and the TTY patch panels, as shown in figure FO-4. Echo-suppressor-disable leads also terminate at the CDF assembly. The CDF provides the operator with a facility to reconfigure any VF/TTY user channel on the out- station side of the terminal onto any channel position on the VF and TTY patch panels. The latter is limited to TTY low-level or FSK users. (High-level TTY users are routed from the entry panel to line isolators.) The principal element of the CDF is a 48/48 by 8-deck matrix board. This device is illustrated diagrammatically in figure 6-6. The 12 echo-suppressor-disable leads terminate at the patch panel side of the matrix board and can be routed through the CDF to users via VF external lines if required. Reconfiguration of the matrix board is accomplished by inserting a program pin (fig. 6-7) into the proper crosspoint. This pin effects the crosspoint connection

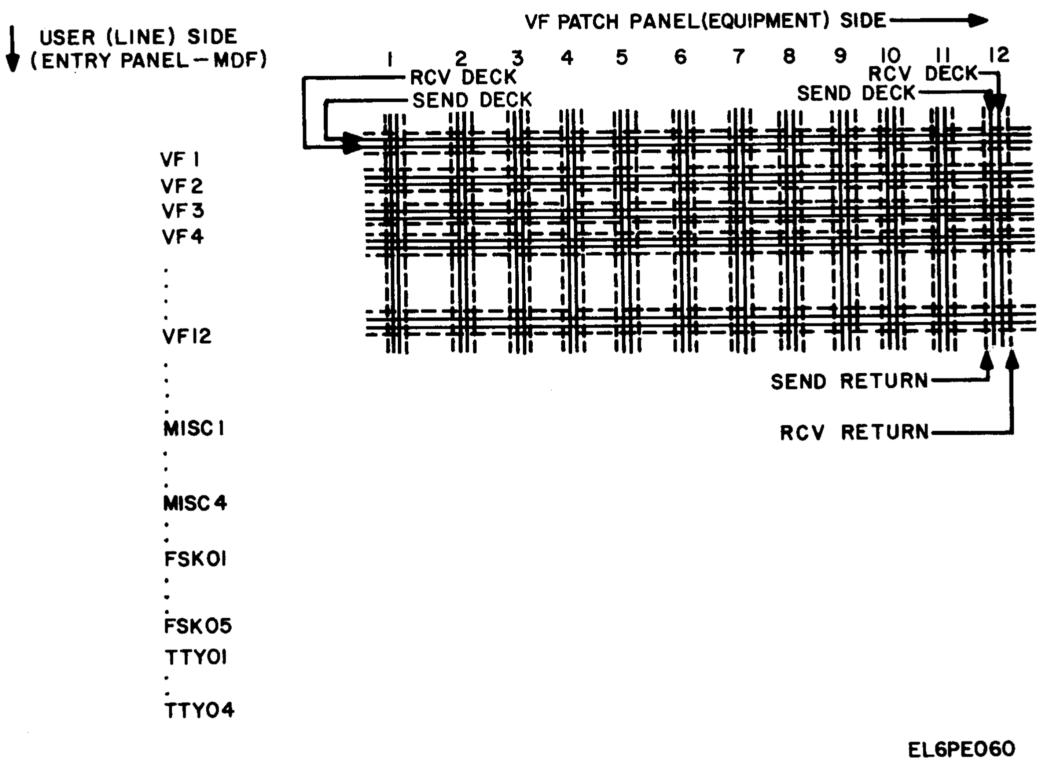

Figure 6-6. CDF Reconfiguration Matrix, Function Diagram.

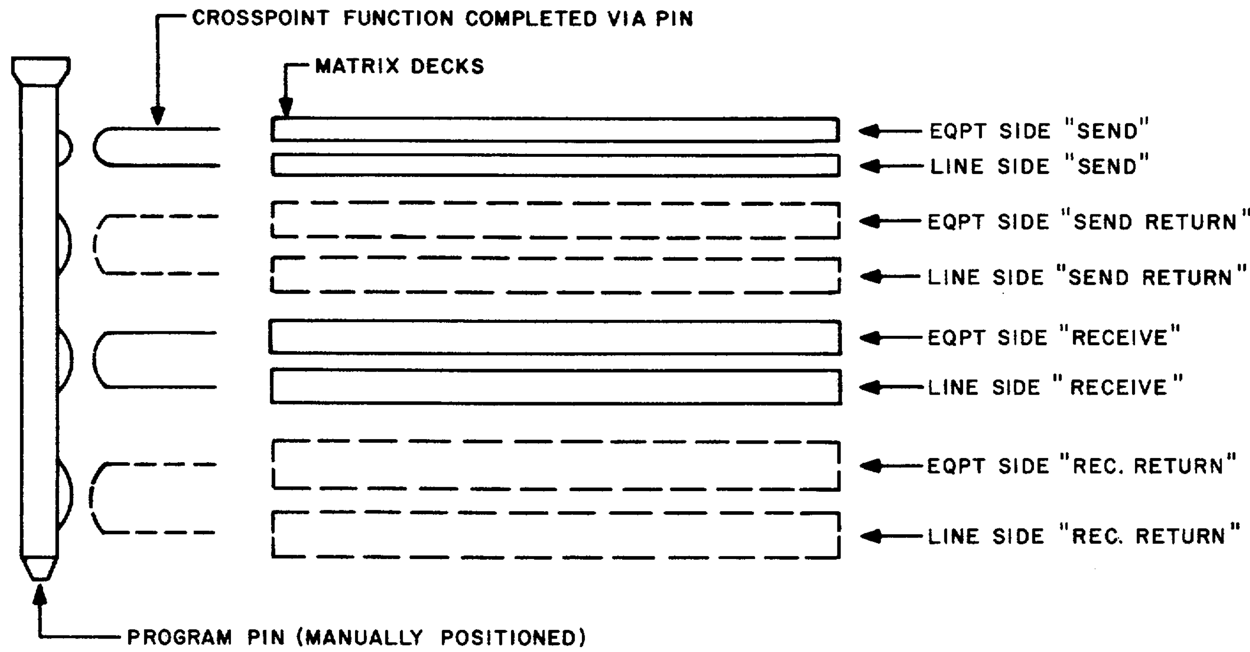

Figure 6-7. CDF Program Pin Crosspoint Switch Function

between the entry panel/MDF (user) side and the patch panel (equipment) side. Figure 6-7 depicts this crosspoint switch function by the insertion of a program pin. Both user side and patch panel side of the CDF matrix board are marked with destination information for operator reference.

h. Voltage Regulation Monitor Panel. A voltage regulator monitor panel, located at the bottom of rack 5, is provided to monitor the voltage output of the 115 volt regulated supply which is mounted behind the data patch panel in rack 6. The voltage regulator is used to power off-line test equipment such as the spectrum analyzer, the data test set, and the RF power meter, since these units require closer tolerance input voltage than other equipments in the terminal. The VR monitor panel contains a meter-relay unit which indicates the regulators output voltage, and senses over-voltage or under voltage according to limits preset by markers on the face of meter. If out of tolerance voltage occurs, the meter-relay causes a fault lamp on this panel to light. The panel also provides an outlet for regulated 115 Vac.

i. Patch Panels. Patch panels included as a portion of the CSS equipment complement serve as interface points for various equipments and provide access to numerous circuits for monitoring processes. Routing of equipments and selection of redundant units are accomplished at appropriate panels. Patching is accomplished by patch cords and looping plugs supplied with each type of panel. Five major patch panel assemblies are included within the CSS racks. These are nomenclatured in accordance with associated signals passing through each panel. Patch panels shown in the terminal functional block diagram, figure FO-4, include the VF patch panel, data patch panel, TTY/low level patch panel, TTY/FSK patch panel and the IF patch panel.

(1) *VF patch panel.* Location of the VF patch panel is shown in figure 6-4. The electrical interface of this panel within the CSS network is shown in figure FO-4. This termination point provides access to both equipment and line sides of each individual signal processing module for monitoring and maintenance purposes. This facility also permits emergency routing of signal processing equipment to specific user lines when required. The jackstrips are arranged with monitor line and equipment appearances on a 4-wire full-duplex basis. When used with 2-wire circuits, the uplink transmit pair is active.

(2) *Data patch panel.* The data patch panel provides the interface point for all digital equipment within the CSS complex, as shown in figure FO-4. Access to all digital inputs and outputs is available at this facility for test and monitoring purposes. The data patch panel is located in CSS rack 6 as indicated in figure 6-4, adjacent to its supporting digital test set. Looping plugs, patch cords, parallel networks, and looping plug with cable adapters are provided for use

with this panel. Appearances on the data patch panel include timing signals from modems, KG-81, and AN/FCC-98, in addition to data lines from appropriate equipment.

(3) *Teletype, TTY/low level patch panel*. The TTY/low level patch panel provides interconnection and circuit routing facilities for:

(*a*) Four user low level circuits.

(*b*) Low level connections of the three line isolator units (LIU).

(*c*) On-board TTY machine.

(*d*) Access for AJ modem (future).

Any combination of four of the above circuits can be patched to the four keyer/converters. Six trunk circuits between the TTY/low level and data patch panels are provided for use when priority TTY traffic has to be routed directly through to an available MUX low data rate channel. Cut-key switches are provided for placing both the up-link transmit and user receive loops in a mark-hold condition for fault isolation or operator system protocol use. Jacks for circuit polarity reversal, paralleling and series patching are provided. In addition, positive and negative (± 6 Vdc) battery connections are provided for circuit test purposes. Jacks are identical to those used in the VF patch panel.

(4) *Teletype, TTY/FSK patch panel*. The TTY/FSK patch panel provides interconnection and circuit routing for:

(*a*) FSK connection of the four keyer/converters.

(*b*) Five user FSK circuits.

These nine FSK circuits can be routed through any of the nine available filter bridge channels. Three trunk circuits are provided between the TTY/FSK and the VF patch panels for use when priority TTY/FSK traffic has to be routed directly through to an available MUX VF channel. Jacks used are identical to those used in the VF patch panel.

(5) IF patch panel. The IF patch panel, located in CSS rack 5 as illustrated in figure 6-4, provides the major interface between CSS and RSS equipments. Coaxial jacks terminate all IF signal ports from the various equipments, including the auxiliary IF port terminated on the IF/FREQUENCY STANDARD/TELEPHONE signal entry panel. The IF patch panel layout is illustrated in figure 6-8, and is designed to facilitate the use of looping plugs. A 20-dB coupler is in series with each upconverter and downconverter appearance. The secondary line on each coupler is routed to a monitor jack on the panel.

Signals from the monitor appearances can be patched to the spectrum analyzer or the C/N test set input terminals which also appear on the IF patch panel.

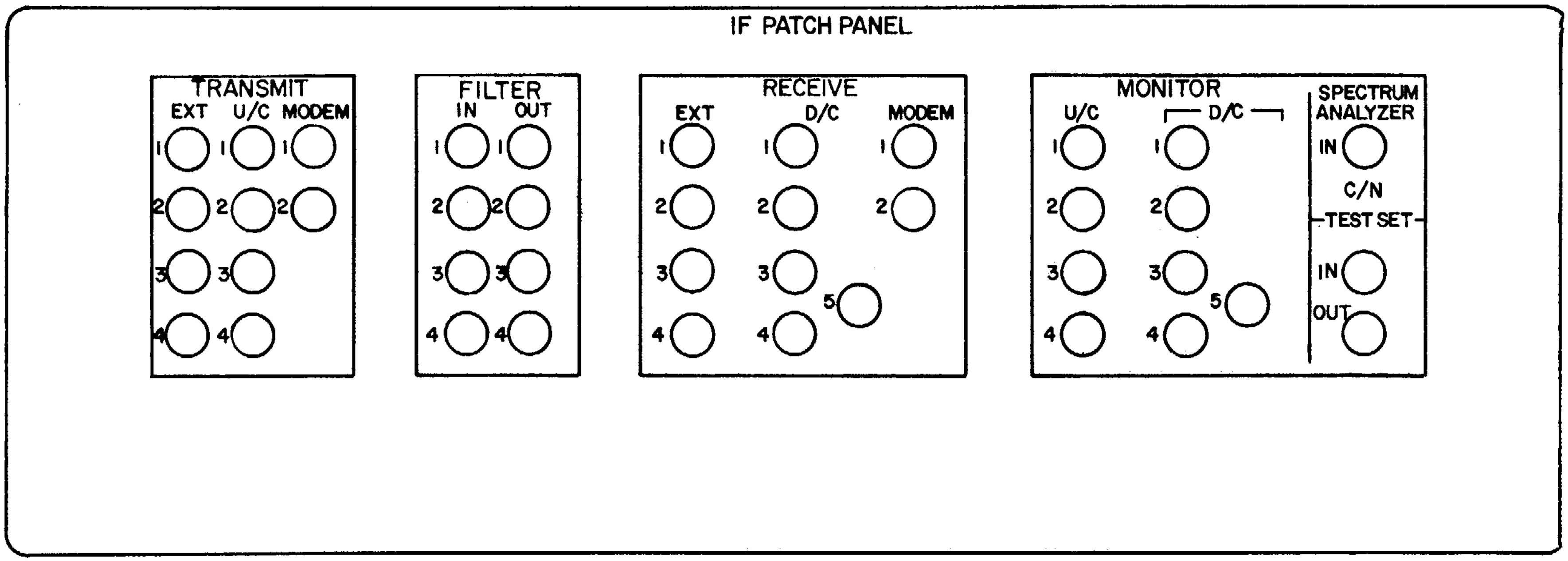

Figure 6-8. Communications Subsystem IF Patch Panel Appearances.

Section III. ELECTRONIC FUNCTIONAL DESCRIPTION

6-7. Introduction

This section contains the overall block diagram discussion pertaining to the terminal. For all of this discussion refer to the overall functional block diagram (fig. FO-4) as well as the specific block diagram within the text. The terminal is designed to provide point-to-point trunking facilities in a diverse range of environmental conditions. Working through the DSCS satellites, either short or long-range communications can be established in minutes without the need for midpoint repeaters or extensive site preparation.

6-8. Signal Flow, RF Subsystem

a. As shown in figure FO-4 and 6-9, the satellite signal is received by the antenna and is routed through the following path: orthomode transducer, waveguide section, directional coupler, waveguide section, wideband preselector, waveguide section, and then to the low-noise amplifier (LNA) waveguide switch. The input to each LNA is common to this waveguide switch. The output of each LNA is common to a coaxial switch located in the LNA BITE ASSEMBLY. An on-line select control on the LNA control/translator inside the shelter actuates both switches. This control selects one of the two LNA for on-line operation by switching the LNA waveguide and LNA BITE coaxial switches simultaneously. The off-line LNA is connected to the LNA BITE. All of the above RF components are mounted on the antenna assembly.

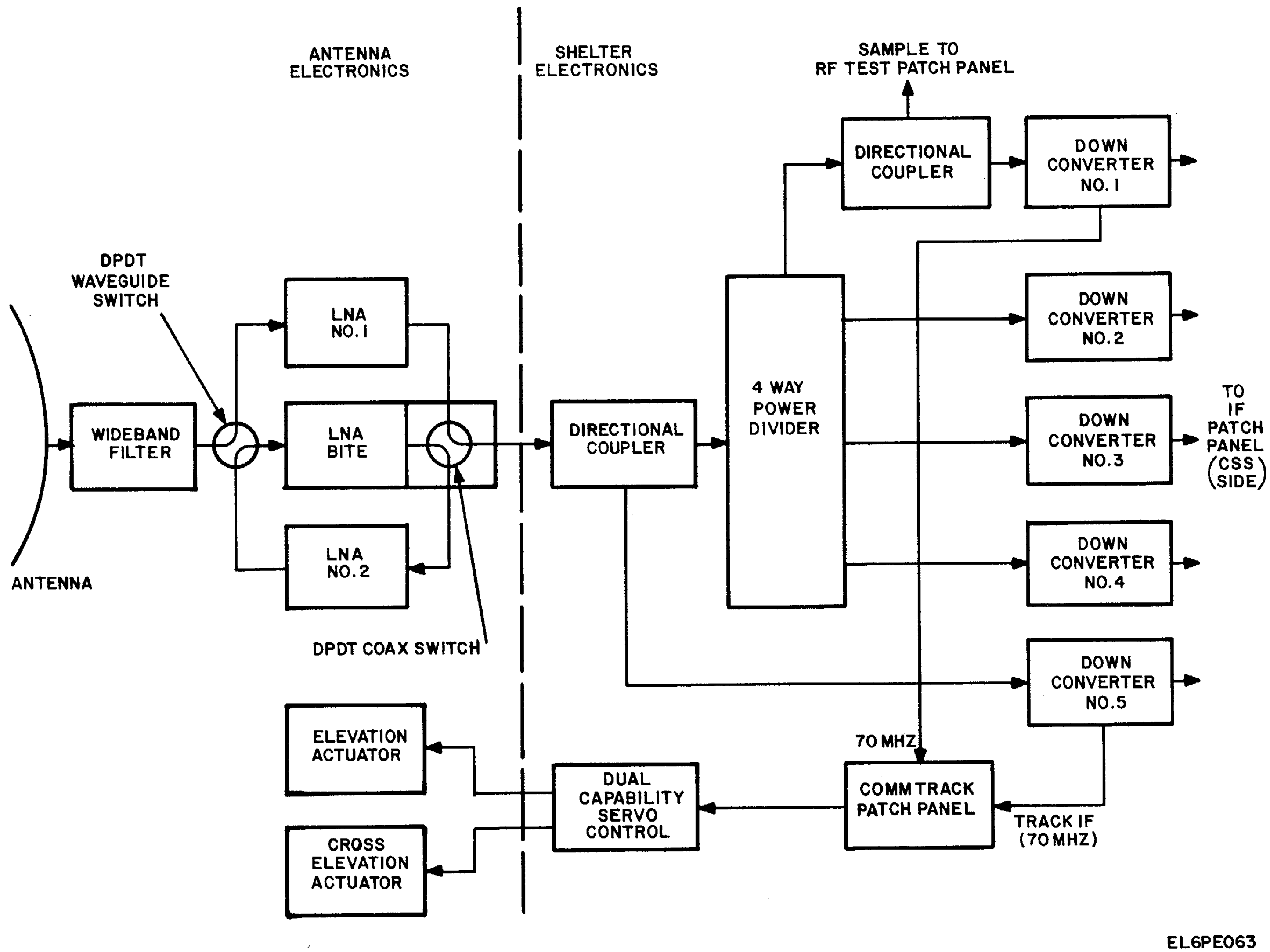

Figure 6-9. Receive Chain Block Diagram.

b. After 39 dB of amplification in an LNA, the signal is carried by coaxial cable to the receive antenna entry port at the shelter wall. Within the shelter, the received signal is divided five ways to provide equal inputs to each of the five downconverters. The five way signal division is accomplished by the combination of a directional coupler and a 4-way power divider as shown in figure 6-9. Another directional coupler samples the input to downconverter No. 1. This sample is routed to the RCV TEST OUT jack on the RF test patch panel. In the downconverters, the received SHF signal is translated to an IF signal at either 70 or 700 MHz, as desired. The IF outputs are routed to the IF patch panel in rack 5 on the CSS side of the shelter, where patching to the modems is performed. The track IF output of either downconverter No. 1 or No. 5 (as selected at the tracking patch panel) is routed to the communications tracking module within the antenna control unit.

c. In the transmit portion of the radio subsystem, as shown in figure 6-10, the 70-MHz IF input from the IF patch panel goes to the on-line upconverter where it is translated up to 700 MHz. After amplification and filtering, the 700 MHz is translated to the transmit output frequency of 7.9 to 8.4 GHz, as selected by the frequency synthesizer in the upconverter. This frequency synthesizer is identical to and interchangeable with the downconverter frequency synthesizer. The signal at the selected transmit frequency is filtered and amplified by an intermediate power amplifier in the upconverter, to a level suitable for driving the amplifier/mixer.

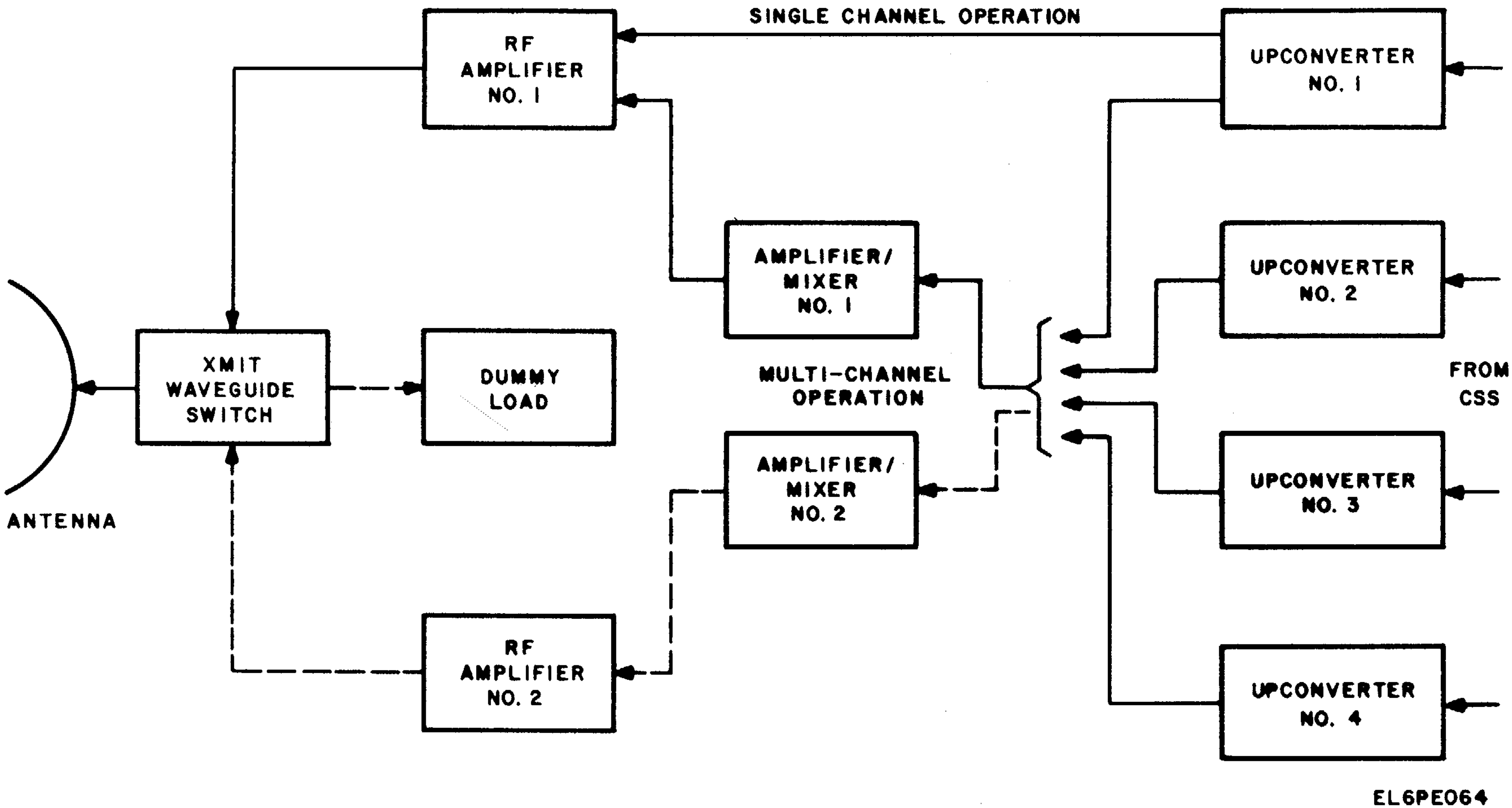

Figure 6-10. Transmit Chain Block Diagram.

d. The output of up to four upconverters may be applied to the on-line amplifier/mixer. In the amplifier/mixer, all incoming levels are balanced and then applied to the input of the power amplifier. For single channel operation the output of a single upconverter is applied directly to the power amplifier.

e. The output of the on-line amplifier/mixer or upconverter drives the on-line power amplifier. The power amplifier contains a five-cavity klystron amplifier tunable over the 500-MHz transmit band with five calibrated tuning adjustments available through the access cover in the front panel. The output of the transmitter (power amplifier) goes to a manually-operated transmit waveguide switch in the shelter which selects either power amplifier as the online unit to drive the antenna. The off-line or standby power amplifier is terminated in a dummy load through the waveguide switch, allowing the unit to be turned on and monitored or tested, as desired. Operating high voltage for each power amplifier is provided by an associated power supply, which has complete fault and status monitoring capability.

6-9. Signal Flow, Communications Subsystem

The communications subsystem (CSS) consists primarily of voice frequency, teletype, and digital baseband processing equipment. It interfaces the users to the terminal and is interfaced with the radio subsystem through either 70-MHz or 700-MHz signal lines.

a. Voice Frequency Circuits. Twelve voice frequency (VF) circuits (fig. 6-11) are fed from junction boxes to the central distribution frame (CDF), through the VF patch panel to the line conditioning equipment. The line conditioning equipment handles 4-wire circuits using 1600-Hz and 2600-Hz in-band signaling, or 2-wire circuits using 20-Hz ringdown. Signals from the line conditioning equipment are routed to the AN/FCC-98 multiplexer set which forms the mission bit stream.

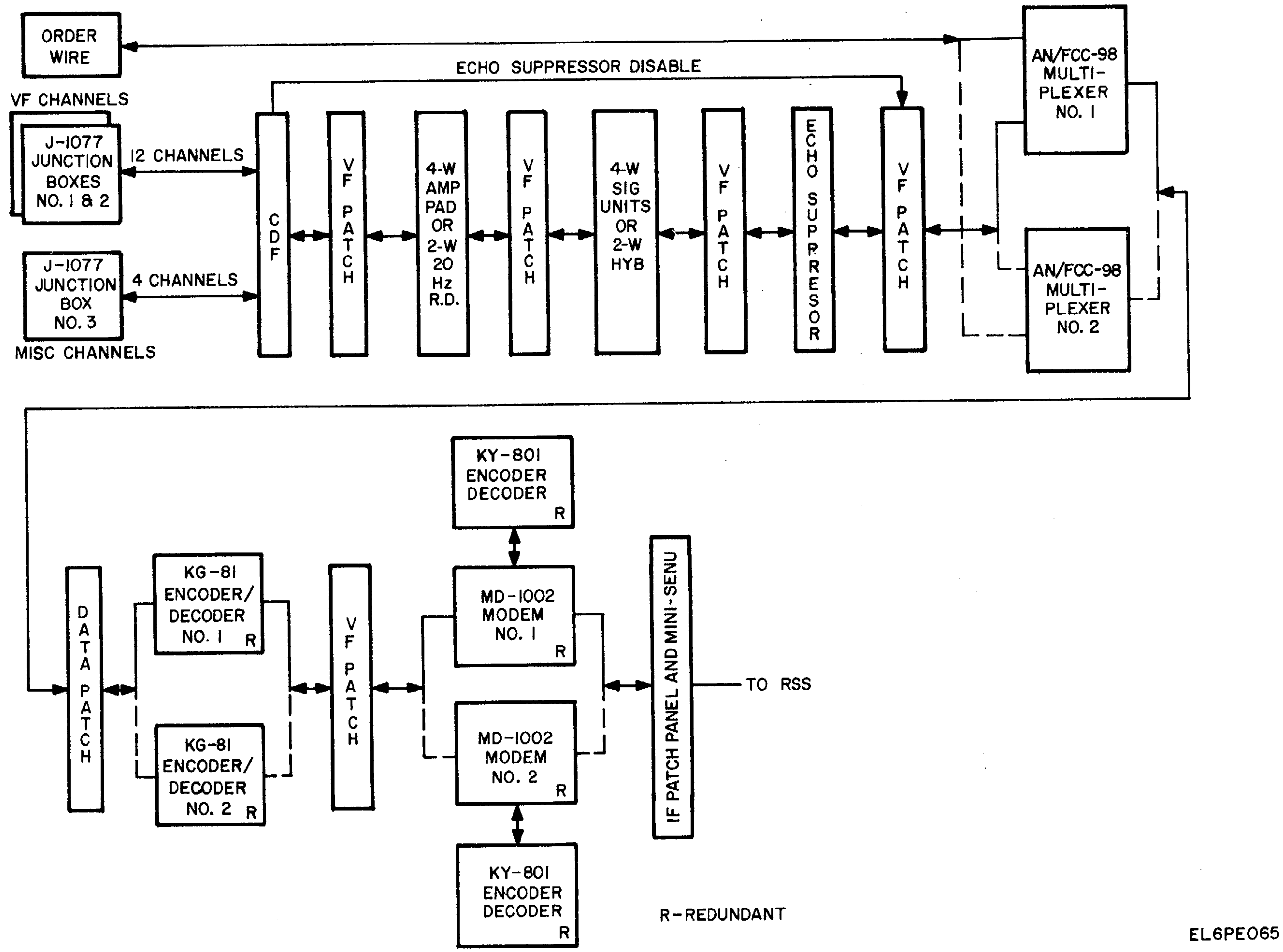

Figure 6-11. Voice Frequency Circuits, Block Diagram.

b. Teletype Circuits. A total of nine teletype (TTY) circuits (fig. 6-12) are available. Five frequency-shift-keying (FSK) circuits are fed from the junction boxes through the CDF to the TTY/FSK patch panel. Four low-level teletype circuits may be fed through the miscellaneous junction box to the keyer/converters via the TTY/ low-level patch panel. Three high-level circuits are processed through the line isolators and keyer/converters. All nine TTY circuits are routed from the TTY/FSK patch panel to the filter bridge. The filter bridge combines all nine circuits into one telegraph voice frequency (TGVF) channel, which is sent to the multiplexer unit. When mission requirements dictate, a KG-81 key generator may be 6onnected between the multiplexer and the modem.

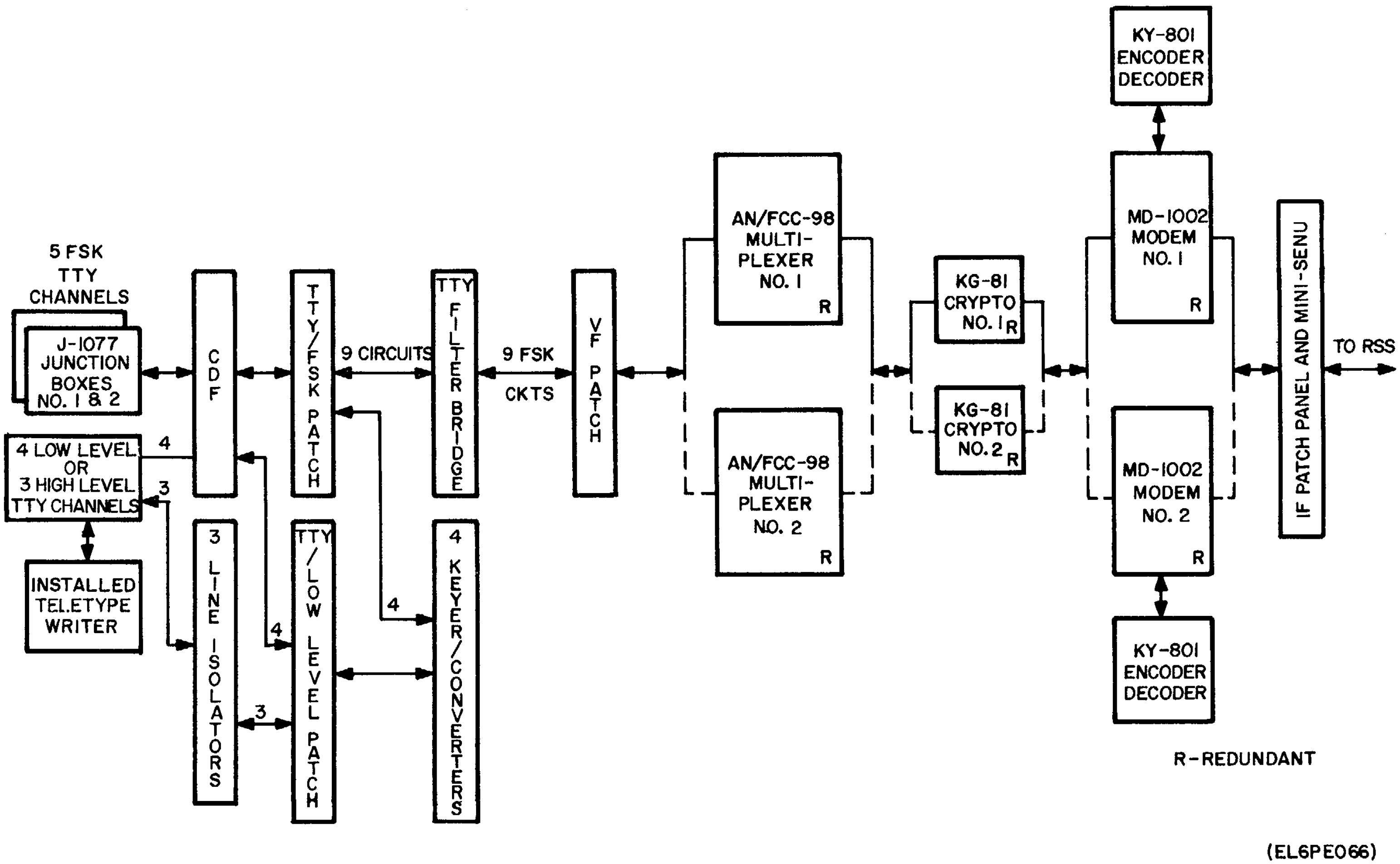

Figure 6-12. Teletype Circuits, Block Diagram.

c. Data Circuits. The data circuits are fed directly from the data entry panel to the data patch panel (fig. 6-13). The data entry panel provides connections for both data and clock circuits. Two source encrypted, hybrid, data circuits are fed through the data patch panel to the A/D converters (CV-3034). All circuits are fed from the data patch panel directly to the multiplexer. Data rates above 512 k/bs are fed through the DATA patch panel to the modem. The 70-MIHz IF output from the modem is terminated at the IF patch panel, which provides the interface with the RSS.

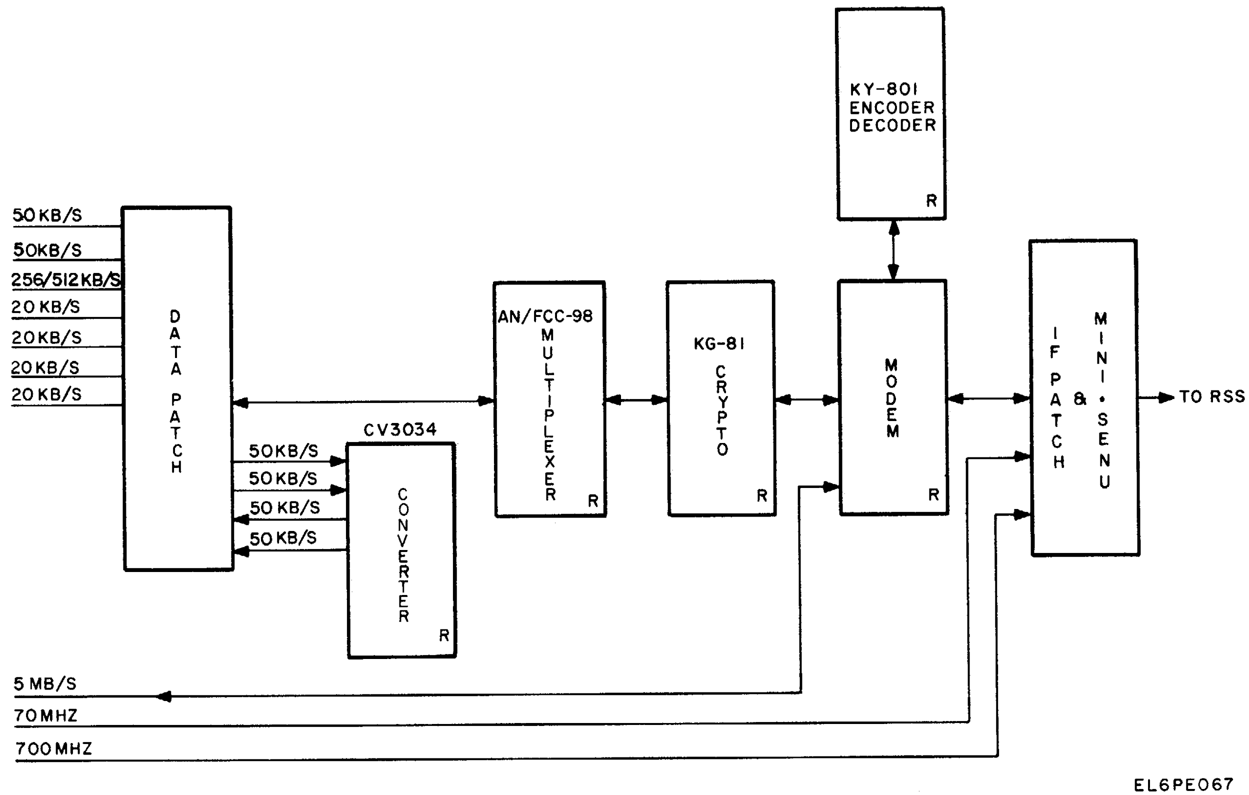

Figure 6-13. Data and Auxiliary IF Circuits, Block Diagram.

d. Auxiliary IF, Frequency Standard, and Telephone Circuits. The IF, frequency standard, and telephone entry panel contains the external connections for the auxiliary 70or 700-MHz signals, the frequency standard, and the external telephone circuits. The auxiliary IF signal lines are terminated at the IF patch panel. The frequency standard is routed directly to the frequency standard distribution amplifier in the RSS.

6-10. Unit Functions

a. Waveguide Components and 8-Foot Antenna. The transmission path from the power amplifier to the antenna consists of solid and flexible waveguide sections, a transmit waveguide switch, dummy load, and proximity switches that are part of a safety interlock system. An orthogonal mode transducer, circular polarizer, feed tube assembly, and reflector make up the antenna portion of the transmission and reception path.

(1) Proximity switches are used at four locations in the waveguide system, to sense an uncoupled or loose coupling at the waveguide quick-disconnect joints. These switches are wired into the high-voltage inhibiting circuitry in the high voltage power supplies so that if a faulty connection exists at the quick disconnects, the high voltage to the klystron in the PA will be disabled and RF power cannot be generated. These switches are located just above each PA, at the antenna entry panel, and at the waveguide connection at the 8-foot antenna input. The proximity switches at the top of each PA operate independently. The on-line PA will be inhibited by its associated proximity switch and the two switches in the waveguide run to the antenna, but the off-line PA can be inhibited only by the switch at its waveguide coupling. Likewise, a break at the off-line PA waveguide coupling will not inhibit the on-line unit. Auxiliary contacts in the waveguide transfer switch sense which PA is the online unit and configure the high voltage disabling circuits accordingly. One power amplifier is coupled through to the antenna while the other is coupled to the dummy load by the transmit waveguide transfer switch. The dummy load is capable of dissipating the full power output of the off-line PA for troubleshooting, testing, and adjustment.

(2) Figure 6-14 is a cross section view of the antenna feed. The antenna feed is composed of three components, an orthogonal mode transducer (OMT), a circular polarizer and a feed tube assembly. The antenna feed passes through the center of an eight-foot parabolic reflector with the front end of the feed tube at the focal point of the reflector. The orthogonal mode transducer is a three-port device consisting of a transmit port, a receive port, and a common port. Energy can pass into the transmit port through the OMT and out of the common port. Energy can also pass into the common port through the OMT to the receive port. The transmit port is isolated from the receive port; that is, energy going into one will not pass on to the other. Signals at these ports will not mix with each other because the transmit and receive ports are orthogonal (at 90 degrees) to each other. Isolation, between the transmit and receive ports is in excess of 40 dB.

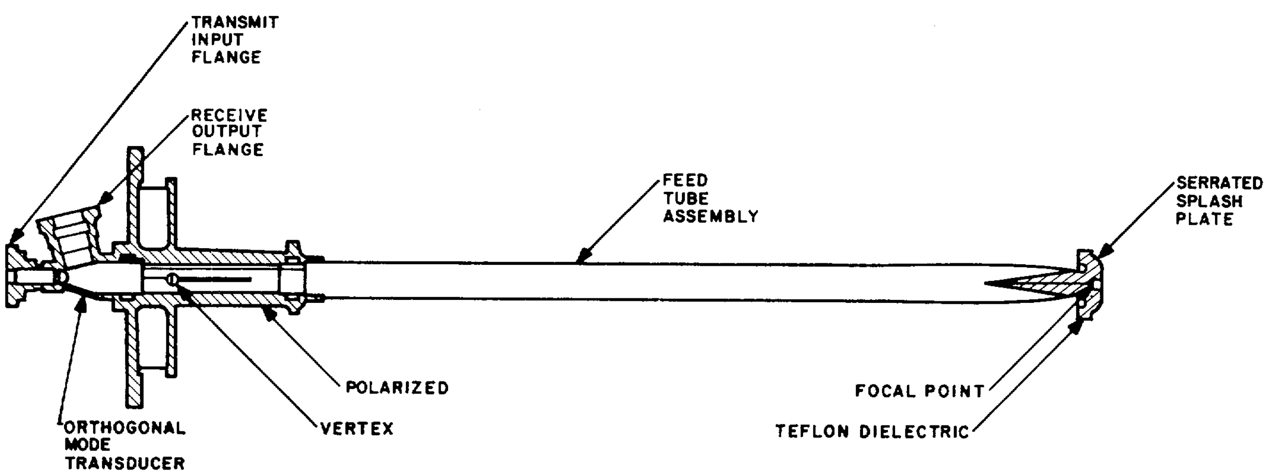

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Figure 6-14. Antenna Feed Cross Section.

(3) The common port of the orthogonal mode transducer will accommodate a signal acceptable to either of the other ports. This port couples to a circular polarizer section which will accept the signal from the transmit port and convert it to a right-hand, circularly-polarized signal. This is an RF signal whose electric field appears to be rotating clockwise when viewed toward the direction of travel. The transmit signal out of the polarizer enters the feed tube assembly where it is further processed. At the front end of the feed tube assembly is a splash plate that reflects the RF energy over the surface of the parabolic reflector. The reflector, figure 6-15, directs the RF energy forward into space in a narrow beam about one degree wide at the half-power points. A received signal follows the same path in the reverse direction. Energy coming into the polarizer toward the OMT will be left-hand circularly polarized, and when it passes through the polarizer will be in the proper orientation to enter the OMT and pass through to the receive port.

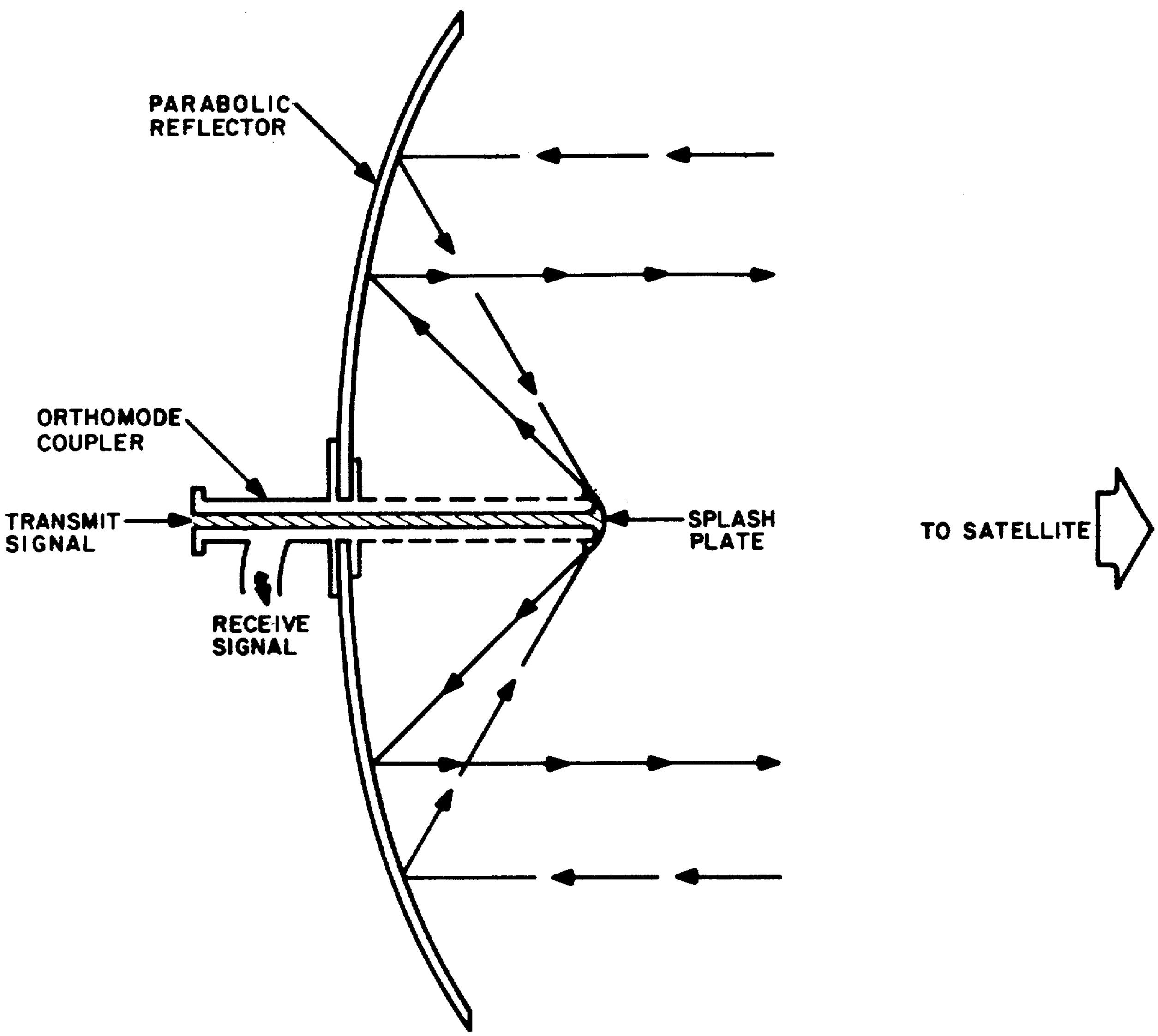

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Figure 6-15. Basic Antenna Operation.

(4) The transmit and receive paths, as noted, undergo circular polarization processing. This is necessary to avoid signal losses or dropouts that could occur when using linearly polarized signals. For instance, if a vertically polarized signal (electric field vertical) reaches an antenna that is horizontally polarized (will accept signals with horizontal electric fields), very little, or none, of the signal will be accepted by the receiving antenna. A circularly polarized signal will be accepted by the antenna with about a 3-dB loss. As long as one antenna is circularly polarized, signals passing between two antennas directed toward each other should be received at about the same intensity even if one antenna is rotated about the signal path. The antennas used in the satellite are also circularly polarized doubly ensuring that signal fading due to signal polarization will be kept to a minimum.

b. Low Noise Amplifier. The low-noise amplifier (LNA) is contained in a temperature controlled, weatherproof case mounted at the rear of the antenna reflector. It is an SHF preamplifier which provides an excellent noise figure and increases the received signal power to a level sufficient to provide an adequate input to the downconverters in the shelter.

(1) The LNA consists of a single-stage parametric amplifier (paramp) driving a single-stage FET " amplifier. Because of its remote location, ac power, control, and monitoring are provided by the LNA control/translator unit within the shelter.

(2) The LNA is shown in the block diagram of figure 6-16. Received SHF signals are amplified by a parametric amplifier stage to amplify the signal with a high signal-to-noise ratio. Its output drives an SHF field-effect transistor stage to amplify the signal further, for a combined stage gain of about 39 dB at the FET output. A bandpass filter, to reduce out-of-band noise, and an output isolator follow. The unit is maintained at a constant temperature of + 75 C by a dual heater system. A normal heat unit of 130 watts is on and thermostatically controlled whenever the LNA is operating. In low-temperature areas an additional 300-watt unit can be used in a high heat mode to bring the LNA up to operating temperature more quickly. All dc voltages are provided by an internal power supply. Fault circuitry is connected to a FAULT lamp on the LNA control to indicate failure, low limit in dc bias levels, or high or low temperature.

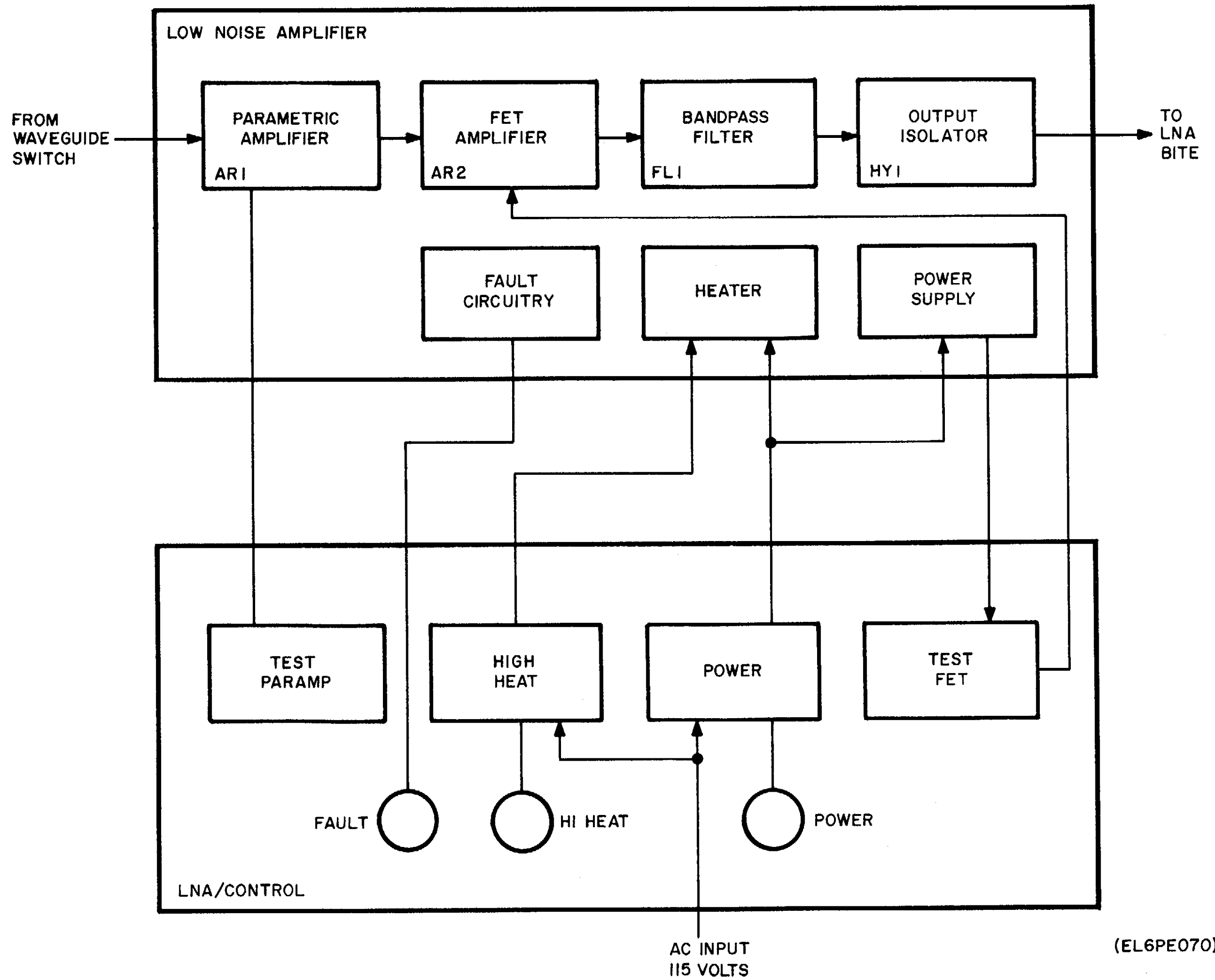

Figure 6-16. LNA Block Diagram.

(3) Each LNA has a corresponding LNA control panel located in the LNA control/translator. This unit allows control of the ac power, normal or high heat, and control of the paramp and FET stages during testing of the LNA when it is in standby. The TEST switches allow checking the operation of either the paramp or FET stage.

c. LNA Control/Translator. The LNA control/-translator performs several distinct functions. These are: operational control of the LNA, testing of the off-line LNA, fault detection in the LNA, loop testing control of the terminal, and monitoring. The LNA control/translator used in the AN/TSC-86 contains two independent LNA control panels, ON LINE switching control, TRANSLATOR controls, and an LNA control MONITOR. Each independent LNA control unit contains a POWER breaker for application of power to the antenna-mounted LNA. Either LNA control panel may be removed from the control unit drawer for maintenance without interrupting operation of the on-line units. Although contained in one assembly, the LNA switching and testing electronics can be treated as separate equipments.

(1) LNA and on-line controls. ON LINE controls between the LNA controls allow switching either LNA on line and the other to standby. STBY LNA TEST provides a means of checking the operational status of the standby LNA. The TEST OSC switch turns on an SHF oscillator in the BITE assembly for this check. When the TEST switch is in the ON position, the LNA NORMAL lamp will illuminate if the LNA is operating properly.

(2) *Test translator*. The LNA control/translator unit contains two modules, a power supply and passive components that make up the test translator. Figure 6-17 is a block diagram of the translator. The output of the power amplifier ranges from about 37 dBm to 61 dBm (5 watts to 1250 watts). One port of the triple section directional coupler in the PA samples this power range and provides a maximum signal of 0 dBm, i 3. The sample signal is sent to the test translator. An attenuator, AT1, located in the LNA control translator unit, further reduces the SHF signal before application to the double balanced translator mixer module. A 725-MHz signal from a 725-MHz source module mixes with the SHF signal and the resulting downconverted signal passes through to a second variable attenuator. Upconverted signals are suppressed in the mixer. The converted signal is now in the receive band of the terminal. The resulting coupler in the receive path. This coupler attenuates the signal another 20 dB. The 725-MHz source is a phase-locked oscillator-multiplier. A 5-MHz signal taken from the upconverter 5 MHz OUT jack is used as a frequency control. The 725-MHz source spurious signal output is about 60 dB down.

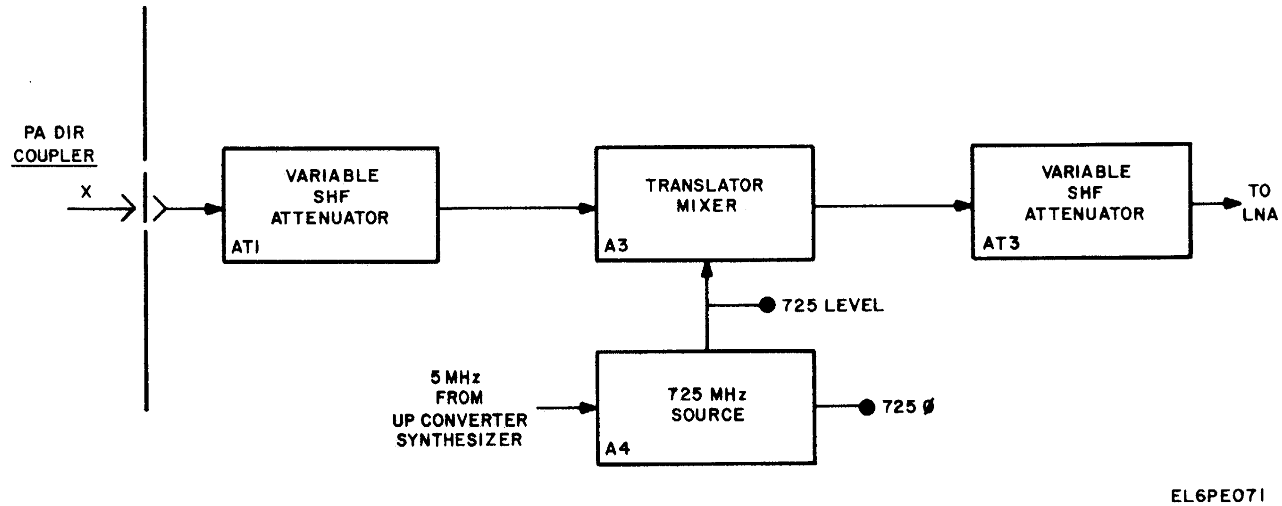

Figure 6-17. Test Translator Block Diagram.

(3) *Control, fault detection and isolation*. The POWER circuit breaker on the right side of the panel controls the power supply. Power to the LNA is directly controlled by the LNA control POWER circuit breakers. Translator operation is initiated by the TRANSLATOR switch. POWER supply voltages and the 725-MHz source output and phase are checked by the MONITOR meter and switch group. The translator should be used only when the terminal is not performing any of its operational functions. The upconverter must be tuned 725 MHz above the downconverter for this test. To avoid interference through the satellite, this system loop test should be done with the PA output connected to a dummy RF load.

(4) *LNA BITE*. The LNA BITE assembly is used for switching the output of either LNA to the receiving equipment in the shelter. A second function of the unit is to generate a test signal to test the off-line (standby) LNA. The directional coupler (fig. 6-18) connects to a test translator. By a simple 725-MHz downshift of the output of the power amplifier (sampled from the output waveguide) and the coupling of the result to the receive channel at the proper level, the test translator enables a complete loop test of the communications channel. The RF components mounted on the antenna are presented in diagram form in figure 6-18. Signals received by the antenna follow the heavy-line path through the directional coupler, wideband preselector, wave-guide switch, LNA-1, the coaxial switch in the LNA BITE assembly, and out to the received power divider in the shelter. The input directional coupler permits the coupling of a test signal into the receive path. It isolates the test signal input from the receive path by 20 dB. Test signals are sent from the test translator located inside the shelter and are used when performing a loop test of the entire communications channel. When no testing is required, the unit can be turned off. The off-line LNA, in this case LNA-2, is connected into the LNA BITE assembly through the remaining ports of the waveguide and coaxial switches. When energized by a TEST switch on the LNA control/translator panel, the LNA BITE assembly generates an SHF test signal. This signal is routed through the standby LNA and reenters the LNA BITE assembly where it is detected. If the gain of the LNA is at least 37 dB, the detected output will illuminate an LNA NORMAL test lamp on the LNA control/translator panel. Refer to figure 6-18. This test can be performed at any time on either LNA when it is off-line and has been energized for at least five minutes.

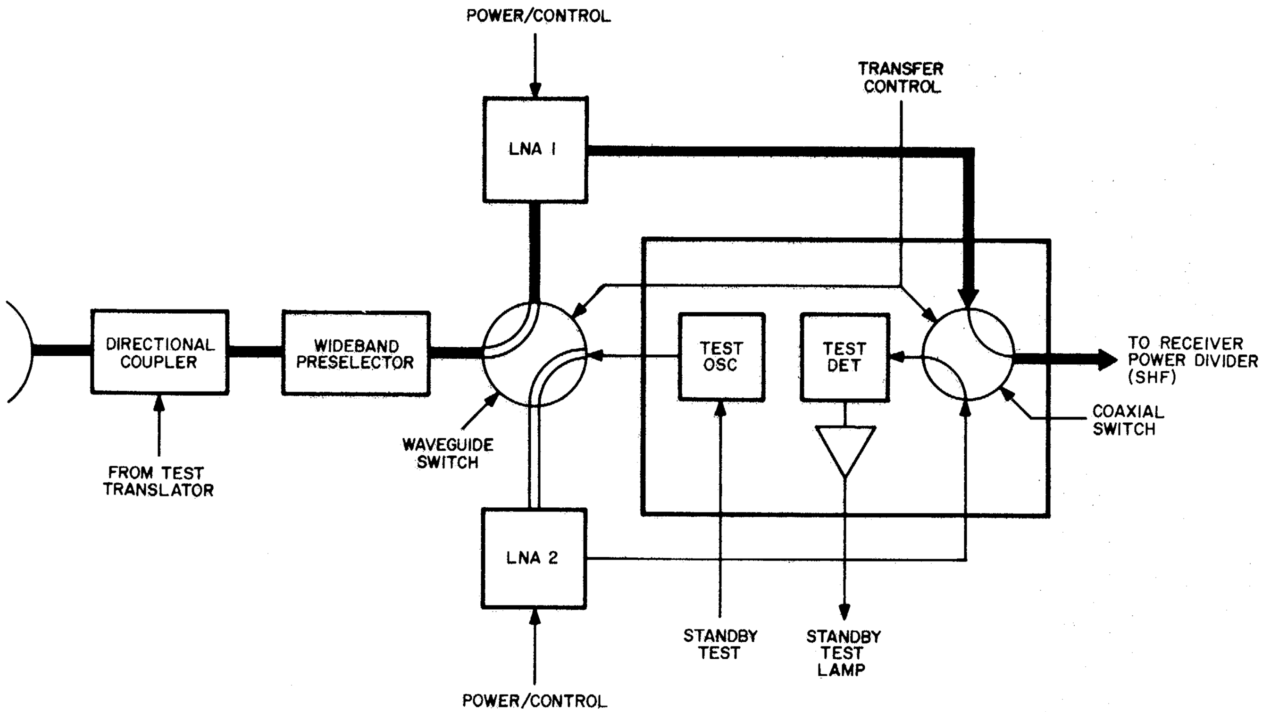

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Figure 6-18. LNA Testing Block Diagram.

d. Downconverter. The downconverter unit performs single or double downconversion from an SHF input to a 70/700 MHz modem interface. Tuning is adjustable in 1-kHz intervals over a frequency range of 7250 MHz to 7750 MHz by the use of direct-reading, decade, front-panel switches. No tuning is required in the terminal for signal reception other than in this unit. Local oscillator signals for down-conversion are generated in a frequency synthesizer subassembly located in the downconverter. It is a separate removable unit and is identical to the one used in the upconverter.

(1) The downconverter is a completely independent operating unit requiring only 115-volt line power for its operation. It consists of six major components:

(*a*) Frequency synthesizer, A1.
(*b*) 70-MHz channel, A2.
(*c*) 700-MHz channel, A3.
(*d*) Power supply, PS1.
(*e*) 700 MHz WB filter, FL1.
(*f*) 700 MHz NB filter, FL2.

Figure 6-19 is a simplified block diagram of the downconverter unit. The modules within the frequency synthesizer are not shown. Figure 3-3 shows the front panel layout of the downconverter.

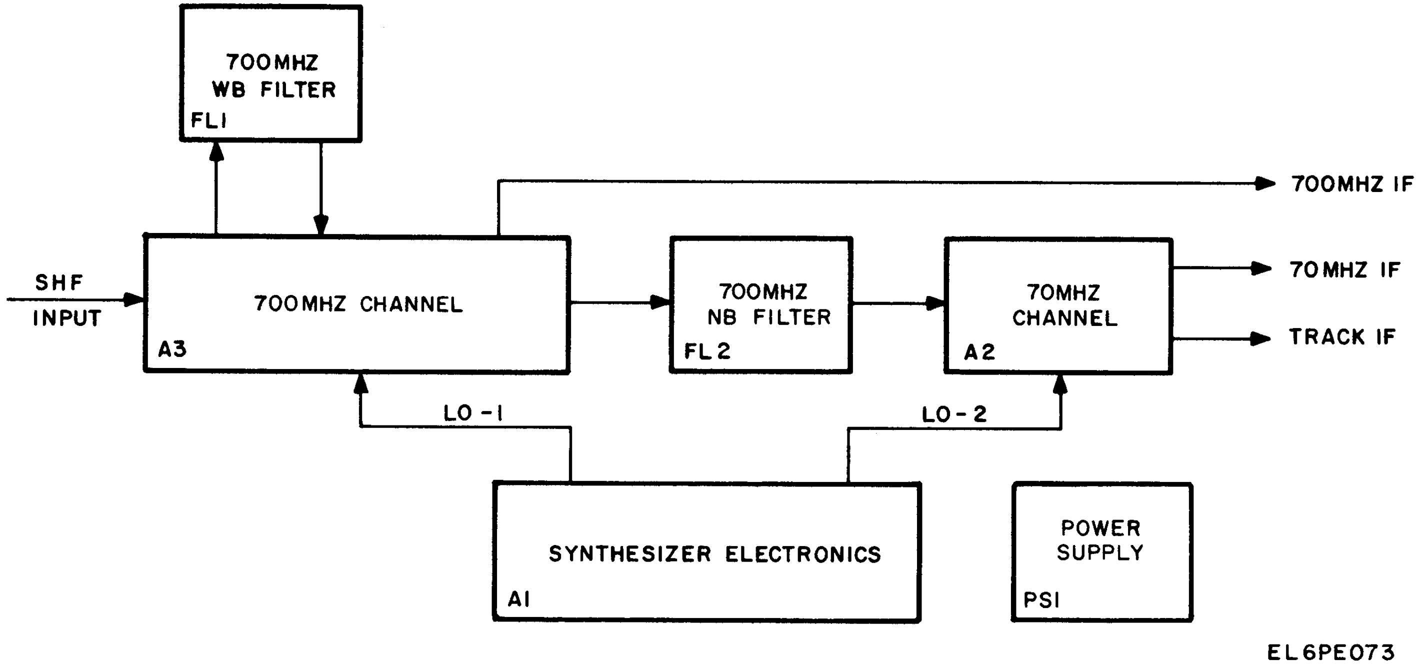

Figure 6-19. Downconverter Block Diagram.

(2) The 700-MHz channel module performs a frequency conversion from the 7250to 7750-MHz receive band to an IF output of 700 MHz. Conversion is from SHF to 700 MHz for any multiple of l-kHz in the SHF band. This is accomplished in an SHF mixer, using the LO-1 output of the frequency synthesizer. Further conversion to 70 MHz is accomplished by a 70-MHz mixer in the channel module, using the LO-2 output of the frequency synthesizer. When used in conjunction with the 700-MHz wide-band filter, FL1, the 700-MHz channel will supply a wideband 700-MHz ± 62.5 MHz output to the user.

e. Upconverter. The upconverter is the first unit in the transmit chain of the radio subsystem. It accepts a 70-MHz modulated IF signal from a modem in the communications subsytem, or from an external source, and translates it to the final SHF output frequency, using double conversion techniques. It can also accept , a 700-MHz (auxiliary) IF and convert it to SHF by a single conversion. Its output may be fed directly to the power amplifier (PA) or to an amplifier/mixer unit which feeds the PA.

(1) The upconverter unit consists of seven functional subassemblies, as shown in figure 6-20. These are:

(*a*) Frequency synthesizer, A1.
(*b*) Amplifier/mixer, A2.
(*c*) Delay equalizer, A3.
(*d*) IF amplifier (700/SHF), A4.
(*e*) SHF filter monitor/IPA, A5.
(*f*) 700 MHz bandpass filter, FL1.
(*g*) Power supply, PS1.

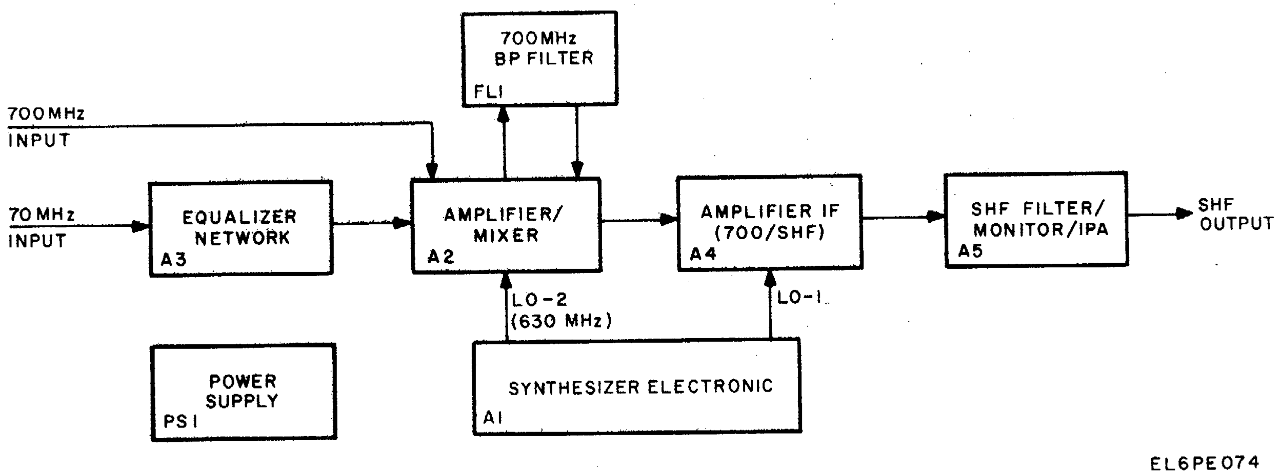

Figure 6-20. Upconverter Block Diagram.

(2) The 70-MHz modulated carrier is converted to 700-MHz by the amplifier/mixer module. This is accomplished by mixing the signal with a 630-MHz signal (LO-2) from the frequency synthesizer. A second conversion to SHF is achieved in the IF amplifier module. Here, the 700-MHz output from the amplifier-mixer is mixed with the LO-1 output from the frequency synthesizer. The resultant output is in the SHF region from 7900 MHz to 8400 MHz, selectable in 1-kHz increments by front panel control of the synthesizer LO-1 frequency. The output of the IF amplifier module is amplified by an intermediate power amplifier (IPA) which provides drive to the amplifier/mixer or the power amplifier. On the left side of the front panel are the input and output connectors, power switch, a MONITOR meter and switch for power supply and operational checks. An UPCONV FAULT lamp will illuminate whenever there is a failure in the upconverter unit. A TEST OSC switch will turn on a 70-MHz or 700-MHz oscillator to provide a signal through the upconverter for self testing. On the right side are the frequency synthesizer controls and monitoring selector switch. When the MONITOR switch is in the SYNTH position, the SYNTH MONITOR switch selects test points in the frequency synthesizer to be monitored by the MONITOR meter.

f. Power Amplifiers. The power amplifier consists of an individually packaged RF amplifier unit and a high-voltage power supply unit. The amplifier uses a five-cavity klystron to provide a maximum gain of 41.5 dB to deliver up to 1000 watts of RF power to the antenna input terminal. It is tunable over a 500-MHz range from 7.9 to 8.4 GHz, with a bandwidth of 40 MHz. Gain is manually adjustable over a 23-dB range. Load isolation permits the , equipment to operate at full power into any load mismatch without damage to PA components. Internal monitoring functions provide an operator with both forward and reflected RF power output level information. Monitors of various types allow fault isolation to the module level. A low-level-RF alarm network with adjustable threshold alerts an operator if the RF output level falls below a preset value.

(1) A block diagram of the RF amplifier is shown in figure 6-21. The low-level modulated SHF carrier from the upconverter or amplifier/mixer is applied to a coaxial input network consisting of a ferrite isolator, directional coupler, and a front-panel controlled variable attenuator. RF output from the attenuator is used to drive a five-cavity klystron amplifier. Another ferrite isolator, HY3, is used at the klystron input port for VSWR improvement. The klystron output is then sent through a network composed of a differential circulator, low-pass filter, bandpass filter, and directional coupler. RF from the unattenuated output port of the directional coupler is sent to the antenna.

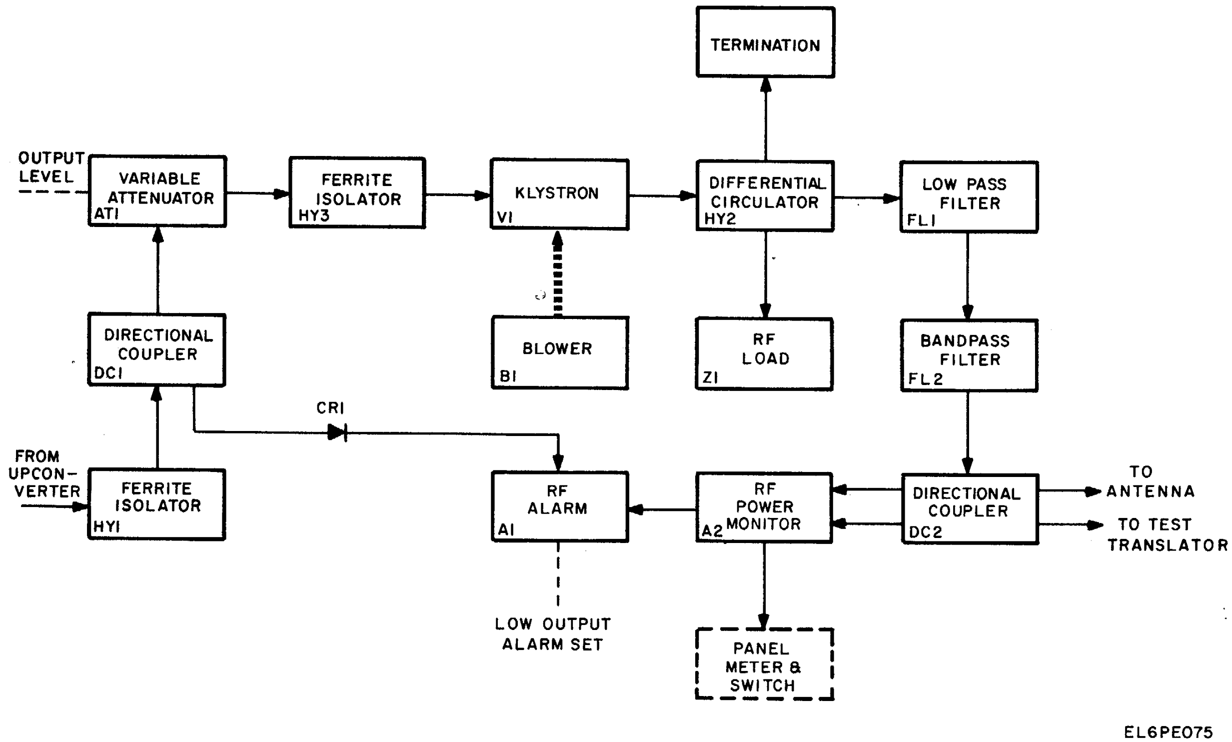

Figure 6-21. RF Amplifier Block Diagram.

(2) An isolated output from the input directional coupler is detected and sent to the RF alarm module for use in monitoring and fault detection circuitry. This signal inhibits RF amplifier fault indications in the absence of an input signal. Three separate low-level outputs from the output directional coupler are used to measure output RF power and reflected power from the antenna transmission line and to provide a low-level signal to the test translator for use in loop testing. The forward or out-put RF signal output from the coupler is also used in a low-power RF alarm network which warns an operator of a reduction in amplifier output power below a preset level. The klystron is cooled by a three-phase, ac, squirrel-cage blower mounted inside the RF amplifier. Heat sensors at the klystron and the RF load (Z1) inhibit application of high voltage to the klystron if either of these units overheats.

(3) The front panel of the PA provides all the drawer's controls and indicators, which include the OUTPUT LEVEL adjustment knob, the elapsed-time meter (FIL HRS) for the klystron's filament hours, the LOW OUTPUT ALARM SET knob, the meter ZERO SET adjustment, and the meter select switch.

(4) The RF amplifier and high-voltage power supply are separate units, but are not capable of independent operation without special load terminations and power sources. Both contain monitoring networks to enable fault isolation to a replaceable module, but some RF amplifier fault isolation is done at the high-voltage power supply. However, a ± 15-volt power supply for the RF power monitor, output power, reflected power, and tube operation can be monitored. Problems in the high-power output network or transmission line to the antenna that cause high reflected energy will cause a fault alarm. A disconnected waveguide coupler will inhibit the operation of the klystron. If RF power falls below a level set by the LOW OUTPUT ALARM SET, a fault will be indicated by a front panel FAULT indicator. Other problems associated with the power supplied to the klystron, such as klystron arcing, are checked at the high-voltage power supply.

g. High Voltage Power Supply. The high-voltage power supply contains the circuitry necessary to convert line power to the power required by the klystron. It also supplies the cooling fan power and provides circuitry for fault sensing, equipment safety, and control. Most of its circuitry is in the form of removable modules.

(1) Refer to figure 6-22, HVPS block diagram. In operation, three-phase, 120/208 Vac primary power is supplied to the line rectifier and filter from the power distribution panel. The START and BLOWER circuit breakers apply ac line voltage to the fans and start module. When these are on, the power supply start cycle begins. A resistor in series with the filter capacitors limits the turn-on line surge current to less than the required operating current. Rectified line voltage is applied to the low voltage, control and overload, pulse synthesizer, and HV overload modules. The start module supplies control voltages which power several of the other modules. The pulse synthesizer module provides the drive outputs for the low-voltage and all of the high-voltage switching modules. For an initial period of one second, all drive outputs are inhibited to allow the pulse synthesizer to stabilize. After the one second delay, the inhibit is removed from the circuits providing drive to the low-voltage module. A switching section of the low-voltage module drives the filament module, which produces the klystron filament potential. To prevent a large surge current from being drawn by the cold filament, a primary surge limiting resistor is used. After a period of thirty seconds, a filament surge timer circuit on the low-voltage module activates a filament surge bypass relay and allows full filament voltage to be applied to the klystron. A potentiometer allows adjustment of the filament voltage. At this point, all of the power supply circuits are active except the high voltage section, which is inhibited by a filament time-delay circuit in the pulse synthesizer. After a four minute period, during which the klystron filament is permitted to reach the proper operating temperature, the filament timer removes the inhibit from the high-voltage drive circuits, and the high-voltage switching modules are activated. To prevent a high transistor surge current from occurring during initial high voltage turn-on, a surge limiting resistor, in series with the high voltage capacitor, is used. Two hundred milliseconds after a high-voltage turn on, a vacuum relay is activated to short-circuit the turn-on surge-limiting resistor.

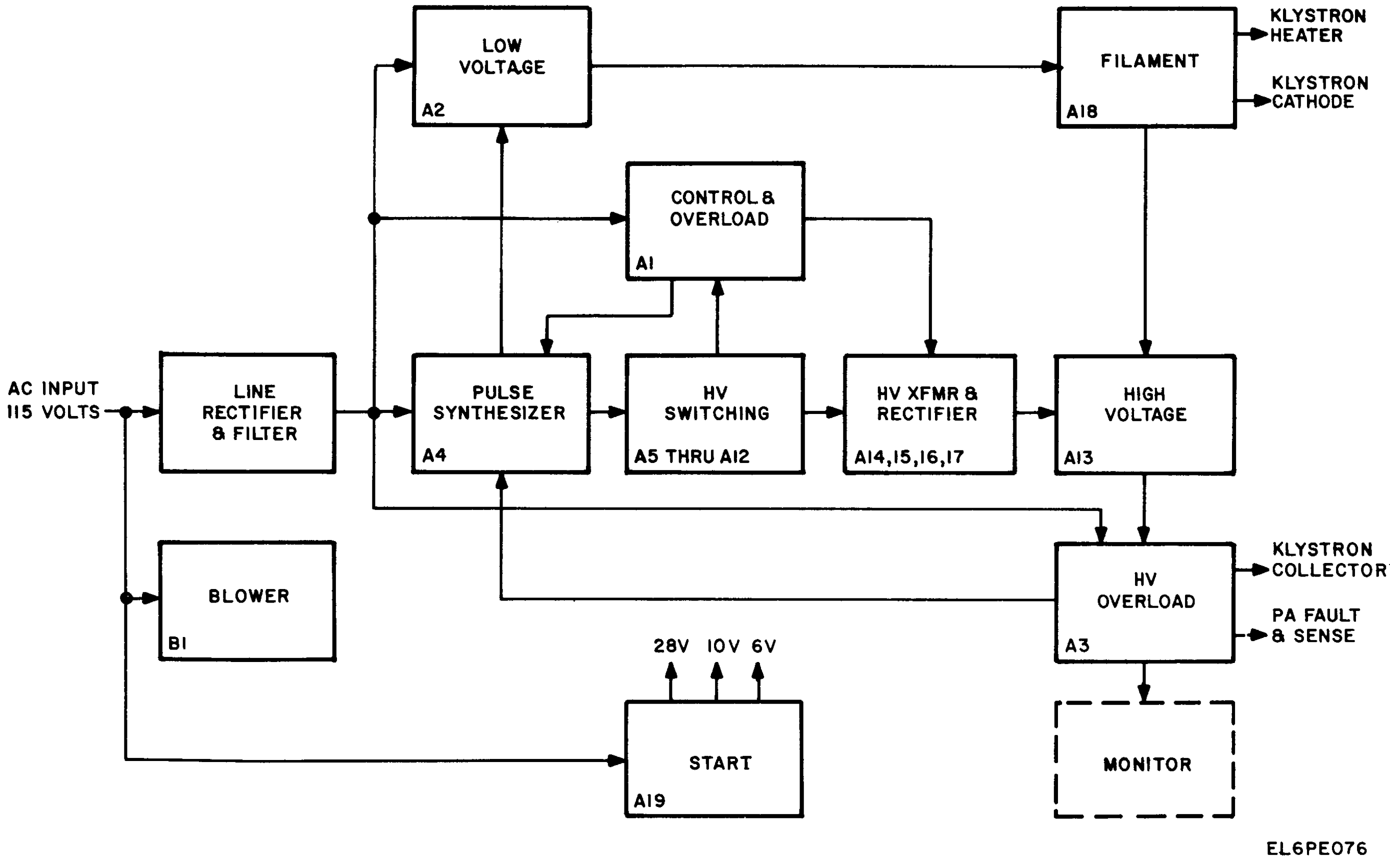

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Figure 6-22. HVP Block Diagram.

(2) On the front panel of the HVPS, a MONITOR meter and associated selector switch permit the observation of various voltage and current levels within the power amplifier group. Operating conditions are indicated by five STATUS lamps. These include STANDBY, OPERATE, HV INHIBIT, FIL INHIBIT, and WG/ANT INHIBIT. The STANDBY or OPERATE lamp will light, according to the position of the OPERATE-STANDBY switch. STANDBY indicates that the high voltage is inhibited, but the RF amplifier is ready to operate. Illumination of the HV INHIBIT lamp is accompanied by the illumination of another status or fault lamp indicating the cause of the inhibit.

(3) The five FAULT lamps are BODY OVLD, HV ARC, INTERLOCKS, TEMP-LOAD, and TEMPKLY-STRON. Body overload and high voltage arc faults will cause the high voltage to be inhibited until the reset switch is depressed and released. The temperature faults will inhibit the high voltage until the over-temperature condition is reduced. Illumination of the INTERLOCKS fault indicates that the BLOWER circuit breaker is off, or that RF amplifier or HVPS covers are not in proper position.

(4) Four fuses labeled HV1, HV2, HV3, and HV4 fuse 280 Vdc to the high voltage transformers in A14, A15, A16, and A17, respectively. The HV MAIN fuse is a primary fuse to the other four. A crowbar overload protection thyristor will blow this fuse under certain fault overload conditions. The 280-Vdc power to the low-voltage module is fused by the LV fuse.

h. Amplifier/Mixer. During multicarrier operation, the amplifier/mixer combines the SHF outputs of two, three, or four upconverters onto a single cable for driving a PA. The unit consists of power combining circuitry which provides isolation between the four input ports, a low-distortion broadband TWT (or FET) linear amplifier, monitor and alarm circuits and power supplies.

(1) Figure 6-23 is a simplified block diagram of the amplifier/mixer. SHF output signals from the upconverters enter the SHF combiner. Front-panel LEVEL ADJUST controls provide for input level balancing. The SHF MONITOR meter indicates the level of the channel selected by the coaxial selector switch. The combined signal is routed to the SHF drive assembly, where the OUTPUT LEVEL control adjusts the drive level to the TWT amplifier to control the TWT output, TWT amplifier output is applied to the SHF output assembly, where it passes through a bandpass filter. The filtered output is connected to the front-panel SHF OUTPUT connector.

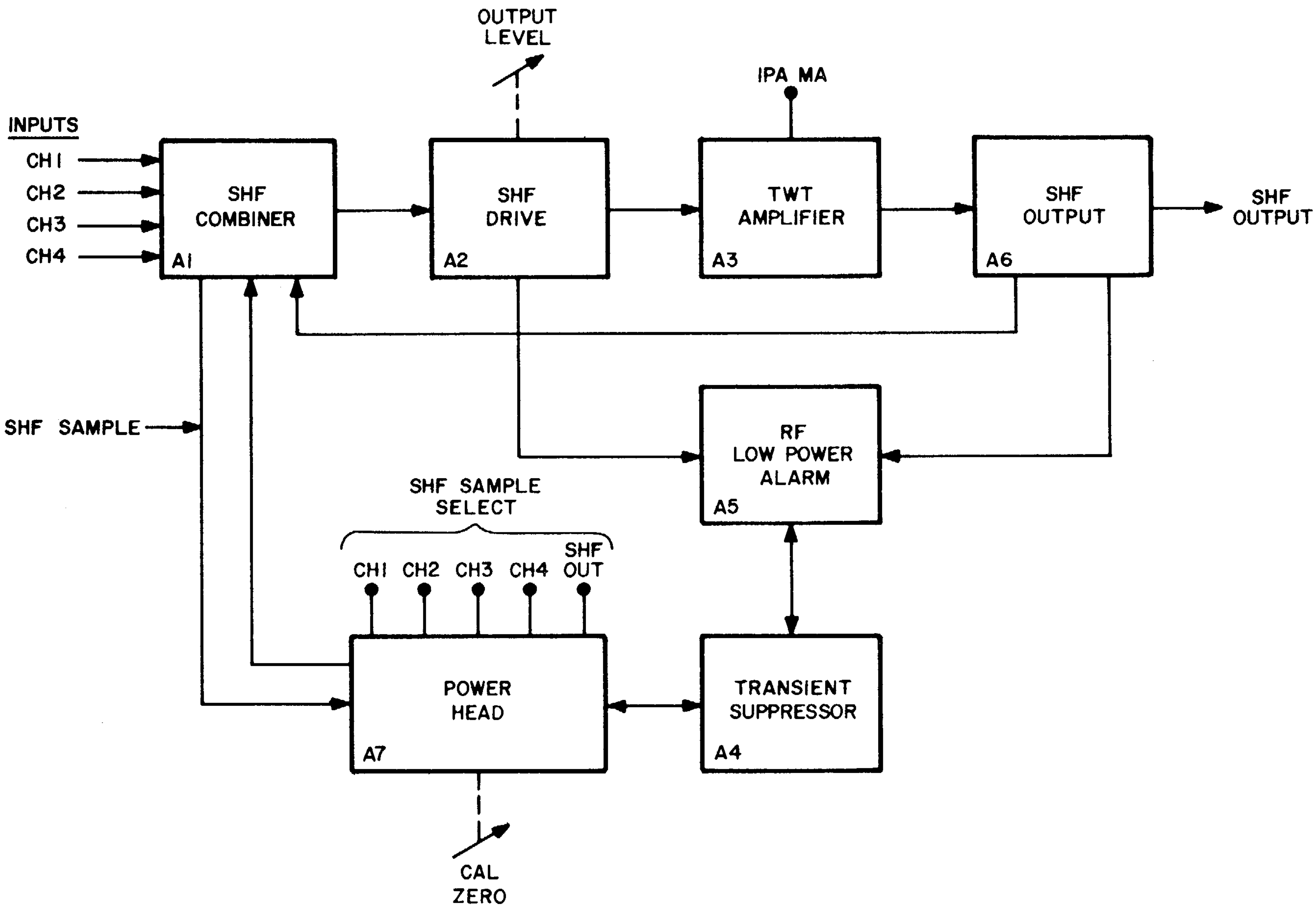

Figure 6-23. Amplifier-Mixer Simplified Block Diagram.

(2) Each input channel of the amplifier/mixer contains directional couplers for sampling the SHF signal. The coaxial switch on the SHF MONITOR section of the front panel can select a sample of each input for measurement after input level adjustment; it can also select an unfiltered sample of SHF output.
Other SHF samples from the SHF drive assembly and the SHF output assembly are monitored by the RF low-power-alarm module. The alarm module lights the front-panel FAULT lamp when RF drive is present, but output is below a predetermined level.

(3) Two power-supply modules provide low voltage dc power to the amplifier/mixer drawer. These voltages, and the TWT beam current, can be monitored at the STATUS MONITOR meter. A third power supply provides power for the TWT amplifier.

i. Antenna Control Unit. The antenna control unit can control either of two types of motorized antenna structures. These structures are the AS-3036/TSC (8-foot diameter) or AS-3199/TSC (20-foot diameter).

(1) *Angle control*. The antenna control unit controls antenna pointing angles by means of motor drive actuators which provide antenna motion in elevation and cross elevation. The actuators are controlled in the antenna control unit by an amplifier operating within a closed servo loop. Antenna control is provided in three modes of operation; manual, acquisition, and autotrack. Semiautomatic satellite signal acquisition and fully automatic tracking of the satellite is provided, using signal strength information from either the beacon signal or from a communication signal, both of which are detected by the comm-track module. A step track algorithm is used for autotracking with either of the two antenna systems.

(2) *Mode selection*. The control modes are selected by a front-panel switch on the antenna control unit or from the remote control unit (which when plugged in disables the similar functions in the antenna control unit and so indicates by lighting the REMOTE ON indicator).

(*a*) *Manual mode*. The manual mode allows the operator to position the antenna by using the axis control switch, which selects left, right, up or down movement.

(*b*)ACQ (*acquisition*). In the acquisition mode, the servo automatically conducts a spatial search, using a cross elevation bar covering an area 5.6 degrees wide in cross elevation and 0.8 degree in elevation for the 20-foot antenna and 13 degrees by 0.8 degree for the 8-foot antenna. Upon detection of a signal, an acquisition command from the receiver commands the antenna to stop and the track loss lamp to go out. The operator can then optimize the signal, using the axis control switch. After assurance that the main beam has been acquired, the operator then selects the auto track mode.

(*c*) *Autotrack*. The autotrack mode uses a step track algorithm to keep the antenna alined to the maximum satellite signal. This method of tracking can be considered as a hill-climbing or peak-signal-seeking technique. A step-by-step description of the tracking algorithm function is to step the antenna in the elevation axis by + 0.020 (0.060), integrate the receiver tracking video voltage for 0.5 second, return the antenna to the center position, step the antenna in the elevation axis in the direction opposite to that of step 1 by 0.020 (0.06°), integrate the inverted tracking video receiver voltage for 0.5 second, return the antenna to the center position, examine integrator value and make a decision on the direction of the scan which gave maximum power, allow antenna to remain still for an average of 4 seconds, and repeat all of the preceding steps in the cross elevation axis.

6-11. Unit Functions, Communications Subsystem

a. Modem. Modem MD-1002 has independent transmit and receive circuits which modulate and demodulate the IF, utilizing biphase shift keying (BPSK) and quadraphase shift keying (QPSK). The data rate for each circuit may be selected independently, depending on the mode of operation.

b. Multiplexer. Multiplex Unit AN/FCC-98 consists of three different circuits: the transmit and receive multiplexing circuits, the voice frequency circuits, and the data circuits. The transmit-receive multiplexing circuits produce a mission bit stream of from 196 kb/s for three-channel operation to 1.5440 Mb/s for 24-channel operation. The circuits also produce and accept only NRZ mission bit stream (MBS). The voice circuits prepare the voice signals for the multiplexing circuits and occupy one 64 kb/s time slot. The data circuits are divided into three independent circuits: 0-20 kb/s, 50 kb/s, and 56/64/128/256/512 kb/s. The 0-20 kb/s circuit requires no clock input. The 50 kb/s circuit requires a clock input normally provided by Converter CV-3034. The 56/64/128/256/512 kb/s circuit require a clock from the user. The 56/64 kb/s circuit occupies one 64 kb/s time slot and the 125/256/512 kb/s circuits occupy 2, 4 and 8 64 kb/s time slots respectively.

c. Encoder/Decoder. The encoder/decoder unit KY-801 is connected to the modem to provide a better bit error rate (BER) while transmitting and receiving the mission bit stream.

d. Line Conditioning Equipment. The voice frequency line conditioning equipment consists of three universal shelves and replaceable modules for processing up to 12 user VF channels configured for the following traffic modes:

(1) 4-Wire circuitry employing either 1600 or 2600 Hz in-band signalling by using line amplifiers or pads and single frequency signalling units (SFSU) at 1600 Hz, 2600 Hz, or mixed.

(2) 2-Wire circuit employing 20 Hz ringdown using the ringdown converter (RDC-4) and the termination set (4TS-2B). These modules occupy two of the line conditioning shelves while the third shelf contains redundant 1600 Hz and 2600 Hz signal supply units and a control-monitor panel for the 48 Vdc power supplies and 20 Hz ringing generator assembly.

e. Patching.

(1) The VF circuits are patched through the VF patch panel (fig. FO-4) which gives the operator the ability to route the circuit through the system when the equipment malfunctions.

(2) Four low-level teletype circuits may be connected to the keyers (transmit mode), which convert the electrical impulses into frequency shift keying (FSK) signals sent to the filter bridge unit.

During the receive mode, the signals from the filter bridge are connected to the converters then sent out as low-level TTY.

(3) Three high-level teletype circuits are connected to line isolators, which convert the 130 volt, 20- or 60-mA impulses into low-level 6-volt impulses.

These are sent to the keyer to be converted into FSK signals, and then sent to the filter bridge unit. The received signals are sent to the isolators where they are converted back to 130-volt, 20-60 mA teletype impulses.

(4) The five teletype circuits connected to the VF TTY junction boxes are FSK and are routed through the TTY/FSK patch panel to the filter bridge unit which combines all teletype circuits into one group to be connected directly to the VF patch panel for routing to a multiplexing VF channel unit for both transmission and reception. All teletype circuits appear at patch panels for ease of rerouting traffic, (5) The data circuits are connected from the entry panel through the data patch panel to the multiplexing unit. Data rates above 512 kb/s are routed through the DATA patch panel to the modem.

f. Orderwire. The orderwire provides terminal-to terminal communications between operators. The unique feature is the signalling tone for ringing. The orderwire is connected through the VF patch panel to the multiplexing unit.

Section IV. AUXILIARY FUNCTIONS

6-12. Fault/Safety Alarm Monitor

The alarm monitor alerts terminal personnel to equipment failures or safety hazards in either the radio subsystem or the communications subsystem, using an audible alarm and visual indicators. The alarm monitor drawer includes a fault/safety gate, self-test circuits, and a power supply.

a. Function. The alarm monitor receives fault input signals from the receive antenna control unit, multiplex carrier group alarm, modem, power amplifier (PA), CSS rack temperature, low antenna elevation (antenna safety cutoff switch), and waveguide alarms (waveguide proximity switches). The fault signal (high or low) inputs are processed through the fault/safety gate. When a fault occurs, the alarm monitor sounds an audible alarm and provides a visible signal on the front panel. A modem fault will cause both the RSS and CSS alarm indicators to light.

Either a low antenna elevation or a waveguide fault will inhibit the high-voltage power supply.

b. Fault Override. The fault override switches on the units give the operator a quick means of localizing a fault from a general indication at the alarm monitor.

When the fault override switch on the fault unit is operated, the audible alarm will be silenced, the alarm monitor fault indicator will extinguish, and the OVERRIDE indicator will light.

c. Audible Signal Test. Placing the FAULT switch in the TEST position causes the audible alarm to sound.

6-13. Power Distribution

a. Prime power to the terminal is three-phase, four wire, 50/60 Hz + 5%, 120/208 Vac + 10%. Power is supplied by either of two 30-kW diesel-powered generator sets mounted on the power pallet. Manual no-break switchover between the on-line generator and the standby unit is accomplished by means of a generator-paralleling switch and a transfer switch.

b. Three-phase ac power enters the terminal by two main feeder cables through the power entry panel and EMI filters. From the power entry panel, the feeders are routed to the power distribution panel and four pole circuit breakers CB1 and CB2, MAIN POWER 1 and MAIN POWER 2, respectively. These circuit breakers control main power to the shelter. Main 1 supplies power to the radio subsystem, shelter lights and utility receptacles, antenna radiation hazard light, and the dehydrator for the 20-foot antenna waveguide system. Main 2 supplies power to the communications subsystem and the air conditioners. A voltage trip module is on each main to protect the equipment against prolonged undervoltage or over voltage conditions. The voltage trip modules also monitor phase sequence and drive the PHASE SEQUENCE indicators on the power distribution panel.

c. Power is distributed to the various subsystems through branch circuit breakers. Each power amplifier and each rack in the RSS is supplied through a three-pole circuit breaker, as is each air conditioning unit. Each CSS rack and the TTY is supplied through a single-pole circuit breaker. Shelter lights and utility receptacles, the antenna radiation hazard light, and the waveguide dehydrator are also supplied through single-pole circuit breakers.

d. Power amplifiers 1 and 2 and the two air conditioners are the heaviest loads. All four operating simultaneously would exceed the rate capacity of the on-line generator. To prevent generator overload, the MODE SELECT switch selectively locks out one of the four loads. The phase C terminal on the load side-of the equipment circuit breaker is connected to one side of the main trip coil for that breaker. The other side of the trip coil is connected to a contact on the MODE H SELECT switch. When that contact is selected, the MODE SELECT switch completes a circuit path to neutral. When main power is on and a selected equipment breaker is set to ON, phase C power immediately energizes the trip coil and trips the ' breaker to OFF.

CAUTION

To avoid damage to the MODE SELECT switch, do not use it to turn off operating equipment.

e. MONITOR meter M1 and MAIN 1/MAIN 2 switch S1 provides for monitoring each phase of each feed between the main power circuit breakers and the branch circuit breakers.

CHAPTER 7
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

7-1. Scope
The items requiring direct support maintenance and covered in this manual are listed in table 7-1. Many of the items of the terminal are covered in separate TMs. Refer to appendix A for a listing of these TMs.

Section II. TOOLS AND TEST EQUIPMENT

7-2. Tools
The tools required for direct support maintenance are listed in table 7-2.

7-3. Test Equipment.
The test equipment required for direct support maintenance is listed in table 7-2.

Table 7-1. Items to be Maintained at Direct Support

Item	Maintenance action req'd	Ref to
Shelter	Removal and replacement	Paragraph 7-4
	Voltage and continuity checks	Paragraph 7-5
Power Pallet	Troubleshooting	Paragraph 7-10
	Removal and replacement	Paragraph 7-11

Section III. MAINTENANCE OF WIRED SHELTER

7-4. Scope
Maintenance of the wired shelter focuses on the power distribution panel (PDP), EMI filter, and power entry panel (fig. 1-5) and is limited to removal and replacement of components found to be defective during performance of the fault isolation procedures (below). See figure 7-1 for location of components. See figure FO-6 for the PDP schematic wiring diagram.

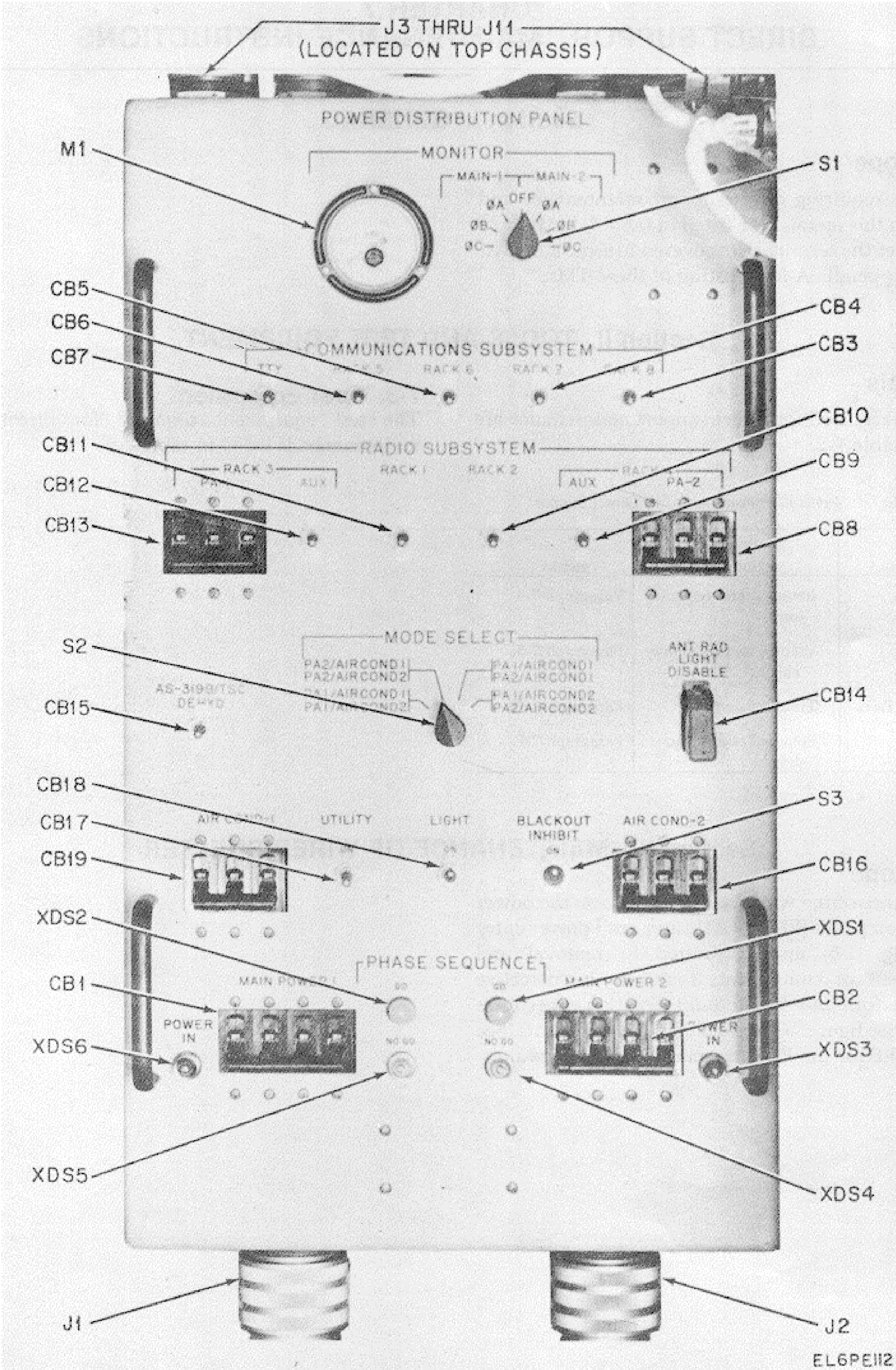

Figure 7-1. Power Distribution Panel, Component Parts Location.

Table 7-2. Tools and Test Equipment Required

Nomenclature	NSN or Part number
Multimeter AN/USM-223 Kit, Tool	6625-00-999-7465 SM-A-777797
Tool Kit, Electronic Equipment TK-105/G	5180-00-610-8177

7-5. Troubleshooting the Wired Shelter
Troubleshooting the wired shelter is accomplished by performing voltage and continuity checks.

WARNING
Voltages dangerous to life exist in the PDP. Exercise extreme care if voltage checks must be performed. When performing continuity checks, disconnect the main power input cables from the shelter power entry panel MAIN POWER 1 and 2 connectors.

a. Disconnect the main power input cables from the shelter power entry panel main power connectors. Verify proper power input at the power source (120/208 Vac ± 10 %, 3 phase, 50/60 Hz 5%).

NOTE
This may be accomplished by measuring 120 Vac between each phase and neutral. Phase A is in pin B, phase B is in pin C, phase C is in pin E, and the neutral is in pin F (fig. FO-5). If the voltage is not correct, proceed to paragraph 7-10.

b. Remove P3 through P11 from PDP connectors J3 through J11 and apply power to the shelters.

c. Observe the two POWER IN Lamps. If lit, proceed to step f below.

d. If the POWER IN lamps are not lit, check the lamps by substitution. If the lamps still do not light, remove the two shelter cable plugs (P1 and P2) from PDP unit connectors J1 and J2, respectively (fig. 7-1).

e. Check for presence of the voltage at the proper pins in P1 and P2 (fig. FO-6). If the voltage is not present check the wiring between the main power input connectors J1 and J2 and the EM1 filters by removing the cover on top of the EM1 filter assembly. This is done by removing the 18 screws securing the cover to the chassis. Repeat step a above and replace the appropriate filter or other component in the EMI filter. (para 7-6.) If the wiring is defective, repair or replace.

f. If the proper voltage is present on P1 and P2, remove the PDP as instructed in paragraph 7-6 and proceed to step g below as follows:

g. Circuit check the wiring between J1, J2 and XDS1, XDS2, CB1 and CB2 (fig. FO-6) and replace wiring on lamp socket if faulty (para 7-7).

h. After repairs or replacement, reinstall the PDP in the shelter and return the shelter to operational status.

i. If MAIN-1 circuit breaker trips repeatedly, remove PDP as instructed in paragraph 7-6.

j. Replace MAIN-1 circuit breaker CB1 as instructed in paragraph 7-7.

k. If MAIN-1 still trips, replace the voltrip unit Al as instructed in paragraph 7-7. Replace PDP in shelter and check for proper operation.

I. If MAIN-2 circuit breaker trips repeatedly, remove PDP as instructed in paragraph 7-6.

m. Replace MAIN-2 circuit breaker CB2 as instructed in paragraph 7-7.

n. If MAIN-2 still trips, replace the voltrip unit A2 as instructed in paragraph 7-7. Replace PDP in shelter and check for proper operation.

o. Observe that the phase sequence indicators are illuminated. Check the phase sequence wiring at the source if the NO GO indicators are illuminated. If the phase sequence is correct, replace voltrip unit Al if DS5 is lit or voltrip unit A2 if DS4 is lit as instructed in paragraph 7-7.

p. If either GO indicator is not illuminated replace the lamps. If either GO indicator is still not illuminated replace voltrip unit Al for lamp DS2 or voltrip unit A2 for lamp DS3 as instructed in paragraph 7-7.

q. If circuit breakers for the TTY, dehydrator, rack 1 through 4 or utilities and lights trip repeatedly check for continuity of the shelter wiring and shorts to ground (fig. FO-7, FO-21 and FO-22).

WARNING
Remove power from the shelter.

r. If the shelter wiring is satisfactory, check the PDP wiring for continuity and shorts to ground (fig. FO-6).

s. If the PDP wiring is satisfactory replace the appropriate circuit breaker as instructed in paragraph 7-7. Replace the PDP in the shelter and check for proper operation.

t. If the PA1, PA2 or air conditioner operation is faulty, check the shelter wiring with the power removed from the shelter (fig. FO-7 for the basic terminal, fig. FO-21 for the radio subsystem racks and fig. FO-22 for the communications sub-system racks).

u. If the shelter wiring is satisfactory, check the wiring and switch S2 in the PDP (fig. FO-6). Replace the defective wiring or switch S2 as instructed in paragraph 7-7.

v. If circuit breakers for racks 5 through 8 trip repeatedly, check for continuity of the shelter wiring and shorts to ground with the power removed from the shelter (fig. FO-7).

w. Verify that the temperature in the CSS racks 5 through 8 is within the required range of +320 F to + 1200 F.

x. Verify that the thermostats S2 through S9 are not closed if the temperature is within the range. Replace any thermostat that is closed.

y. If the shelter wiring and thermostats are satisfactory, check the wiring and relays (K1 through K4) in the PDP (fig. FO-6).

z. Replace defective wiring or relay as instructed in paragraph 7-7.

aa. Replace appropriate circuit breaker if the preceding items are satisfactory. Replace the PDP in the shelter and check for proper operation.

ab. If the MONITOR meter functions improperly, check the PDP wiring of switch S1 and meter M1.
Replace the defective item.

7-6. Removal and Replacement of Power Distribution Panel (fig. 1-5)

WARNING

Turn off main power to the shelter at the trailer power distribution output switch. Remove the main power cables from the power entry panel.

a. On the unit front panel, place all circuit breakers to the OFF position.

b. On the bottom of the unit, remove two shelter cable plugs P1 and P2 from unit connectors J1 and J2, respectively, and the ground wire from terminal El.

c. On the top of the unit, remove nine shelter cable plugs P3 through P11 from unit connectors J3 through J 11, respectively.

d. At the sides of the unit front panel, loosen 16 captive screws and rest the unit on the shelf located below the unit and remove.

e. Replace the unit by performing steps a through d above in reverse order.

7-7 Removal, and Replacement of Power Distribution Panel Components.

Remove the PDP first (para 7-6 above), replace the appropriate component (see below), and then reinstall the PDP.

a. Switch S1 or S2.

(1) On the front panel remove the knob from the shaft.

(2) Tag and remove the wires from the switch terminal.

(3) On the front panel, remove the hardware which secures the switch to the front panel.

(4) Replace the switch by performing steps (1), (2) and (3) above in reverse order.

b. Circuit Breakers CB, CB2, CB8, CB13, CB16 and CB19.

(1) Using a nut driver, remove all the wires from the circuit breaker terminals. Tag each wire after it is removed. Retain the hardware.

(2) On the front panel remove screws with washers (note the position of the flat washer and lockwashers) which secure the circuit breaker to the front panel. Note the orientation of the circuit breaker and then remove it from the PDP. Retain the hardware.

(3) Replace the circuit breaker by performing steps (1) and (2) above in reverse order.

c. Circuit Breaker CB3 through CB7, CB9 through CB12, CB14, CB15, CB17, CB18 and S3.

(1) Use a soldering iron and remove and tag all the wires from the terminals. Take extra caution with the auxiliary switch contacts on CB3 through CB6, CB9 and CB12.

(2) On the front panel remove the nut and washer which secure the unit to the front panel. Note the orientation and remove.

(3) Replace the unit by performing steps (1) and (2) above in reverse order.

d. Connectors J1 through J11.

(1) Remove the jam nut that secures the connector to the chassis.

(2) Slip the sleeving back on the wires (do not replace unless defective).

(3) Unsolder one lead at a time. Resolder to the same terminals on the replacement connector.

(4) Remove the old connector and mount the new connector using the jam nut.

(5) Slide the sleeving forward.

e. Voltrip Modules A1 and A2.

(1) Remove the four nuts and washers which secure the voltrip support bracket to the front of the PDP.

(2) Using a soldering iron, remove and tag the wires from the voltrip unit.

(3) Remove the nut and washer securing the voltrip to the bracket. Note the orientation of the voltrip.

(4) Replace the voltrip unit by performing steps (1), (2), and (3) above in reverse order.

f. Resistor Boards El and E2.

(1) Remove the four nuts and washers which secure the board to the front of the PDP.

(2) Using a soldering iron, remove and tag the wires from the board.

(3) Replace the board by performing steps (1) and (2) above in reverse order.

g. Relay Board- E3.

(1) Remove the two nuts and lockwasher which secure the board to the front of the PDP.

(2) Using a soldering iron, remove and tag the wires from the board.

(3) Replace the board by performing steps (1) and (2) above in reverse order.

h. Meter M1.

(1) Remove the nuts and washers securing the wires to the meter and tag the wires.

(2) Remove the capacitor mounted on the terminal lugs.

(3) Remove the three screws, washers, and nuts which secure the meter to the front panel.

(4) Replace the meter by performing steps (1), (2), and (3) above in reverse order.

i. AC Indicator Lamps (XDS1 and XDS2).

(1) Remove the lens from the front of the lamp holders.

(2) Using a soldering iron, remove and tag the wires from the lamp holder.

(3) Remove the nut and lockwasher at the rear of the lamp holder. Remove the lamp holder.

(4) Replace the lamp holder by performing steps (1), (2), and (3) above in reverse order.

7-8. Maintenance of Power Entry Panel and EMI Filter.

Maintenance of power entry and EMI filter is limited to replacement as described in paragraphs a, b, and c below.

a. Removal and Replacement of EMI Filter and Power Entry Panel (fig. 1-5).

(1) Turn auxiliary power off and disconnect power cable and ground cable at outside of shelter.

NOTE

It is not necessary to remove the assembly to replace or check all components. Refer to applicable section before removing.

(2) Remove the two connectors P1 and P2 from the bottom of the PDP unit.

(3) Remove the stowage bracket located in front of the EMI filter by removing the six screws and washers.

(4) Remove the four screws securing the bottom of the unit to the shelter floor.

(5) Outside the shelter, remove the 16 Phillips-head screws from the power entry panel.

(6) Remove the EMI filter and power entry panel taking care to keep the watertight RFI gasket intact when separating it from the shelter wall. (Retain the gasket.)

(7) With the EMI filter and power entry panel out of the shelter refer to figure FO-8 and perform continuity checks to determine the defective component, if necessary. (Remove bottom cover by removing 14 screws and lockwashers to gain access to components.)

(*a*) Check for obvious physical damage to the EMI filters, FL1 through FL8. Replace if necessary (refer to c below). Check for charring or other evidence of shorts.

(*b*) Perform a continuity check of the suspected input line by measuring between the power input connector and the terminal on the top of the EMI filter: 0 ohm resistance.

(*c*) Check for shorts to ground by continuity checking between the input terminal of the suspected EMI filter to ground (if necessary, electrically disconnect the associated resistor, R1 through R8).

(*d*) If a short is found, disconnect the appropriate filter from the input connector and perform continuity checks to determine if the filter or connector is at fault.

(8) Refer to b and c below for component replacement procedure.

(9) Replace EMI filter and power entry panel by reversing the procedure of steps (1) through (6) above.

b. Replacement of MAIN POWER CONNECTORS J1 and J2.

(1) It is not absolutely necessary to remove the filter assembly from the shelter to circuit check or remove the connectors.

(2) Remove the 18 screws and lockwashers holding the top cover plate in place. (Carefully remove the top cover plate and RFI gasket taking care not to damage the gasket.) (3) Remove the four wires from the INPUT terminals of filters FL3, FL4, FL7 and FL8, if removing J1, or filters FL1, FL2, FL5 and FL6, if removing J2. Take care not to damage the terminal insulator and bleeder resistor on the filters. (Note the identification marking on each lead as it is removed for later replacement.) (4) Remove the two ground wires from bus bar W1. (Note the identification marking on each lead for later replacement.) (5) Remove the protective cover from the connector.

(6) Remove the jam nut securing the connector to the power entry panel. Also remove the washer captivating the protective cover.

(7) Remove the connector carefully.

(8) Unsolder the wire from one lug on the connector and resolder to the corresponding lug on the replacement connector. Repeat this process for the remaining wires.

(9) Install the new connector orienting the

antirotation slot to the screws in the opening. Be sure to install the protective cover washer and fasten the connector to the panel using the jam nut.

(10) Replace the four wires to the respective input connections on the filters. Be careful not to damage the bleeder resistor.

(11) Replace the two wires to the bus bar.

(12) Replace the top cover and RFI gasket.

c. Replacement of the filters. This procedure is for the replacement of a single filter. The procedure is applicable to all filters.

(1) Remove the power entry panel from the shelter. (Perform steps a(1l) through (6) above.) (2) Remove the 19 screws, washers and lockwashers holding the top cover plate in place.
Carefully remove the top cover plate and RFI gasket taking care not to damage the gasket.

(3) Remove the 14 screws and washers holding the bottom cover plate in place and remove the cover.

(4) Remove the wire from the INPUT terminal to the defective filter. Take care not to damage the terminal insulator or bleeder resistor on the filter.

(5) Remove the wire from the OUTPUT TERMINAL of the defective filter. Take care not to damage the terminal insulator on the filter.

(6) Remove the two Phillips-head screws at the INPUT end of the filter.

(7) On the bottom of the unit, locate the four nuts used to fasten the filter to the plate. While holding the filter in place, remove these four nuts and their associated washers.

(8) Carefully remove the filter and the RFI gasket between it and the unit. Be sure not to damage the porcelain terminals at each end of the filter or the gasket.

(9) Install a new filter placing the RFI gasket between it and the unit. Use the hardware removed in step (8) above.

NOTE

If a bleeder resistor was removed with the defective filter install a 47,000 ohm, 5%, 1/2 watt resistor between the INPUT terminal of the filter and one of the two mounting screws of the filter while doing the next two steps.

(10) Install the two mounting screws and washers at the INPUT end of the filter.

(11) Connect the wire from the MAIN POWER connector to the INPUT terminal of the ac line filter.
Take care not to damage the porcelain insulator (and the resistor, if used)

(12) Replace the two cover plates and RFI gasket with the 18 screws, washers and lockwashers removed in step (2) above.

(13) Replace the bottom cover plate with the 14 screws and washers removed in step (3) above.

(14) Replace EMI filter and power entry panel by reversing the procedure of a(1) through (7) above.

Section IV. MAINTENANCE OF POWER PALLET

7-9. Scope

Maintenance of the power pallet is limited to removal and replacement to the interconnecting cables, power switch box, and components found to be defective during performance of the fault isolation procedures. See figure 7-2 for component parts location and figure FO-5 for the power pallet schematic wiring diagram.

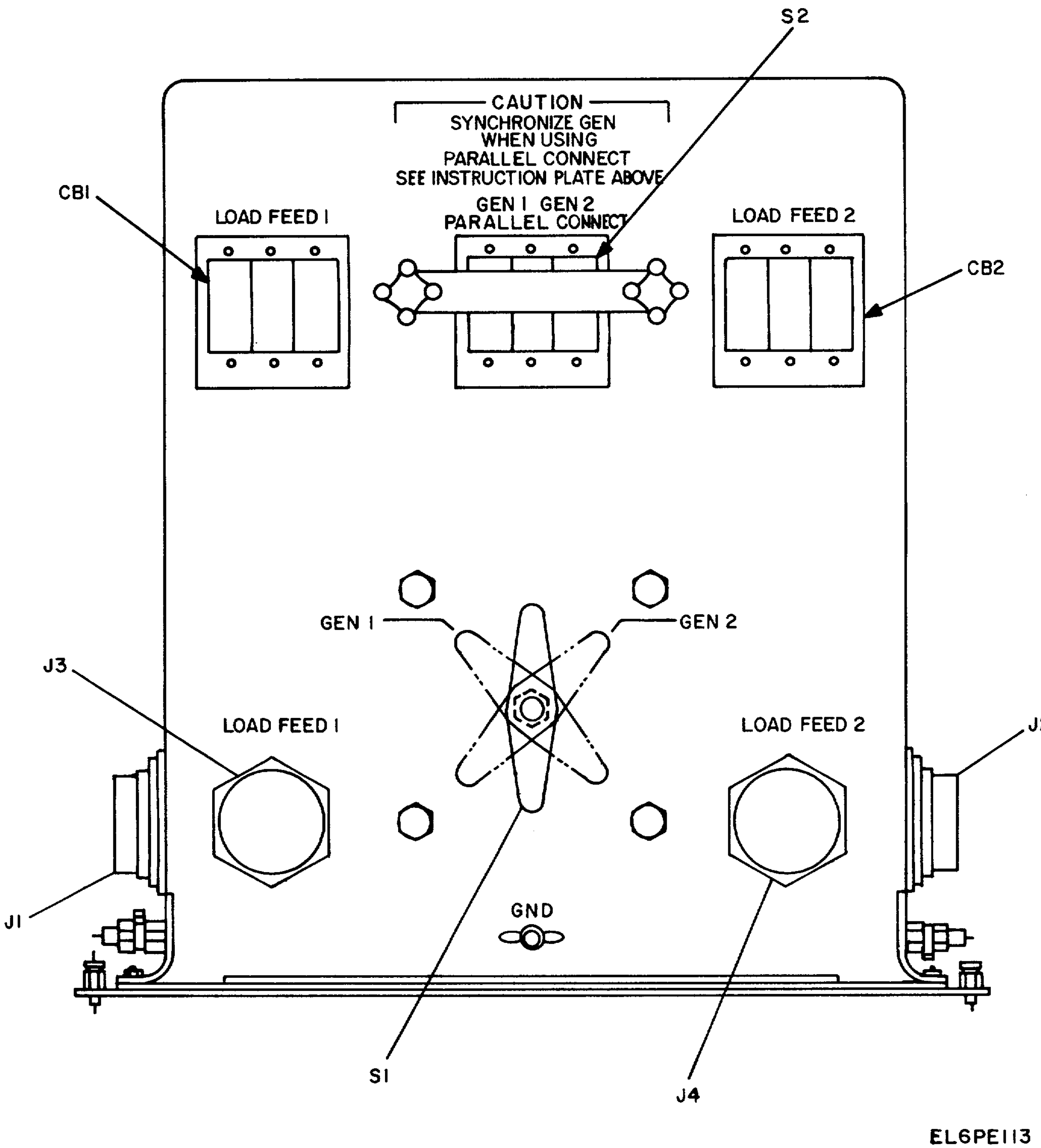

Figure 7-2. Power Pallet, Component Parts Location

7-10. Troubleshooting the Power Pallet

Troubleshooting the power pallet is accomplished by performing voltage and continuity checks.

WARNING

Voltages dangerous to life exist in the power switch box. Exercise extreme care if voltage checks must be performed. When performing continuity checks, disconnect the main power input cables from the generator 1 and 2 connectors.

a. The MONITOR meter located on the power distribution panel in the shelter may be used to perform the fault isolation techniques contained in steps b through h below. Verify that no fault is present in the power distribution panel or EMI filter assembly by performing the test contained in paragraph 7-5.

b. Apply power to the shelter by using the two 50 ft interconnecting cables from the switch box.

c. Place one of the two redundant 30 kW generators ON-LINE at the switch box. Using the transfer switch and the LOAD FEED circuit breaker.

d. Use the MONITOR meter to verify the presence of line to neutral voltage on each phase for MAIN-1 and MAIN-2. The circuit breakers for MAIN-1 and MAIN-2 must be ON. All other breakers are OFF.

e. If only one MAIN breaker trips, at least one of the phases is missing or out of tolerance. Interchange the connections at the power entry panel. If the other MAIN breaker trips the problem is in the external cabling. Circuit check the cables between the switchbox and shelter. Replace any defective cable.

f. If both mains trip, circuit switch-over to the other generator. If this eliminates the problem check the generator and the cable between the faulty generator hookup and switchbox. Replace any defective cables. If both main switches trip, the problem is in the switchbox. Circuit check the switchbox using the schematic wiring diagram in figure FO-5. Repair or replace the defective components or wires.

g. If a load feed breaker trips, check for shorts in the external cable or in the switchbox. Replace the breaker if no fault is found.

h. Replace the parallel connect switch S2 if difficulty is encountered in paralleling the two generators during switchover.

NOTE

Use instructions on plate provided and verify use of a good synchronizing instrument cable.

7-11. Removal and Replacement of Power Switchbox

a. Turn off the generators and remove the main power cables from the generators and to the shelter. Remove the ground cable.

b. On the unit, place the load feed breakers to the off position.

c. On the bottom of the unit, loosen the 16 captive screws and remove the unit.

d. Replace the unit by performing steps a, b, and c in reverse order.

7-12. Removal and Replacement of Power Switchbox Components

Remove the switchbox first (para 7-11) to replace the appropriate component as shown in the following step. Then replace the switchbox in the reverse order of removal.

a. Switch S1.

(1) On the front panel remove the knob from the shaft.

(2) Remove the 30 screws, washers, lockwashers and nuts securing the bottom cover plate to the unit.
Retain the hardware.

(3) Remove the shaft seal from the switch.

(4) Remove the four screws, washers, lockwashers, nuts and sealing washers securing the switch to the front panel.

(5) Slide the switch back from the front panel and rotate to allow removal of the hardware securing the wires to the switch terminals.

(6) Remove the screws, washers, lockwashers and nuts securing the wires to the switch terminal. Remove and tag the wires.

(7) Replace the switch by performing steps (1) through (6) above in reverse order.

b. Circuit Breakers CB1, CB2 and Switch S2.

(1) Remove the switch as described in a above.

(2) If replacing switch S2, remove the bar.

(3) Remove the nine screws and lockwashers securing the part to the front panel. Note the orientation of the part.

(4) Remove and tag the wires from the circuit breaker terminals using a nut driver. Tag each wire after it is removed.

(5) Remove the part from the switchbox.

(6) Replace the part by performing steps (1) through (5) above in reverse order.

c. Connectors J1, J2, J3 and J4.

(1) Remove the 30 screws, washers, lockwashers, and nuts securing the bottom cover plate to the unit.

(2) Remove protective cover from the connectors.

(3) Remove the jam nut that secures the connector to the chassis.

(4) Slip the cover retaining washer off the connector.

(5) Slip the sleeving back on the wires. (Do not replace unless defective.) (6) Unsolder one lead at a time. Resolder to the same terminals on the replacement connector.

(7) Remove the old connector and mount the new connector using the jam nut. Remount the protective cover.

(8) Slide the sleeving forward.

(9) Replace the bottom cover.

CHAPTER 8
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

8-1. Scope
This chapter contains information and procedures for performing tests on the terminal system and maintenance on the alarm monitor unit and its power supply and fault/safety gate modules.

Section II. TOOLS AND TEST EQUIPMENT

8-2. Tools
Tool and repair kits required for general maintenance and removal and replacement are listed in table 8-1 (items 22, 23 and 26). These tools reflect the requirements of the maintenance allocation chart (MAC, appendix B).

8-3. Test Equipment

Test equipment required for testing and troubleshooting is listed in table 8-1 (1 through 21)

Table 8-1. Tools and Test Equipment Required

Item Number	*Nomenclature*	*NSN or FSCM*
1	Generator, Sweep MX-8364-A(P)	6625-00-442-3470
2	Generator, Sweep RF Unit PL1304/USM (HP-8694B)	6625-00-444-2327
3	Attenuator Coaxial (HP-8491B-010)	5985-00-454-6923
4	Adapter, Coax UG-1054	5985-00-295-9824
5	Counter, Freq.CP-772A/U (HP-5245L)	6625-00-973-4837
6	Counter, Plug-in CV-2002/U (HP-5253B)	6625-00-266-3483
7	Counter, Plug-in CV-3059/U (HP-5255A)	6625-00-058-3042
8	Voltmeter, RMS AN/USM-224 (HP-3400A)	6625-00-727-4706
9	Meter, Power ME441/U (HP-432A)	6625-00-436-4883
9	Meter, Power ME441/U (HP-	6625-00-436-4883
10	Mount, Thermistor MX-7772/U (HP-478A)	5840-00-726-3173
11	Attenuator, Variable CN-1367/U (HP-H382A)	6625-00-679-0625
12	Amplifier, Audio AM4 825A (HP-461A)	6625-00-982-2977
13	Coupler, Direc (OMEGA-297)	
14	Coupler, Direc CU-1971/U (HP-H752D)	5985-00-814-4721
15	Load, 50 Ohm (HP-908A)	5935-00-813-9111
16	Dummy Load, Waveguide (RCA-SMA-916398)	
17	Variac (GR-3060-5110)	5950-00-948-6988
18	Multimeter, Digital (FLUKE-8000A)	6625-00-322-8715
19	Power Supply (HP-6202B)	6625-00439-5080
20	Milliammeter, Clip On ME-488/U (HP-428B)	6625-00-816-9324
21	Multimeter AN/USM-223	6625-00-999-7465
22	Tool Kit, Electronic Equipment5180-00-605-0079 TK-100/U	
23	Kit, PCB Repair MK-772/U	5999-00-757-5042
24	Test Fixture Power Supply Sys Mon (RCA-A1545804-5)	
25	Test Fixture, Alarm Monitor, Fault Safety Gate (RCA-(HP-H281A) A1547620)	
26	Kit, Tool (RCA-SMA-777797)	
27	Low Loss Test Cable (RCA-SM- C-937321) (P/O Terminal)	

8-4. Test Fixtures

Test fixtures for maintenance on the alarm monitor and its modules are listed in table 8-1 (items 24 and 25.)

Section III. TESTING OF TERMINAL SYSTEM

8-5. Scope
This section contains information and procedures for performing tests on the terminal system. The purpose of these tests is to detect any degradation in system performance of the particular operating function under test. The terminal will not be operational when these

tests are performed. Perform all tests in sequence at least once every three months during an operational period. For these tests it is assumed that ac power has been applied to the terminnal for at least 15 minutes.

8-6. Receiver Gain

WARNING

The protective grounding terminals of the test instrument and the calibration equipment must be connected to the equipment grounding (safety) conductor of the power cords. For electric shock protection use only extension cords and power receptacles with a safety-ground connector, or otherwise connect the chassis to a safety ground system.

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

a. Test Method. Receiver gain is calibrated using , signal sources within the terminal in conjunction with precision attenuators and a low level SHF hard limiter, as shown in figure 8-1. A signal at the local receiver frequency is obtained from the SHF LO output of the frequency synthesizer in the up converter drawer. The output level of this signal is between the limits of + 6 and + 12 dBm, and is passed through the SHF hard limiter and a 6 dB attenuator to provide a nominal -52 dBm signal at the 20 dB waveguide coupler on the AME subassembly, which gives a nominal -72 dBm signal at the LNA input.

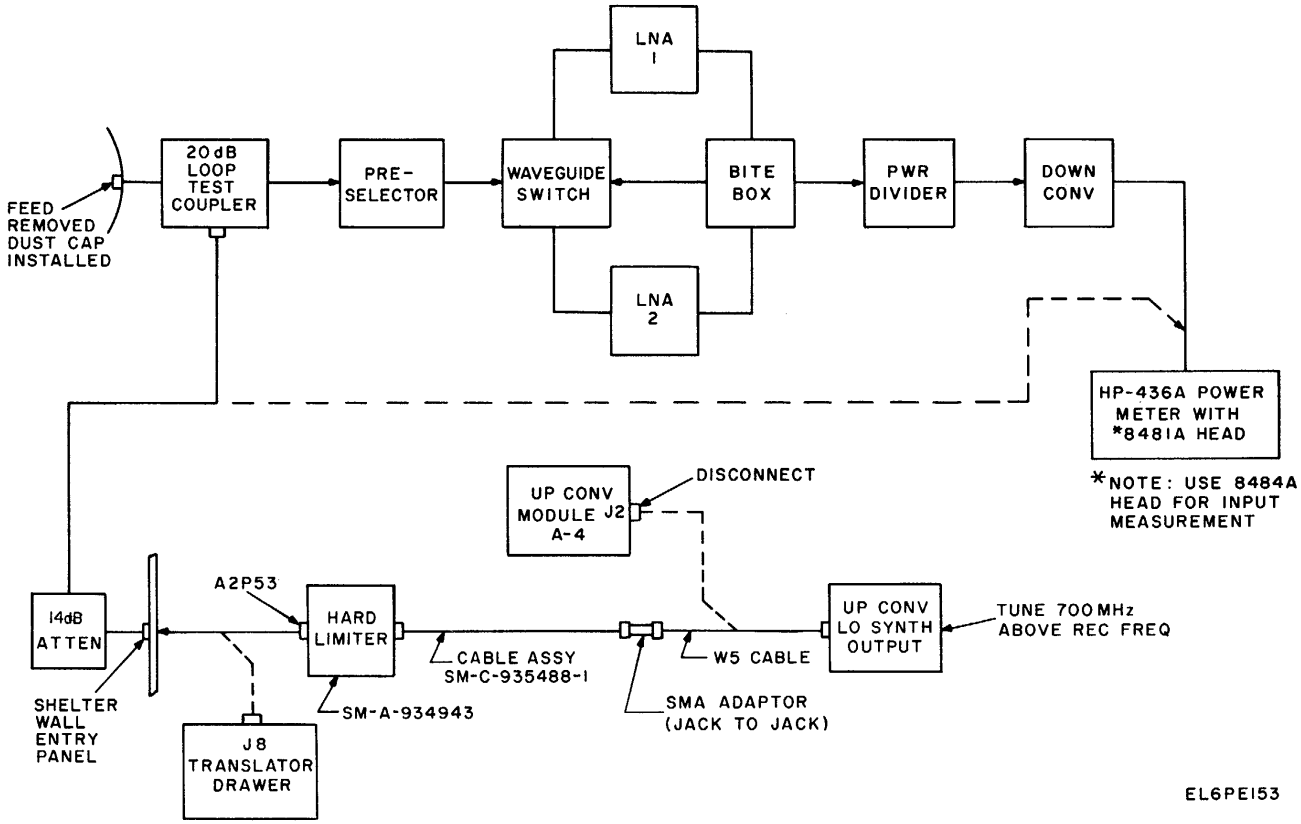

Figure 8-1. Overall Receiver Gain Field Calibration.

(1) Tune the upconverter synthesizer to 8200 MHz, and the receiver to 7500 MHz.

(2) Connect the limiter assembly, SM-A-934943, input to the SHF LO output of the upconverter synthesizer with the 6-foot test cable W401, SMC-935488-1. Insert a 14 dB attenuator in series with the loop test cable at the shelter wall.

(3) Disconnect the SHF output cable from J8 on the rear of the LNA control/translator drawer and connect to the output of the limiter assembly, SMA-934943.

(4) Connect the HP-436A power meter, using the HP-8481A power head, to the IF output of the downconverter drawer. The IF output level of the downconverter should be 50 dB minimum above the coupler input level. The IF output level may be adjusted at the 700/70 MHz mixer assembly, A2A1, in the downconverter drawer, with the receiver gain adjustment R5 or MDL gain R6.

b. Test Procedure.

(1) Remove the feed-tube from the antenna center section and replace it with a dust cap or aim the antenna at a quiet spot in the sky.

(2) Loosen the captive screws on the front panel of the upconverter drawer and pull the drawer forward on its slides.

(3) Disconnect cable W5 going from the synthesizer of the upconverter at J2 on module A4 and connect the same to the hard limiter test assembly, SM-A-934943, through test cable assembly SMC-935488-1, and the SMA adapter provided in the test kit.

(4) Loosen the screw fasteners on the front panel of the LNA control/translator drawer, and pull the drawer forward on its slides.

(5) Disconnect connector A2P53 going to receptacle J8 (SHF out) at the rear of the LNA control/ translator drawer, and connect it to the output of the hard limiter test assembly, SM-A-934943.

(6) Configure the shelter for normal operation and turn the power ON, except that the PA is left on STBY.

(7) At the antenna mounted assembly, disconnect the terminal loop test cable from the LOOP TEST coupler and connect the cable to the RF power meter and low power head HP-8484A using a UG-29B/U adapter.

(8) Set the upconverter to 8399 MHz and the downconverter to 7699 MHz and measure and record the signal level.

(9) Repeat step (8) above at 8200 MHz and 7500 , MHz.

(10) Repeat step (8) above at 7950 MHz and 7250 MHz.

(11) Disconnect the loop test cable from the power meter and connect it through the 14 dB attenuator to the LOOP TEST coupler.

(12) Calculate and record the input levels for each frequency by subtracting 14 dB from the measured levels of steps (8), (9) and (10) above.

(13) Connect the power meter with the HP8481A head to the 70 MHz OUTPUT (J4) of the downconverter to be measured.

(14) Read and record the measure level. The level should be at least 50 dB above the level calculated in step (12) above.

(15) The overall receiver gain may be measured for receive frequencies of 7250 MHz and 7699 MHz by tuning the upconverter synthesizer to 7950 MHz and 8399 MHz, respectively. Output levels should be 50 dB minimum above input.

(16) Repeat above steps for other downconverters as required.

(17) Replace the antenna feed; remove all test cables, and restore all normal connections on the drawers to return the shelter to normal operation.

8-7. Frequency Accuracy

The frequency accuracy tests are intended primarily for diagnostic purposes in locating malfunctioning units which are causing gross frequency error. The test equipment available at this general support level of maintenance is not sufficiently accurate for adjustment of the 5 MHz reference oscillators in the synthesizers of the upconverters and downconverters. For the following test, refer to figure 8-2 and table 8-1 for the required test equipment.

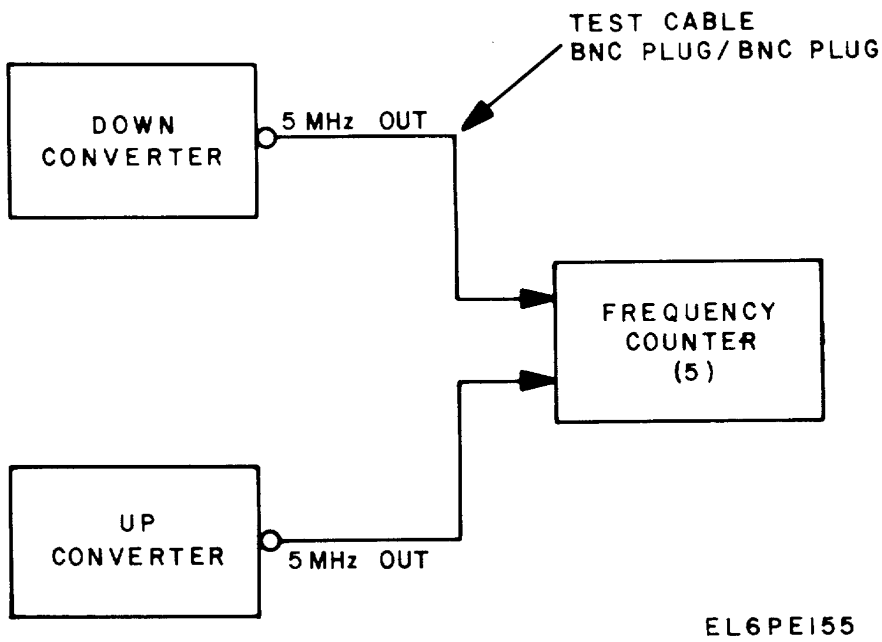

Figure 8-2. Synthesizer Reference Oscillator Test Setup.

a. Synthesizer 5 MHz Reference Oscillator.

(1) Configure test equipment as shown in figure 8-2.

(2) Turn on upconverter or downconverter and frequency counter and allow one hour for warm up.

(3) Measure frequency from 5 MHz output jack on synthesizer. Test limit: 5 MHz + 6 MHz. If the frequency error exceeds the test limit, replace the 5 MHz oscillator module in the synthesizer. Refer the replaced module to depot for maintenance.

CAUTION

Do not attempt to adjust the frequency of the 5 MHz oscillator. The available frequency counter is not sufficiently accurate to make this adjustment.

b. Modem Frequency Accuracy.

(1) Insert the HP-5253B hetrodyne converter (CV-2002/U) in the frequency counter. Turn on counter and allow to warm up.

(2) By using the patching and interconnections shown in figure 8-3, establish a complete transmit and receive test loop, placing the desired modem upconverter, downconverter, PA, etc. on line. Turn on the on-line equipment. Set the PA in standby.

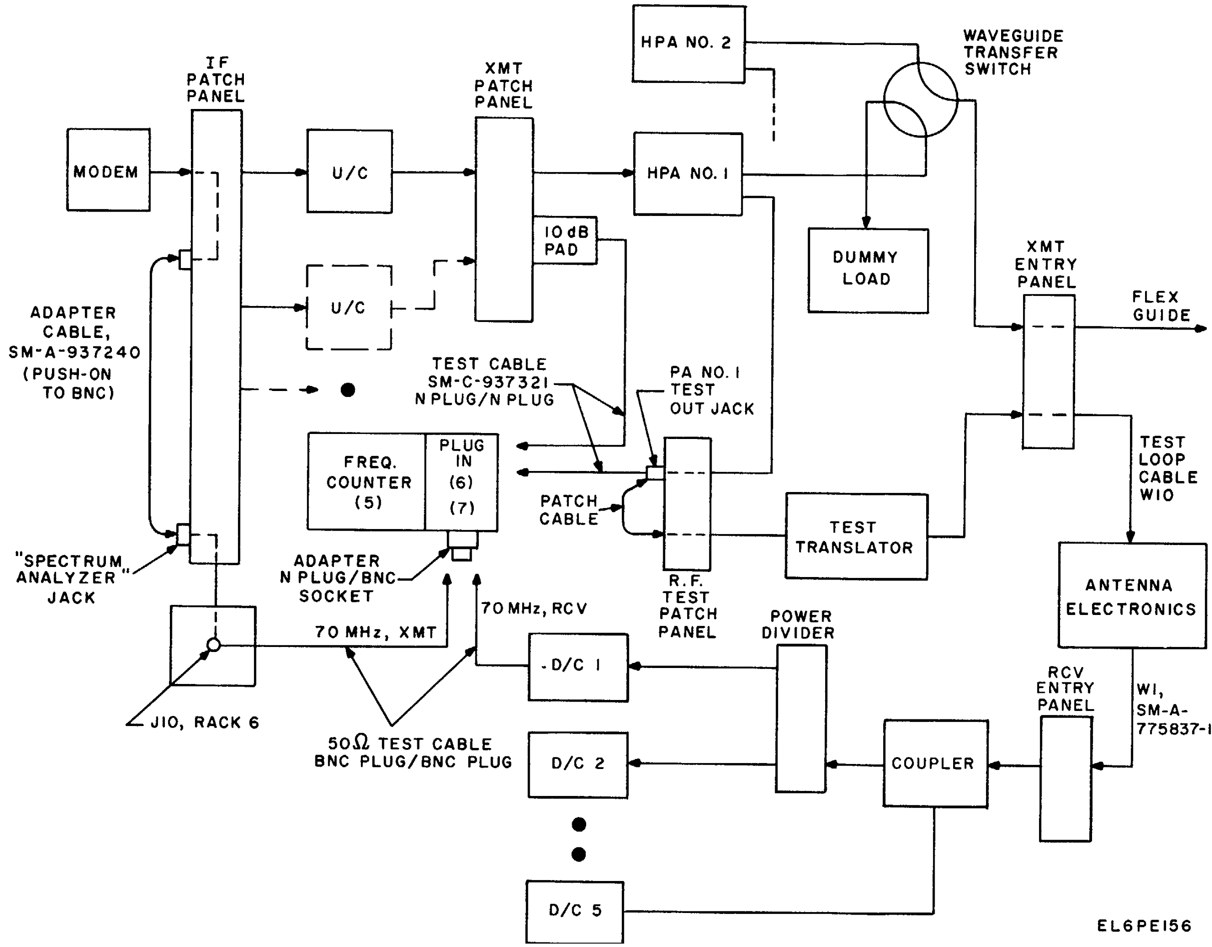

Figure 8-3. Frequency Accuracy Test Setup.

(3) Remove the screws retaining the on-line modem front panel to the rack and pull the modem forward a few inches on its slides.

(4) Put the modem in the CW mode by turning the MODE switch to OPERATE and setting the SOURCE switch (at upper left behind the front panel) to the ICF position.

(5) The 70 MHz IF output signal from the modem is accessed at its appearance on the IF patch panel. Using the push-on to BNC adapter cable, SMA-937240, patch from the appropriate modem output appearance to the BNC spectrum analyzer jack at the right end of the IF patch panel. This jack is wired directly to J10 at the top of rack 6. Connect a 50-ohm test cable from J10 (BNC) to the RF input of the HP5253B hetrodyne converter in the frequency counter. Use a BNC socket to N plug adapter at the converter.

(6) Measure the modem IF output frequency. The test limits are 70 MHz + 1 kHz. If the tests limits are exceeded, refer to the modem maintenance manual, TM 11-5820-847-34.

c. SHF Transmit Frequency. The upconverter output frequency may be checked as follows: CAUTION Do not connect the upconverter output to the frequency counter without an intervening 10 dB pad. The + 21 dBm output level of the upconverter may damage the input circuits of the plug-in module in the frequency counter.

(1) Be sure that the PA is in the standby condition.

(2) Set the desired modem in the CW mode as in b(4) above.

(3) At the IF patch panel, patch the modem to the desired upconverter. Tune the upconverter to 8100 MHz.

(4) Insert the HP-5255A plug-in module into the frequency counter.

(5) Connect a 10 dB pad to the upconverter output on the transmit patch panel. Connect the SMC-937321 low-loss test cable from the pad to the input of the HP-5255A plug-in unit.

(6) Measure the upconverter output frequency.

Test limits: 8100 MHz $\pm$11 kHz

(7) If the measured frequency is out of tolerance, check upconverter synthesizer for faults or an out of lock condition. Refer to TM 11-5895-1092-34 for synthesizer maintenance.

d. Down Converter Frequency.

(1) At the IF patch panel, select a modem and an upconverter which have been previously tested for frequency accuracy. Set the modem in the CW mode and tune the upconverter to 8100 MHz.

(2) Tune the PA to be used to 8100 MHz. Set the waveguide transfer switch to route the output of this PA to the dummy load.

(3) Leave the other PA (the on-line unit connected to the antenna) either off or in the standby condition.

(4) At the RF test patch panel, patch the test out jack for the off-line PA to the test translator input jack.

(5) Turn on the test translator.

(6) Check that the test loop cable, W10, and the receiver input cable, W1, are installed as shown in figure 8-3.

(7) Install the HP-5253B plug-in module in the frequency counter and turn on counter.

(8) Connect the IF output of the downconverter to be tested to the input of the HP-5253B plug-in module. Use a BNC to BNC test cable and a BNC to N adapter for this connection.

(9) Tune the downconverter to 7375 MHz.

(10) Operate the off line PA and set its power output level to 1000 watts.

(11) With the frequency counter, measure the downconverter IF output frequency.

(12) If the measured frequency is out of tolerance, check the test translator for phase lock. Check the downconverter synthesizer for faults or an out of lock condition. Refer to TM 11-5895-1092-34 for synthesizer maintenance.

8-8. Transmitter Power Output

WARNING

This procedure requires that the transmit flex waveguide (W3) be disconnected from the antenna and then connected to the test equipment. Make sure the transmitter power supply is in STANDBY before disconnecting the waveguide from the antenna.

a. Refer to figure 8-4 and table 8-1 for the test equipment required to perform this test. Note on figure 8-4 the quantity required for item 4.

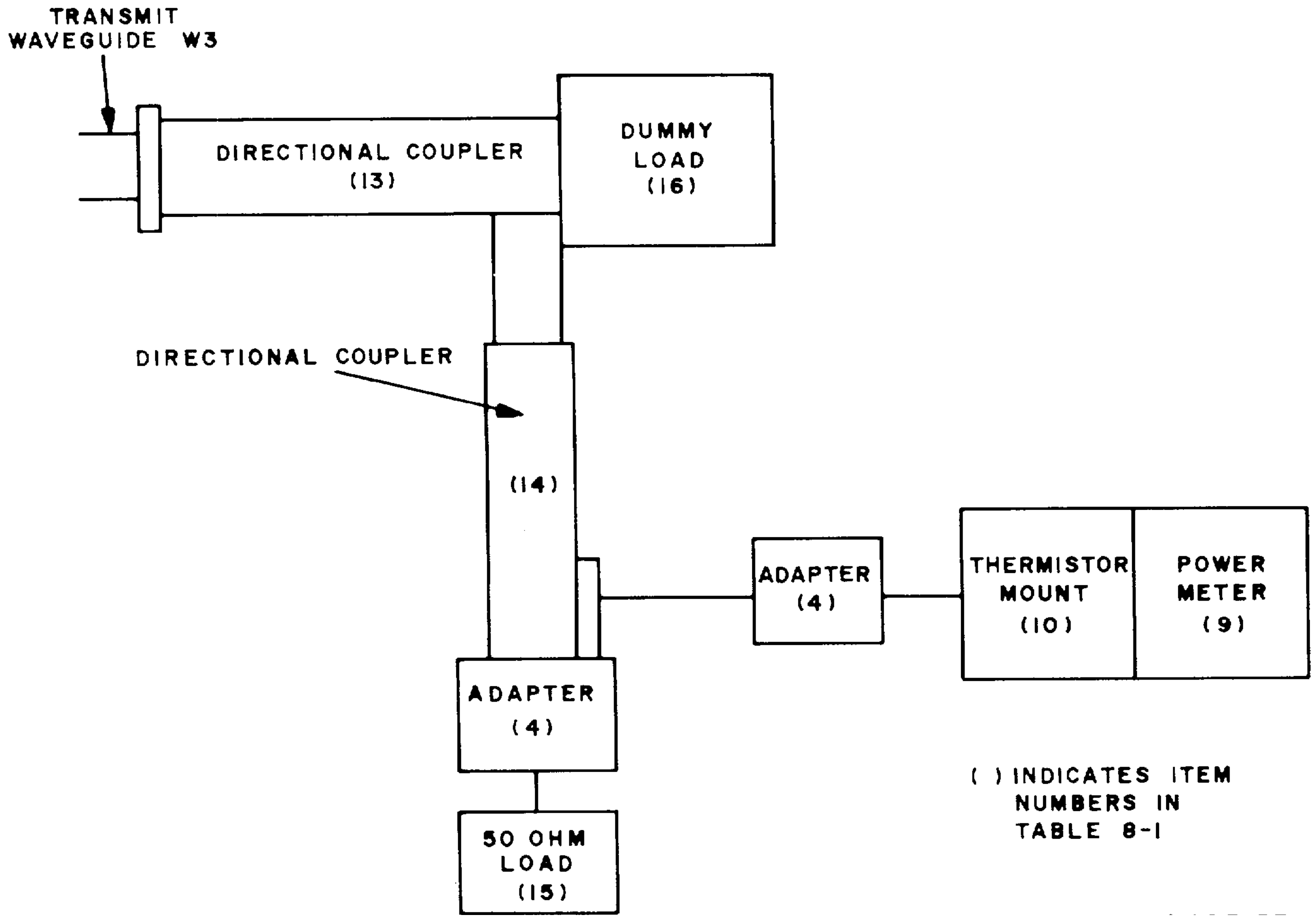

Figure 8-4. -Transmitter Power Output Test Setup.

b. Connect the test equipment as shown in figure 8-4. Apply power to the test equipment and allow it to warm up for approximately 5 minutes.

c. Tune the upconverter and power amplifier to 8100 MHz.

d. Note the on-line status of the transmitter groups. On the on-line power supply place the OPERATESTANDBY switch to the STANDBY position.

e. Disconnect the transmit waveguide, W3, from the antenna and connect it to the test equipment directional coupler (fig. 8-4).

f. On the on-line power supply, place the OPERATE-STANDBY switch to the OPERATE position.

WARNING

1000 WATTS OF RADIATED RF POWER. DO NOT operate the alarm monitor SAFETY ALERT switch when the transmit waveguide is disconnected from either the antenna or the test equipment.

*g.*Open the alarm monitor drawer. While holding the SAFETY ALERT switch in the OVERRIDE position, adjust the on-line power amplifier OUTPUT LEVEL control for a 1000 watt reading on the PA MONITOR meter.

h. The test equipment power meter should read 0 + 1.5 dBm. Note the reading.

i. Continue to hold the SAFETY ALERT switch and return the PA power output to the assigned level; release the switch.

j. On the on-line power supply, place the OPERATE-STANDBY switch to the STANDBY position.

k. On the standby power supply, place the OPERATE-STANDBY switch to the STANDBY position.

l. Position the transmit waveguide switch to place the standby PA on-line.

m. Repeat steps f, g. and h above for the standby transmitter group then proceed to step n below.

n. If both readings are out of tolerance, fault isolate the common waveguide system. If one reading only is out of tolerance, fault isolate to the PA and associated waveguide.

o. Disconnect the transmit waveguide, W3, from the test equipment and connect it to the antenna. Disassemble the test equipment setup.

p. Return the terminal to its normal operating mode.

Section IV. TROUBLESHOOTING OF ALARM MONITOR

8-9. Scope This section contains information and procedures for troubleshooting of the alarm monitor power supply and fault/safety gate modules and the alarm monitor unit. Removal and replacement procedures are provided if it is necessary to remove a module from the unit. Also included is information on test fixtures and a special cable required to interface the item under test with the test equipment.

8-10. Removal and Replacement of Alarm Monitor Modules

a. Alarm Monitor Power Supply. If necessary, refer to chapter 5 for removal and replacement instructions on the power supply module PS1. After removal from the unit, remove the cover from the power supply by removing the eight screws and washers which secure it in place.

b. Alarm Monitor Fault/Safety Gate. If necessary, refer to chapter 5 for removal and replacement instructions on fault/safety gate module Al.

8-11. Test Fixtures and Universal Power Cable

a. Table 8-2 lists the test fixtures and cable required for troubleshooting of the alarm monitor and its modules.

b. Table 8-3 lists the parts required to fabricate (if necessary) the test fixture for the power supply module. Reference the drawings listed in table 8-2 for fabrication details.

Table 8-2. Test Fixtures Required for Maintenance of Alarm Monitor Modules

Description	RCA part no.	Parts list table no.	Drawing reference figure no.
Test fixture, alarm monitor power supply	A1545804-505	8-3	FO-9 through FO-14
Test fixture, alarm monitor	A1547620-501	8-4	FO-15, FO-16, and FO-17
Universal power cable	A1547219-501	8-5	8-5

Table 8-3. Test Fixture, Alarm Monitor Power Supply, Parts List

Reference designation	Description	Mfg. Code	Part number	Qty
CB1	Circuit breaker	32720	AP-12-4613-2	1
J1, J2, J3, J4	Pin jack, yellow	83330	1505-107	4
J5, J6, J7, J8, J9 J10, J11, J12	Pin jack, green	83330	1505-104	8
J13, J14, J15, J16	Pin jack, red	83330	1505-102	4
J17	Pin jack, black	83330	1505-103	1
P1	Connector	G96906	MS-3116F-10-6S	1
P2	Connector	71468	DAMM-15P	1
	Connector hood	71468	DA-110963-3	1
P3	Connector	83315	5965VY	1
R1, R2	Resistor, 50 ohm, 25 W	44655	0200D	2
R3, R4, R7, R8 R11, R12	Resistor, 330 ohm, 2 W	G96906	RCR42G331J	6
R5, R6	Resistor, 6.8 ohm, 12 W	44655	3750	2
R9, R10, R13, R14	Resistor, 33 ohm, 12 W	44655	3766	4
R15	Resistor, variable, 25 ohm, 25 W	44655	0147	1
R16	Resistor, 5 ohm, 25 W	44655	0200A	1
R17	Resistor, 10 ohm, 50 W	44655	0400B	1
R18	Resistor, variable, 15 ohm, 25 W	44655	0146	1
R19	Resistor, 10 ohm, 25 W	44655	0200B	1
S1, S2, S3, S4	Switch, spdt, center off	86022	8802-K6	4
S5, S6	Switch, spst	86022	8803-K6	2
TB1	Terminal block	76930	354-28-12-001	1

c. Table 8-4 lists the parts required to fabricate (if necessary) the test fixture for the fault/safety gate module and the alarm monitor unit. Reference the drawings listed in table 8-2 for fabrication details.

d. Table 8-5 lists the parts required to fabricate (if necessary) the universal power cable. Table 8-6 is a wiring chart of the universal power cable. Figure 8-5 illustrates the cable assembly.

Table 8-4. Test Fixture, Alarm Monitor Fault/Safety Gate, Parts List

Reference designation	Description	Mfg. Code	Part number	Qty
CB1	Circuit breaker	32720	AP12-4613-45	1
D1, D2, D3, D4	Diode	04713	1N4006	4
DS1 through DS9	Pilot lamp - 28 V at 0.04 amperes	08806	327	9
	Pilot lamp assembly DS1 through DS9	Dialco	249-7872-3731-504	9
DS10	Pilot lamp, neon	08806	NE-2D	1
	Pilot lamp assembly	G96906	MS-25257-4	1
J1	Connector, receptacle	91662	00-7038-047-217-001	1
J3, J5, J9	Tip jack, red	83330	1506-102	3
J6, J8	Tip jack, yellow	83330	1506-107	2
J13, J15, J17, J18, J19, J20, J21, J22 J23, J24, J26, J28 J30, J31, J33, J35, J37, J39, J41, J43, J45, J46, J48, J72 J74, J76, J78, J80, J82, J84, J86, J88, J90, J92, J94, J96, J98, J100, J102, J104, J105, J106	Tip jack, orange	83330	1506-106	42
J14, J16, J25, J27, J29, J32, J34, J36, J38, J40, J42, J44, J47, J50, J52, J54, J57, J58, J59, J60, J61, J62, J63, J64, J65,	Tip jack, brown	83330	1506-108	25
J7, J4	Tip jack, black	83330	1506-103	2
J66, J67, J68, J71, J73, J75, J77, J79, J81, J83, J85, J87, J91, J95, J99, J101, J103	Tip jack, white	83330	1506-101	17
P1	Connector, cable	G96906	MS-3116F-12-3S	1
P2	Connector, cable	G96906	MS-3116F-18-32S	1
P3	Connector, cable	G96906	MS-3116F-20-39S	1
R	Resistor, 5.1K, 1/2 W, 5%	G96906	RC20GF512J	1
S2 through S28	Switch, toggle, spdt	09353	7101	31
S32	Switch, toggle spst	Cutler Hammer	8803K6	1
TB1	Terminal board	83330	2811	1
U1	Integrated circuit, quad dual power driver	56289	UHP-508	1
	Socket, I. C., 14-pin	91506	314-AG6D2R	1
	Terminal pin, '/2-inch	49675	8830314-4	14
P4	Connector, cable	83315	5965VY	1
J2, J11, J108, J109,	Binding Post, Red	74970	111-0102-001	4
J10, J12, J107,	Binding Post, Black	74970	111-0103-001	4

Table 8-5. Universal Power Cable, Parts List

Item no.	Description	Mfg. code	Part number	Qty
1	Block, connector	09769	205516-1	1
2	Pin, connector	09769	66104-3	34
3	Pin, connector	09769	66100-3	2
4	Pin, connector	09769	202417-1	6
5	Guide, male	09769	200833-4	1
6	Guide, female	09769	203964-2	1
7	Jackscrew	09769	200867-2	1
8	Clamp, strain relief	09769	201847-1	1
9	Screw, machine, R. H. 440 x 5/8	G96906	MS-51957-18	2
10	Lockwasher, split	G96906	MS-5338-135	4
11	Nut	NAS-7104		4
12	Marker, cable	04740	8537551	3
13	Marker, wire	85480	MM-0-49	37
14	Connector	83315	5965VY	1
15	Connector	G96906	MS-3106A-16-llP	1
16	Clamp	G96906	MS-3057-8A	1
17	Bushing	G96906	MS-3420-8	1
18	Wire, white, no. 20 AWG		M22759/11-20	AR
19	Wire, white, no. 18 AWG		M22759/11-18	AR
20	Wire, white, no. 12 AWG		M22759/11-12	AR
21	Sleeve, vinyl, 48" lg. x 3/8" dia.			AR
22	Sleeve, vinyl, 36" lg. x 3/16" dia.			AR
23	Sleeve, vinyl, 36" lg. x ¼ "dia.			AR

Table 8-6. Universal Power Cable, Wiring Chart

P1 Pin no.	Voltage	Current	Wire size	Remarks
1	+6V	5A	20	
2	+ 6 V ret	5A	20	
3	-6V	5A	20	
4	-6Vret	5A	20	
5	+ 24 V	25 A	12	High current, pin 202417-1
6	+24 V ret	25 A	12	High current, pin 202417-1
7	-24 V	25 A	12	High current, pin 202417-1
8	- 10 V	5 A	20	
9	- 10 V ret	5 A	20	
10	+ 12 V	5 A	20	
11	+ 12 V ret	5 A	20	
12	- 12 V	5A	20	
13	- 12 V ret	5 A	20	
14	+ 15 V	5 A	20	
15	+ 15 V ret	5 A	20	
16	- 15 V	5 A	20	
17	-15 V ret	5 A	20	
18	+24V	5 A	20	
19	+24 V ret	5 A	20	
20	-24V	5 A	20	
21	-24 V ret	5 A	20	
22	+28 V	5 A	20	
23	+28 V ret	5 A	20	
24	+ 100 V	1 A	20	
25	+ 100 V ret	1 A	20	
26	+ 148 V	6 A	18	P2-A, pin 66100-3
27	+ 148 V ret	6 A	18	P2-B, pin 66100-3
28	-	-	20	Spare
29	-	-	20	Spare
30	+ 115 V high	5 A	20	wires 30, 31, 32 terminate
31	+ 115 V low	5 A	20	in P3. For use with variable
32	+ 115 V gnd	5 A	20	voltage transformer.
33	-	-	20	Spare
34	-	-	20	Spare
35	-	-	20	Spare
36	-	-	20	Spare
37	Chas gnd	-	20	
38	- 24 V ret	25 A	12	High current, pin 202417-1
39	- 10 V	10 A	12	High current, pin 202417-1
40	+ 10 V ret	10 A	12	High current, pin 202417-1
41	-	-	20	Interlock
42	-	-	20	Interlock

*All pins are type 66104-3 except as noted.

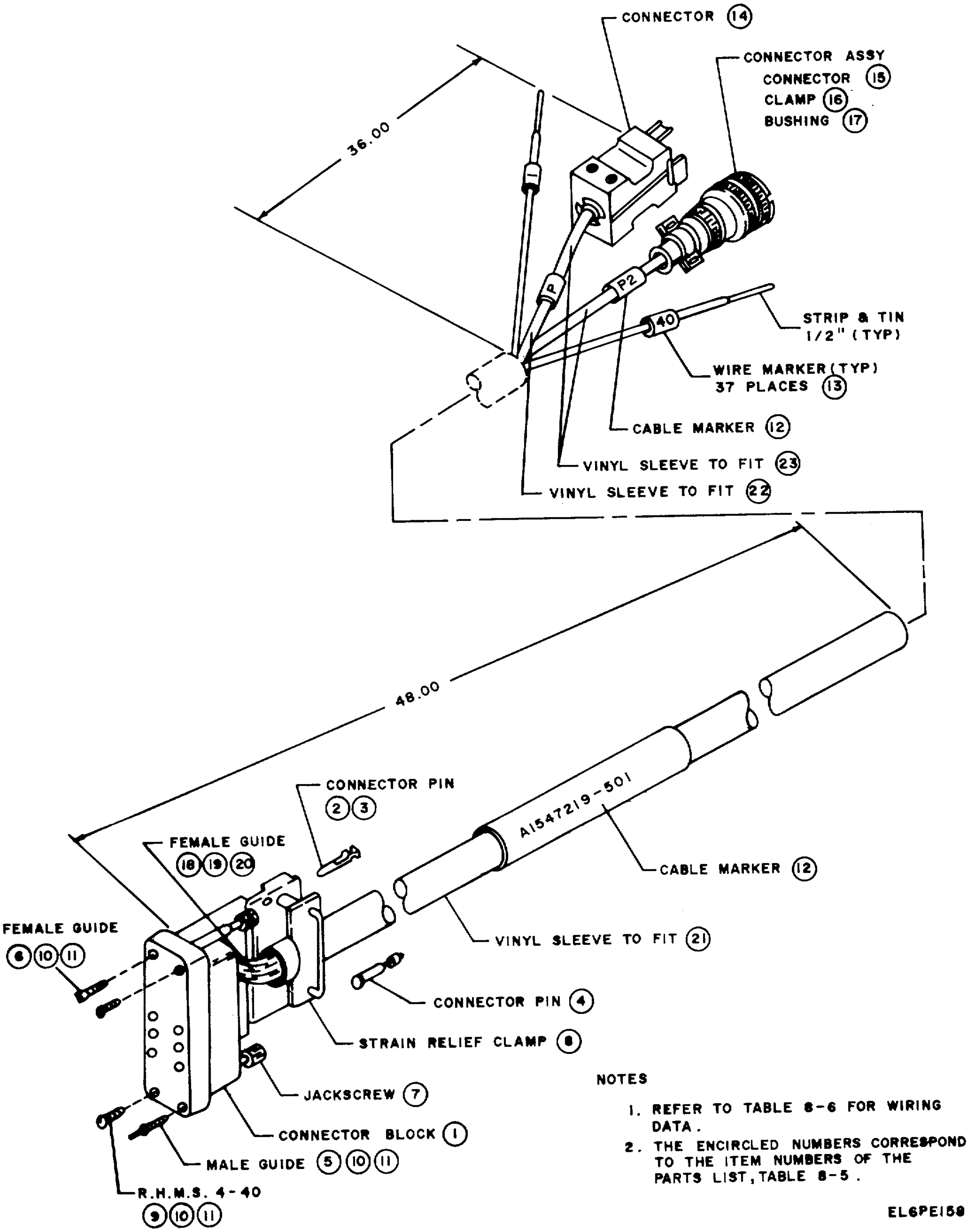

Figure 8-5. Universal Power Cable Assembly.

e. Table 8-7 lists the manufacturers' names for those federal supply code numbers listed in the parts list tables.

8-12. Alarm Monitor Power Supply Troubleshooting.

WARNING

The protective grounding terminals of the test instrument and the calibration equipment must be connected to the equipment grounding (safety) conductor of the power cords. For electrical shock protection use only extension cords and power receptacles with a safety-ground connector, or otherwise connect the chassis to a safety ground system.

a. Table 8-8 contains test procedures for troubleshooting the alarm monitor power supply. Refer to figure 8-6 and then table 8-1 for the test equipment required to perform these test procedures. Note in figure 8-6 the quantity required for item 18. Figure 8-7 shows the location of the power supply adjustment controls.

Table 8-7. Federal Supply Code for Manufacturers (FSCM), Code-to-Name Sequence

Code	Manufacturer	Code	Manufacturer
00929	Microlab/FXR 10 Microlab Rd. Livingston, NJ 07039	71218	Bud Industries, Inc. 4605 E. 355th St. Willoughby, OH 44094
04713	Motorola Inc Semiconductor Products Group 5005 E. McDowell Rd. Phoenix, AZ	71468	ITT Cannon Electric 666 E. Dyer Rd. Santa Ana, CA 92705
04740	Duramark Inc. 2 Secatoag Ave Port Washington, NY 11050	74970	E. F. Johnson Co. 299 10th Ave. SW Waseca, MN 56093
08806	General Electric Co Miniature Lamp Dept., Nela Park Cleveland, OH 44112	76530	TRW Electronic Components Cinch-Monadnock 18301 E. Arenth Ave. City of Industry, CA 91744
09353	C and K Components Inc. 103 Morse St Watertown, MA 02172	79405	Wood Electric Operations Potter and Brumfield Div., AMF Inc. 961 Chestnut St., Drawer C Gainesville, GA 30501
09769	Amp Inc., Automatic Machine Div. Eisenhower Blvd. 83315 Harrisburg, PA 17105		Hubbell Corp. 407 E. Hawly Mundelein, IL 60060
15145	Never-Seez Compound Corp. 2910 S. 18th Ave. Broadview, IL 60153	83330	Smith, Herman H., Inc. 812 Snediker Ave. Brooklyn, NJ 11207
15305	Omega Laboratories, Inc. 408 Haverhill St. Rowley, MA 01967	85480	W. A. Brady Co. 727 W. Glendale Ave. Milwaukee, WI 53209
32720	Airpax Electronics Inc. Pacific Division South El Monte, CA	86022	C and H Electric Co. 1352 NE 1st Ave. Miami, FL 33132
44655	Ohmite Mfg. Co. 3601 W. Howard St. Skokie, IL 60076	91506	Augat Inc. 633 Perry Ave. P. O. Box 779 Attleboro, MA 02703
49671	RCA Corporation 30 Rockefeller Plaza New York, NY 10020	91662	Elco Corp., A Gulf & Western Mfg. Co., Connector Div. Huntingdon Industrial Park Huntingdon, PA 16652
54565	Duramic Products Inc 426 Commercial Ave Palisades Park, NJ 07650	96508	Xcelite Inc. Orchard Park, NY
56289	Sprague Electric Co North Adams, MA 01247	G96906	Military Standards Promulgated by Standardization Division, Directorate of Logistic Services, DSA
56556	Omni Spectra Inc Microwave Component Div. 21 Continental Blvd. Merrimack, NH 03054		

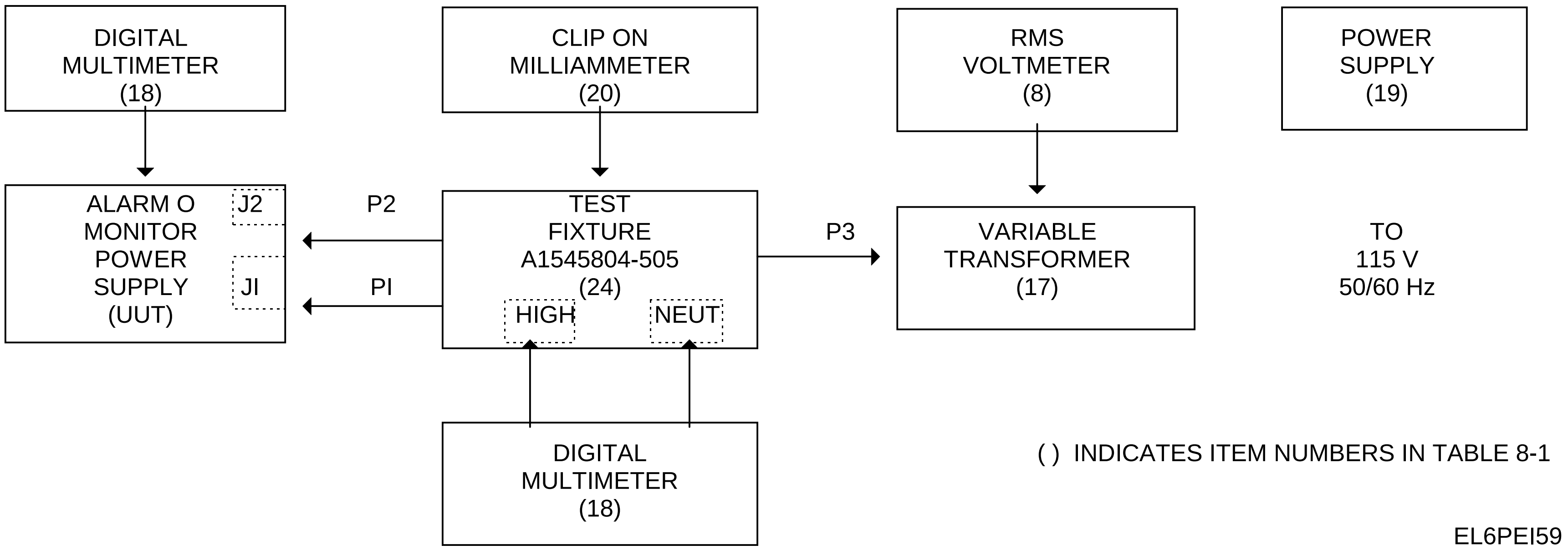

Figure 8-6. Alarm Monitor Power Supply, Test Setup.

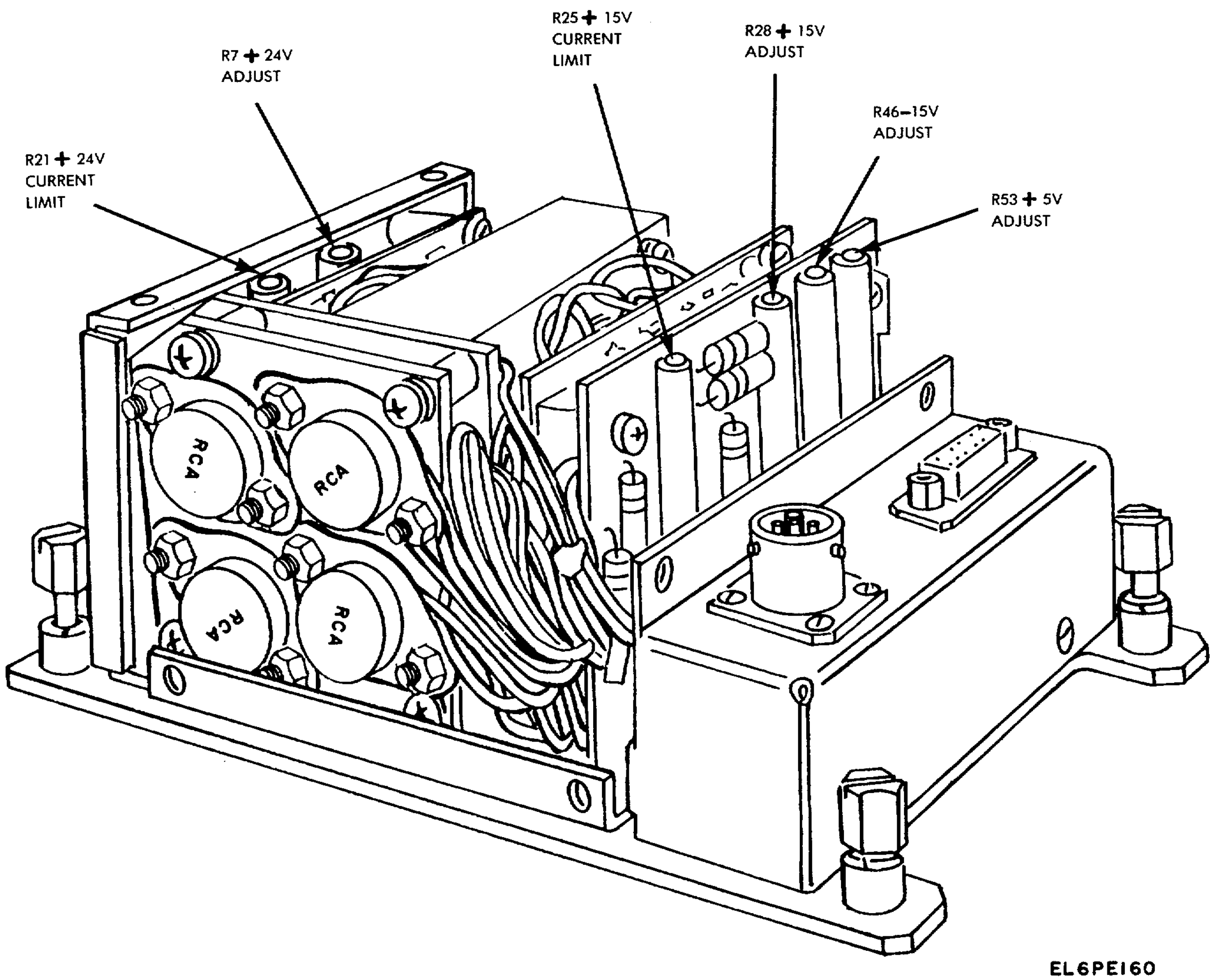

Figure 8-7. Alarm Monitor Power Supply, Adjustment Locations.

Table 8-8. Alarm Monitor Power Supply, Troubleshooting Chart

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

Item of Check	Test Conditions	Normal Indications	Remarks
1. Preliminary setup.	*a.* Perform the procedures of paragraph 8-12b and c. *b.* Set the variable transformer control to the 110 volt position and the power switch to OFF. *c.* Connect the variable transformer power line cord to a 115 volt, 50/ 60 Hz power source.		
2. Dc regulated voltage adjustment, 115 Vac input, full load output.	*a.* Place the test fixture LOAD switches to the F.L, position and the POWER LINE CIRCUIT BKR. to the ON (up) position. *b.* Connect one digital multimeter (DMM) to PWR. LINE T. P. HIGH A (E) and NEUT C (D) test points. *c.* Turn on the variable transformer and adjust the control for 115 t 0.5 volts on the DMM. Move the DMM test leads to the E and D test points and observe the same voltage reading.		
	d. Measure each of the de outputs. Connect the second DMM in turn (left-to-right) to each VOLTAGE T.P. and the clip-on millammeter to the associated CURRENT T.P. jumper (observe clip-on polarity). If necessary, adjust the appropriate voltage control on the power supply to obtain the correct voltage indication (fig. 8-7). **NOTE** The test fixture is a simulated, not actual, load on the power supply. Therefore, current indications are nominal and for referency only.	+ 24 t 0.24 V, 0.5 A + 5 ± 0.05 V, 0.75 A + 15 ±0.15 V, 0.5 A -15 t0.15 V, 0.5 A	The + 24 Vdc regulator, U1, is the voltage source for the + 15 Vdc regulator, U2. The latter, in turn, is the source for the - 15 Vdc regulator, Q12, Q13 (a differential pair), and the + 5 Vdc regulator, U3. Therefore, if the + 24 Vdc supply is faulty, the + 15 Vdc supplies will be affected. Also, if the + 15 Vdc supply is malfunctioning, the - 15 Vdc and the + 5 Vdc supplies will be affected. If a supply voltage indication is abnormal and it cannot be set to the normal indication, check for a fault in the regulator stage of the associated supply. See power supply schematic, figure FO-18.
3. Line and load regulation, half-load output.	*a.* On the test fixture, place the LOAD switches to the H. L. position. *b.* Observe the DMM connected to the PWR. LINE test points and adjust the variable transformer control for 126.5 ±0.5 Vac on the DMM.		
	c. Measure each de output voltage with the DMM at each VOLTAGE T.P.	+ 24 t 0.24 V + 5 t 0.05 V + 15 ± 0.15 V -15 ± 0.15 V	If a supply voltage indication is abnormal, check the associated circuits as follows: regulator IC (U1, U2, Q12-Q13, or U3), series regulator transistor (Q1, Q8, Q1O,

Table 8-8. Alarm Monitor Power Supply, Troubleshooting Chart

Item of Check	Test Conditions	Normal Indications	Remarks
3. Continued			or Q14), and the driver transistor (Q9, -15 volt supply only). See power supply schematic, figure FO-18.
4. Line and load regulation, full-load output.	a. On the test fixture, place the LOAD switches to the F. L position.		
	b. Observe the DMM connected to the PWR. LINE test points and adjust the variable transformer control for 103.5 ± 0.5 Vac on the DMM.		
	c. Measure the dc output voltage with the second DMM at each VOLTAGE T.P.	+ 24 ± 0.24 V + 5 + 0.05V + 15 ± 0.15 V - 15 ± 0.15V	If a supply voltage indication is abnormal, make the checks described under Remarks in item 3 above.
5. Ripple voltage full-load output.	a. On the test fixture, assure that the LOAD switches -are in the F.L. position.		
	b. Observe the DMM connected to the PWR. LINE test points and adjust the variable transformer control for 103.5 ± 0.5 Vac on the DMM.		
	C. Measure the ripple voltage. Remove the DMM test leads and, in turn, connect the RMS voltmeter to each VOLTAGE T.P.	+ 24 V:10 m V rms (max) + 15 V:10 m V rms (max) - 15 V:10 m V rms (max) +5 V:10 m V rms (max)	If any indication exceeds the maximum limit, check the appropriate supply for faulty filter capacitors and rectifiers. See power supply schematic, figure FO-18.
6. Transient recovery at full-load output.	a. On the test fixture, assure that the LOAD switches are in the F.L. position.		
	b. Observe the DMM connected to the PWR. LINE test points and adjust the variable transformer control for 138 ± 0.5 Vac on the DMM. Maintain this voltage for one minute and then reduce it to 115 ± 0.5 Vac.		
	c. Measure each dc output voltage.	+ 24 ± 0.24 V +5 ± 0.05 V + 15 ± 0.15 V - 15 ± 0.15 V	If a supply voltage indication is abnormal, make the checks described under Remarks in item 3 above.
7. Short circuit recovery at full-load output.	a. On the test fixture, assure that the LOAD switches are in the F.L. position.		
	b. Observe the DMM connected to the PWR. LINE test points and adjust the voltage transformer control for 115 ± 0.5 Vac on the DMM.		
	c. Individually short each dc output to ground at the VOLTAGE T.P. Remove the short and then measure the voltage at the test point using the second DMM to determine that the output has returned to normal.	+ 24 ± 0.24 V + 5 ± 0.05 V + 15 ± 0.15 V - 15 ± 0.15 V	If any output voltage fails to recover, check the current limit section (pins 2 and 3) of the regulator IC (U2) of the + 15 volt supply. Check the associated regulator transistor and current

Table 8-8. Alarm Monitor Power Supply, Troubleshooting Chart

Item of Check	Test Conditions	Normal Indications	Remarks
7. -- Continued			limit circuit components. See power supply schematic, figure FO-18.
8. Overvoltage protection.	a. On the test fixture turn off the POWER LINE CIRCUIT BKR. Disconnect power connector P1 from connector J1 on the UUT (fig. 8-4). b. On the test fixture place the LOAD switches to the N.L. position. c. Connect the test equipment power supply (fig. 8-6, item 19) and the DMM to the + 24 V VOLTAGE T.P. (plus to + 24 V and minus to GND). On the test power supply rotate the output control fully CCW (minimum). Apply power to the test power supply. d. Reconnect power connector P1 to connector J1 on the UUT. On the text fixture turn on the POWER LINE CIRCUIT BKR.		
	e. Observe the DMM and slowly increase the output of the test power supply until the UUT crowbars. At this instant note the highest voltage indication on the DMM before the voltage drops off then decrease the test supply output to minimum. Turn off and disconnect the test power supply.	+ 24 V:30 V max.	If any voltage indication exceeds the max limit, check the over-voltage circuits: + 24 V: Q2, VR2; + 15 V: Q4, VR4; -15 V; Q3, VR3; and +5 V: Q6, VR6. Also check the common crowbar SCR Q7 and associated circuitry. See power supply schematic, figure FO-18.
	f. Repeat the preceding test (steps a through e) for each voltage by connecting the test power supply to the +5V, +15 V, and -15 V VOLTAGE T.P. (step c) Reverse polarity connections of the test power supply when testing the - 15 V output.	+ 5 V: + 6.25 V max. + 15 V: + 18.75 V max. - 15 V: - 18.75 V max.	
	g. Reset the POWER LINE CIRCUIT BKR before preceding to the next item of check.		
9. Current limiting.	a. On the test fixture place the LOAD switches to the F.L. position. Place the CURRENT LIMITING + 24 V ADJ. and + 15 V ADJ. controls fully CCW and + 24 V and + 15 V switches to the OFF position. b. Observe the DMM connected to the PWR. LINE test points and adjust the voltage transformer control for 115 $\pm$ 0.5 Vac on the DMM. c. Connect the second DMM to the + 24 V VOLTAGE T.P. and the clip-on milliammeter to the + 24 V CURRENT T.P. jumper (observe clip-on polarity). d. On the test fixture place the LOAD +24 V switch to the N.L. position.		

Table 8-8. Alarm Monitor Power Supply, Troubleshooting Chart

Item of Check	Test Conditions	Normal Indications	Remarks
9. --Continued	Place the CURRENT LIMITING + 24 V switch to the up position.		
	e. Observe the DMM and clip-on milliammeter. Slowly rotate the CURRENT LIMITING + 24 V ADJ. control CW until the voltage starts to drop off and the current stops increasing (starts limiting). Observe the current indication.	0.625 to 0.750 A max.	If indication is normal, proceed to step g. If indication is abnormal, proceed to step *f.* NOTE If necessary, see paragraph 8-13, step *c* for disassembly procedures required to make current limiting adjustment.
	f. Rotate the CURRENT LIMITING + 24 V ADJ. control fully CCW. (See fig. 8-7.) On the UUT, adjust control R21 CL to another position and then repeat step *e* above. Repeat steps *e* and *f* as necessary, to obtain a normal indication (step e). If a normal indication now can be obtained, proceed to step *g*. If the indication is still abnormal, the current limiting circuitry is probably at fault; see Remarks.		Check CR3, CR4, U1 R21, and R4. See power supply schematic, figure FO-18.
	g. On the test fixture place the CURRENT LIMITING + 24 V ADJ. control fully CCW and the CURRENT LIMITING + 24 V switch to the OFF position. Place the LOAD + 24 V switch to the F.L. position.		
	h. Connect the second DMM to the + 15 V VOLTAGE T.P. and the clip-on-milliammeter to the + 15 V CURRENT T.P. jumper (observe clip-on polarity).		
	i. On the test fixture place the LOAD + 15 V switch to the N.L. position. Place the CURRENT LIMITING + 15 V switch to the up position.		
	j. Observe the DMM and clip-on milliammeter. Slowly rotate the CURRENT LIMITING + 15 V ADJ. control CW until the voltage starts to drop off and the current stops increasing (starts limiting). Observe the current indication.	0.625 to 0.750 A max.	If indication is normal, this procedure is completed. If indication is abnormal, proceed to step *k.* (See note in step 8*e.*)
	k. Rotate the CURRENT LIMITING + 15 V ADJ control fully CCW (fig. 8-7). On the UUT, adjust control R25 CL to another position and then repeat step i above. Repeat steps j and k as necessary, to obtain a normal indication (step *i*). If a normal indication can now be obtained, this procedure is completed. If the indication is still abnormal, the current limiting circuitry is probably at fault: see Remarks.		Check U2, R25, and R26. See power supply schematic, figure FO-18.
	l. Turn OFF POWER LINE CIRCUIT BKR switch and disconnect UUT from test fixture.		

b. Interconnect the test equipment as shown in figure 8-6. Do not connect the variable transformer to the ac power source as yet.

c. On the test fixture check for or perform the following:

(1) POWER LINE CIRCUIT BKR, is in the OFF (down) position.

(2) ALL LOAD switches are in the F. L. position.

(3) The four wire jumpers are inserted in each pair of CURRENT T. P. test points for each of the four voltage outputs.

(4) The CURRENT LIMITING + 24 V ADJ. and + 15 V ADJ. controls are in the fully CCW position.

(5) The CURRENT LIMITING + 24 V and + 15 V switches are in the OFF position.

d. General reference may be made to the test fixture and power supply schematic diagrams figures FO-9 and FO-18, respectively, when performing the troubleshooting procedures.

e. When a circuit or component is suspected of being faulty, perform the checks listed in the Remarks column of table 8-8. Typical voltage readings are shown on the power supply schematic diagram, figure FO-18. Use these voltages as a troubleshooting aid for isolating a suspected faulty circuit and/or component.

f. To gain access to the power supply for taking voltage measurements or removing a component, the power supply must be disassembled. The disassembly instructions are given in paragraph 8-13.

g. Proceed to table 8-8, step 1b.

8-13. Alarm Monitor Power Supply Disassembly

If desired, support fixtures may be fabricated to properly support the various printed circuit boards after the power supply is disassembled. See figure 8-8 for fabrication details for support fixtures. Refer to figure 8-9 when performing the disassembly procedure below. After disassembly, refer to figure 8-10 for typical use of the support fixtures. Proceed as follows to disassemble the power supply (fig. 8-9):

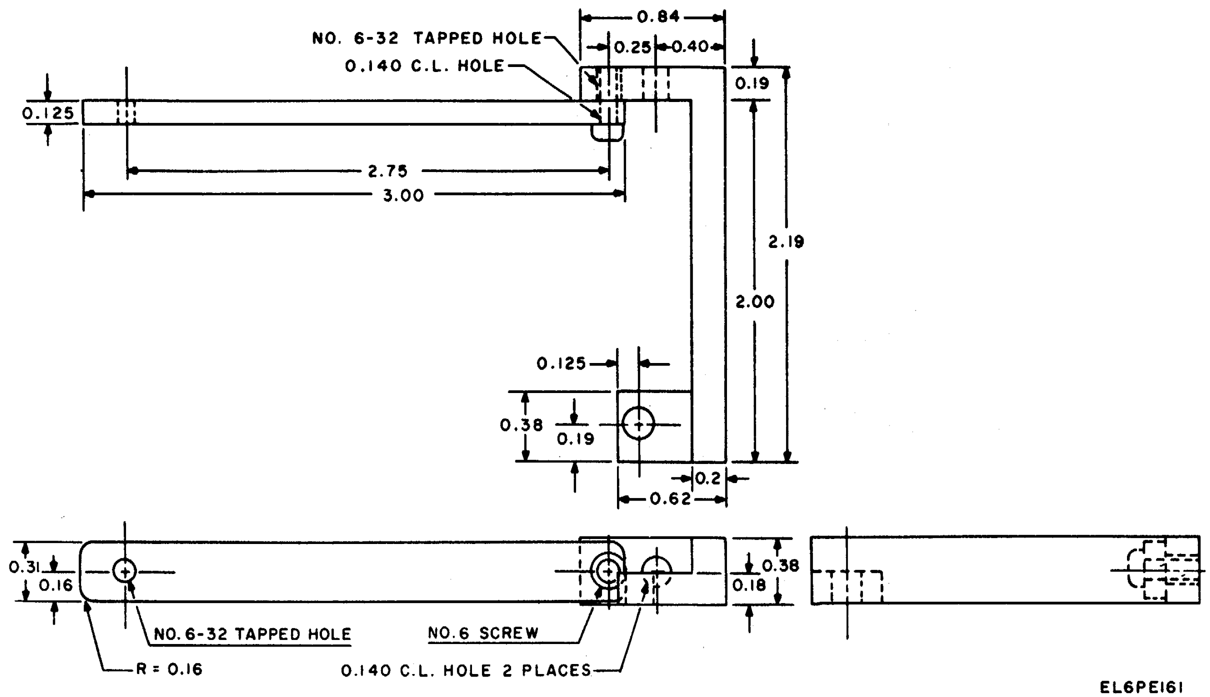

Figure 8-8. Alarm Monitor Power Supply Support Fixtures Fabrication Details (Sheet 1 of 2).

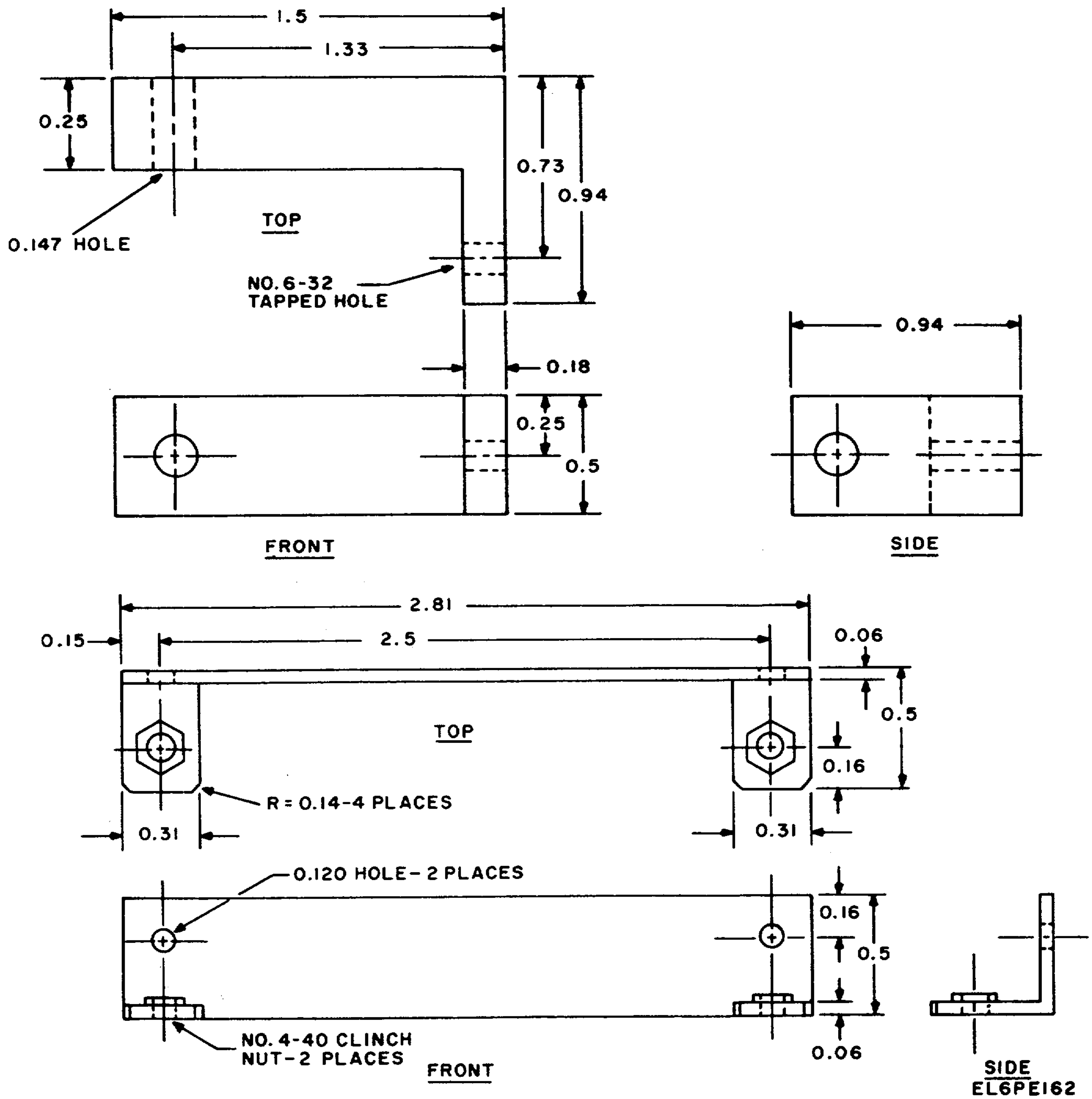

Figure 8-8. Alarm Monitor Power Supply Support Fixtures Fabrication Details (Sheet 2 of 2).

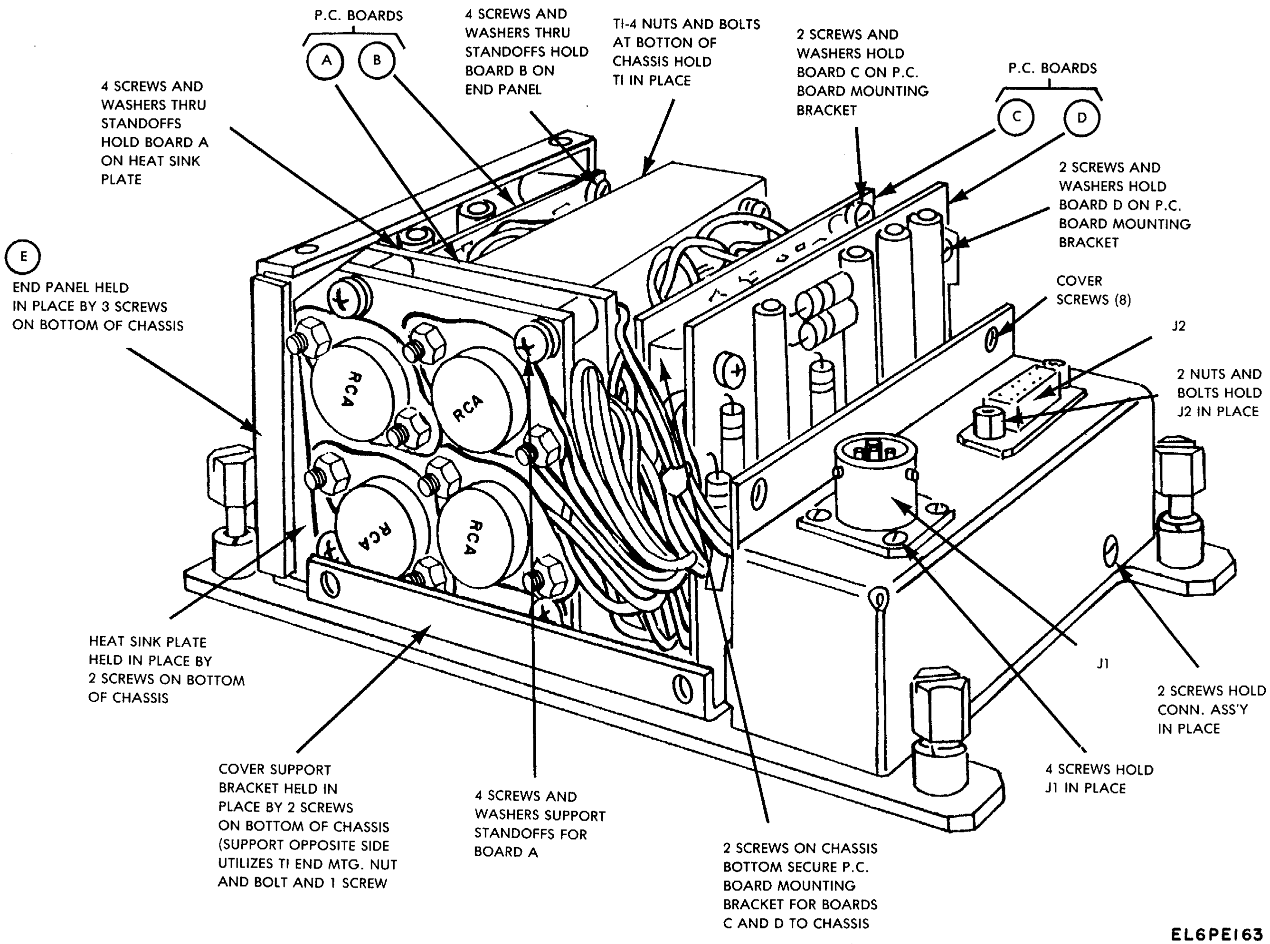

Figure 8-9. Alarm Monitor Power Supply, Disassembly Details.

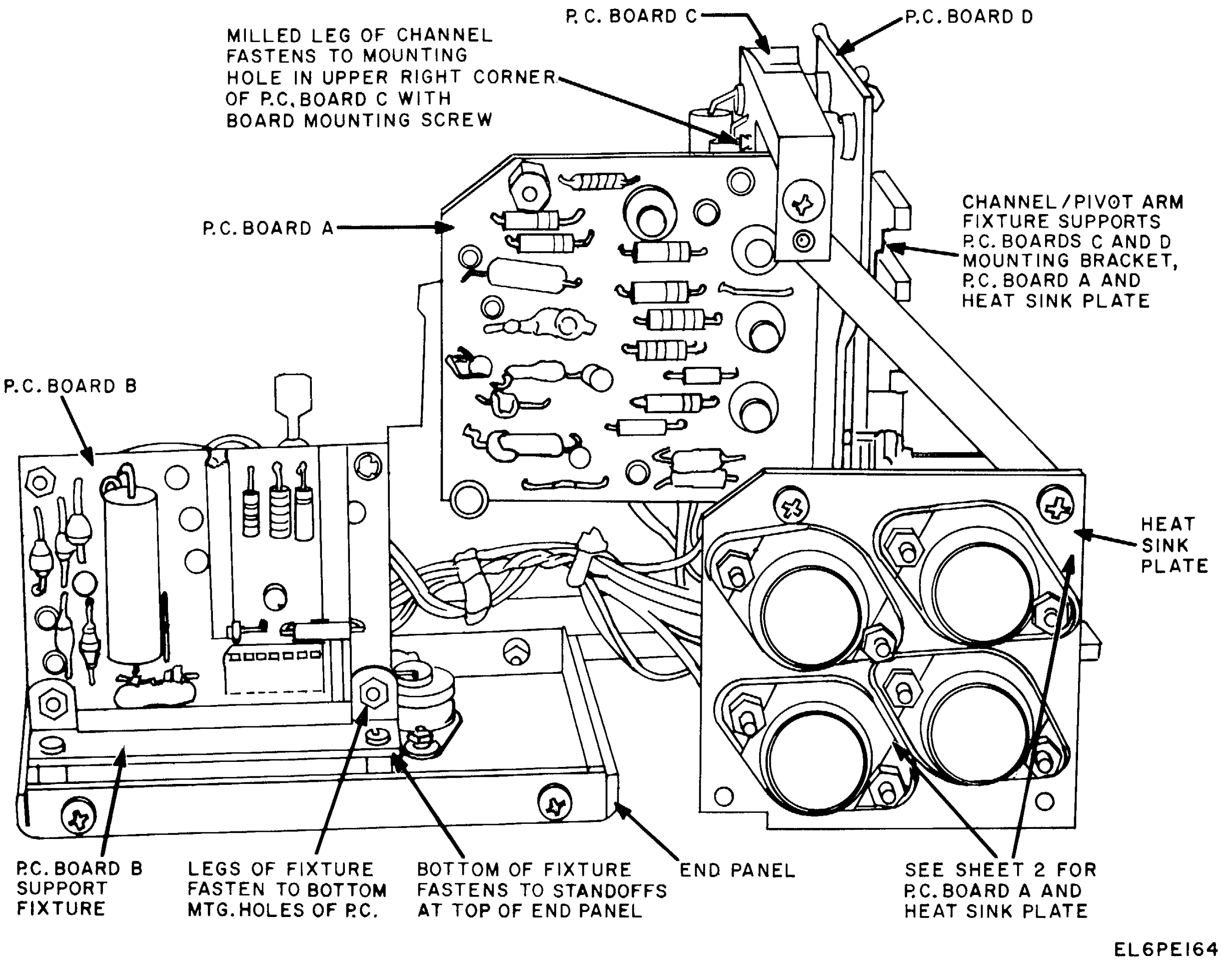

Figure 8-10. Alarm Monitor Power Supply, Disassembled View Showing Typical Use of Support Fixtures (Sheet 1 of 2).

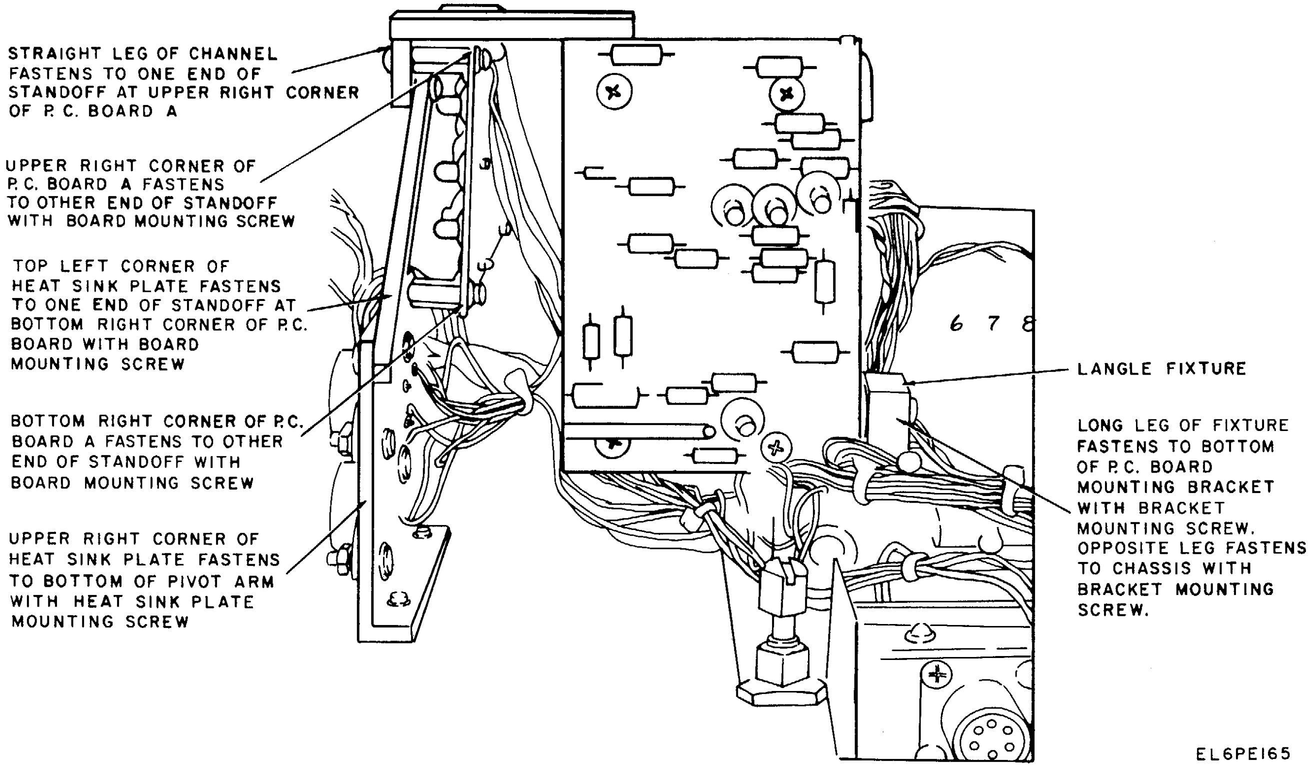

Figure 8-10. Alarm Monitor Power Supply, Disassembled View Showing Typical Use of Support Fixtures (Sheet 2 of 2).

a. Remove the eight screws and washers which fasten the perforated cover to the chassis; remove the cover.

b. To gain access to pc board A, proceed as follows:

(1) Remove the heat sink plate by removing the two screws from the bottom of the chassis holding it in place.

(2) To remove pc board A from the heat sink plate, remove the screws and washers holding the board to the four standoffs on the back of the heat sink plate.

c. To gain access to pc board B, proceeds as follows:

(1) Remove the end panel, E, by removing the three screws from the bottom of the chassis holding it in place.

(2) To remove pc board B from the end panel, remove the screws and washers holding the board to the four standoffs on the back of the end panel.

d. To gain access to pc boards C and D proceed as follows:

(1) Remove the pc board mounting bracket by removing the two screws and washers from the bottom of the chassis holding it in place.

(2) To remove pc board C or D from bracket, remove the screws and washers from the four corners of the board.

e. To gain access to the capacitors under the connector assembly, remove the two screws and washer securing it to the chassis.

8-14. Alarm Monitor Power Supply, Component Replacement

To replace chassis mounted components proceeds as follows (fig. 8-9):

a. To remove transformer T1, proceed as follows:

(1) Disconnect the wires from the transformer terminals. Tag or mark each wire with the identity of the terminal to which it was connected.

(2) Remove the four nuts, bolts, and washers which secure the transformer to the bottom of the chassis.

(3) Install the replacement transformer by repeating steps (1) and (2) above in reverse order.

b. To remove connector J1 or J2, proceed as follows:

(1) Remove the two screws and washers which secure the connector assembly to the chassis.

(a) To remove connectors J1, remove the four screws and washers which hold it in place on the connector assembly.

(b) To remove connector J2, remove the two nuts and bolts which hold it in place on the connector assembly.

(2) Disconnect the wires from the terminals of the connector. Tag or mark each wire with the identity of the terminal to which it was connected.

(3) Install the replacement connector by repeating steps (1) *(a)*, *(b)*, and (2) above in reverse order.

c. Capacitors C16, C13, C10, and C3 are connected to terminals mounted on the chassis beneath the connector assembly. To remove the capacitors, proceed as follows:

(1) Refer to step b(1) above to remove the connector assembly.

(2) Note the polarity of the capacitor to be replaced so as to insure that same polarity when installing the replacement capacitor; disconnect the capacitor leads and other wires as required from the terminals.

(3) Install the replacement capacitor by repeating steps (1) and (2) above.

8-15. Alarm Monitor Fault/Safety Gate Troubleshooting.

a. Table 8-9 contains test procedures for troubleshooting the alarm monitor fault/safety gate. Refer to figure 8-11 and then table 8-1 for the test equipment required to perform these procedures. Note in figure 8-11 the quantity required for item 19.

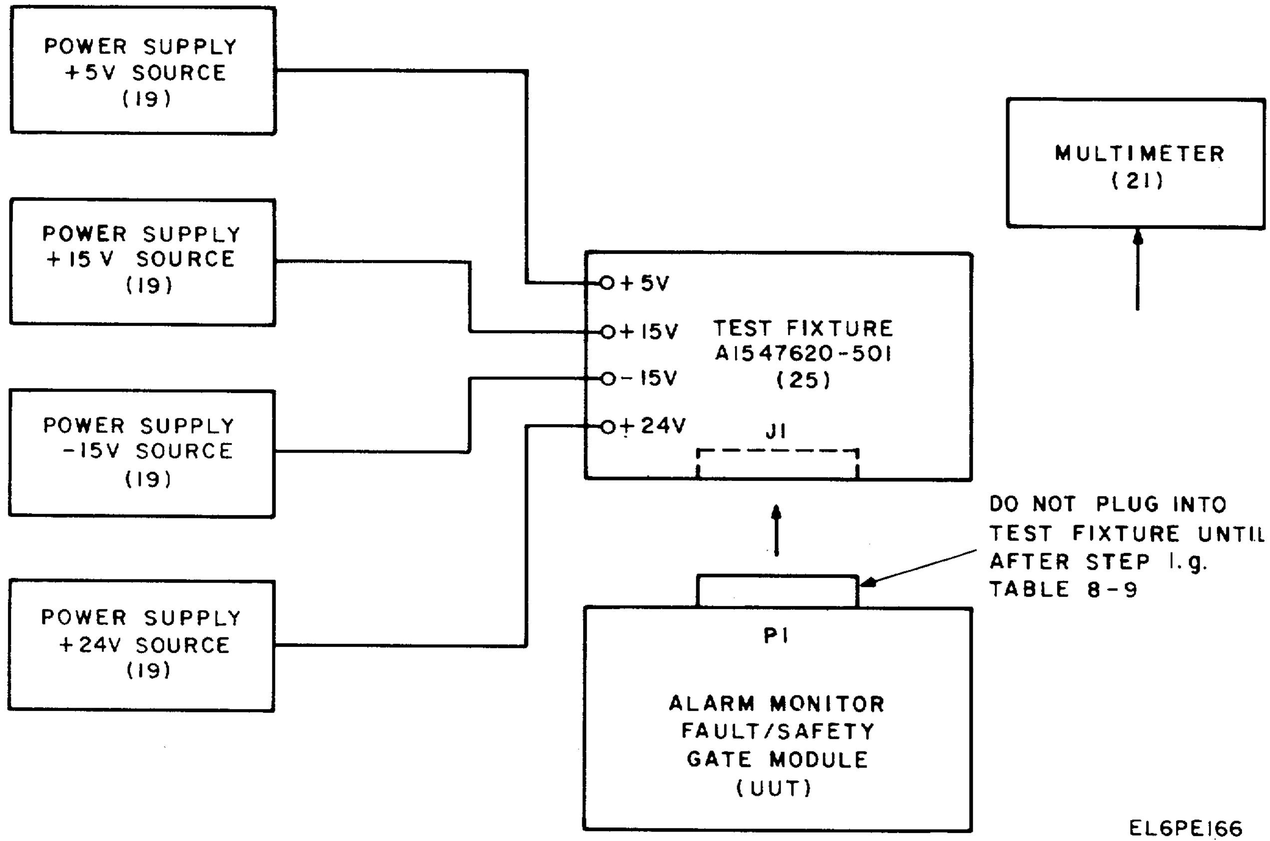

Figure 8-11. Alarm Monitor Fault/Safety Gate, Test Setup.

b. Interconnect the test equipment as shown in figure 8-11. Do not connect the test power supplies to the ac power source. Do not connect the fault/safety gate nor dc power to the test fixture.

Table 8-9. Alarm Monitor Fault/Safety Gate, Troubleshooting Chart

Item of Check	Test Conditions	Normal Indications	Remarks

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

Item of Check	Test Conditions	Normal Indications	Remarks
1. Preliminary setup.	*a.* Perform the procedures of paragraph 8-15*b*, *c*, and *d*. *b.* Connect the power supply line cords to a 115 volt, 50-60 Hz power source. Turn on the power supplies. *c.* See figure 8-11. Adjust the + 5 V source power supply for a 5-volt indication on its front panel voltmeter. *d.* Adjust the remaining power supplies for their respective voltage source output levels. *e.* Turn off the power supplies. Connect power supplies to external power plugs on the right side panel of the test fixture. Turn on the power supplies. *f.* Connect the multimeter to the + 24 V and RETURNS test points on the text fixture. Adjust the + 24 V source power supply for 24 volts on the multimeter. *g.* In turn, connect the multimeter to the + 15 V, - 15 V, and + 5 V test points and adjust the associated power supply for the respective voltage indication. *h.* Proceed to step 2.		
2. Logic circuit fault isolation.	*a.* Insert fault/safety gate module A1 into J1 of the test fixture. *b.* Refer to table 8-10. On the test fixture, set switches S2 through S28 to the positions designated by test No. 1. Observe 1. Observe lamps DS1 thru DS9 on the test fixture. *c.* Refer to table 8-10. Repeat step b above for tests No. 2 through 24. *d.* Remove power and disconnect UUT from test setup.	Refer to table 8-11. Lamps DS1 through DS9 should be on or off as indicated by test No. 1	If any lamp indication does not agree with the test No. 1 indications, refer to table 8-12.

c. On the test fixture check for or perform the following:

(1) Switch S32 AC PWR is in the OFF position. Circuit breaker CB1 is in the up (open) position.

(2) Switches S1 through S31 are in the OFF (center) position.

d. On the test power supplies check that the power switches are off and the voltage output controls are in the minimum output positions.

e. Proceed to table 8-9, step 1*b*.

Table 8-10. Alarm Monitor Fault/Safety Test Fixture, Switch Positions

Test No.	Switch Number																										
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
2	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	1	1
3	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	1	1
5	1	1	1	1	1	0	0	0	1	1	0	1	0	1	0	0	1	1	1	1	1	0	1	1	1	1	1
6	0	1	0	0	0	1	1	0	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
7	1	0	1	1	0	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1
9	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
10	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
11	0	0	0	1	0	0	0	1	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
12	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
13	0	0	0	1	0	0	0	1	1	1	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
14	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
15	0	1	0	1	0	1	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
16	0	0	0	1	0	1	1	1	1	1	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
17	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1
18	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	1	0
19	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1
20	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	1
21	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1
22	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	1	1
23	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1
24	0	0	1	0	1	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	1	1	1

"1" indicates switch in +5 Vdc position
"0" indicates switch in ground position

Table 8-11. Alarm Monitor Fault/Safety Gate Test Fixture, Lamp Indications

Test No.	Lamp Number								
	DS1	DS2	DS3	DS4	DS5	DS6	DS7	DS8	DS9
1	0	1	1	0	1	1	0	1	0
2	1	1	1	0	1	1	0	0	0
3	1	1	1	0	1	1	0	1	1
4	0	1	1	1	1	1	1	1	1
5	1	1	1	0	1	1	0	1	1
6	1	1	1	0	1	1	0	0	1
7	1	1	1	0	1	1	0	0	1
8	1	0	1	0	1	1	0	0	1
9	1	1	1	0	1	1	0	0	0
10	1	1	1	0	1	1	0	0	0
11	1	1	1	0	1	1	0	0	0
12	1	1	1	0	1	1	0	1	0
13	1	1	1	0	1	1	0	0	0
14	1	1	1	0	1	1	0	0	0
15	1	1	1	0	1	1	0	0	1
16	1	1	1	0	1	1	0	0	0
17	0	0	1	0	1	1	1	1	0
18	0	0	1	0	1	0	1	1	0
19	0	0	1	0	1	1	1	1	0
20	0	0	1	0	1	1	1	1	0
21	0	0	1	0	1	1	1	1	0
22	0	0	1	0	1	1	1	1	0
23	0	0	1	0	1	1	1	1	0
24	0	0	0	0	0	0	1	1	0

"1" indicates lamp ON
"0" indicates lamp OFF

Table 8-12. Alarm Monitor Fault/Safety Gate Component Fault Isolation Chart

NOTE

Use this chart in conjunction with the test fixture lamp indication table 8-11. Refer to the appropriate test number below. Alongside the lamp number with the fault indication, find the suspect circuit items that could be the cause (see fig. FO-19 fault/safety gate logic diagram). Apply standard digital troubleshooting techniques to isolate the faulty component. The test fixture lamps DS1 through DS10 represent the following alarm monitor fault and safety alert functions:

a. DS1: safety alert waveguide interlock indication.
b. DS2: safety alert antenna elevation indication..
c. DS3: RSS system fault indication.
d. DS4: dc power indication.
e. DS5: CSS temp indication.
f. DS6: audible alarm signal.
g. DS7: CSS system fault indication.
h. DS8: PA 1 inhibit signal.
i. DS9: PA 1 inhibit signal.
j. DS10: antenna radiation hazard light.

Test No.	Lamp No.	Suspect Circuit Items
1	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U15-10, U24-1, U9-4.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U5-2, U17-3, U9-12, U22-10, U5-12.
	DS9	U12-4, U18-10, U24-10, U24-3, U24-4
2	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K5-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U15-10.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U22-4, U5-6.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U5-2, U17-3, U22-4.
	DS9	U12-4, U18-10, U24-10, U24-3, U24-4
3	DS1	K1-5, U6-12, U18-4, U16-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11, U15-10, U9-10, U15-11, U15-3, U15-4, U7-12, U7-10.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-2, U2-13, U9-6, U13-13, U7-4, U1-3, U14-13, U20-12, U7-2, U1-4, U8-13, U20-15.
	DS7	U4-6, U16-4, U5-4, U11-3,-U11-11, U17-10, U5-2, U17-3, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U5-2, U17-3, U22-4, U5-12.
	DS9	U12-4, U18-10, U24-1O, U24-3, U24-4
4	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11, U15-10, U9-10, U15-11, U15-4.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U12-2, U10-4, U9-6, U13-13, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-1, U5-10, U11-10, U5-12, U11-4, U17-4, U5-2, U17-3, U22-4.
	DS9	U12-4, U18-10, U24-10, U24-4.
5	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-2, U2-13.

Table 8-12. Alarm Monitor Fault/Safety Gate Component Fault Isolation Chart - Continued

Test No.	Lamp No.	Suspect Circuit Items
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-12.
	DS9	U12-4, U18-10, U24-10, U24-3
6	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1.
	DS4	K4-5, U6-8, U4-4, U10-3.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U224.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U12-4, U5-2, U17-3, U224.
	DS9	U12-4, U18-10, U24-10, U24-4.
7	DS1	K1-5, U6-12, U18-4, U16-3, U22-4, U22-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11, U15-10, U9-10, U15-11, U15-3, U7-6, U1-11, U2-1, U7-12, U7-15, U-10, U8-1, U7-10.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U9-2, U213, U7-4, U1-3, U14-13, U7-2, U1-4,, U8-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10, U5-12, U11-4, U17-4, U5-2, U17-3, U22-4.
	DS9	U12-4, U18-10, U24-10, U24-3.
8	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-8, U12-8, U18-15, U13-1, U9-4, U24-11, U15-10, U9-10, U15-11, U15-3, U15-4, U7-6, U1-11, U2-1, U7-12, U7-15, U1-10, U8-1, U7-10.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-1, U10-4, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10, U5-12, U11-4, U17-4, U5-2, U17-3, U22-4.
	DS9	U12-4, U18-10, U24-10, U24-4, U24-3.
9	DS1	K1-5, U6-12, U18-4, U16-3, U22-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U5-4, U11-3, U5-6, U11-11, U17-10, U5-2, U17-3.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.
10	DS1	K1-5, U6-12, U18-4, U16-3, U22-4, U22-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U44, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U5-4, U5-4, U5-6, U22-4, U11-11, U17-10, U5-2, U17-3.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U22-4, U5-12, U5-2, U17-3.
	DS9	U12-4, U18-10, U24-10.
11	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U54, U11-3, U5-6, U22-4, U11-11, U17-10, U5-2, U17-3.

Table 8-12. Alarm Monitor Fault/Safety Gate Component Fault Isolation Chart - Continued

Test No.	Lamp No.	Suspect Circuit Items
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U22-4, U5-12, U5-2, U17-3.
	DS9	U12-4, U18-10, U24-10.
12	DS1	K1-5, U6-12, U18-4, U16-3, U22-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U5-4, U11-3, U5-6.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U5-2, U17-3.
	DS9	U12-4, U18-10, U24-10.
13	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U5-4, U11-3, U5-6, U22-4, U11-11, U17-10, U5-2, U17-3.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U22-4, U5-12, U5-2, U17-3.
	DS9	U12-4, U18-10, U24-10.
14	DS1	K1-5, U6-12, U18-4, U16-3, U22-3, U22-4.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U5-2, U17-3, U22-4, U5-12.
	DS9	U12-4, U18-10, U24-10.
15	DS1	K1-5, U6-12, U18-4, U16-3, U22-4, U22-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U5-4, U11-11, U17-10, U5-2, U17-3, U11-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U5-2, U17-3,, U22-4.
	DS9	U12-4, U18-10, U24-10, U24-4.
16	DS1	K1-5, U6-12, U18-4, U16-3, U22-4, U22-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4.
	DS7	U4-6, U16-4, U5-4, U11-11, U17-10, U5-2, U17-3, U11-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10, U11-4, U17-4, U5-2, U17-3, U22-4, U5-12.
	DS9	U12-4, U18-10, U24-10, U24-4.
17	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1, U9-4, U24-11.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U7-4, U1-3, U14-13, U7-2, U1-4, U8-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.

Table 8-12. Alarm Monitor Fault/Safety Gate Component Fault Isolation Chart - Continued

Test No.	Lamp No.	Suspect Circuit Items
18	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U7-4, U1-3, U14-13, U7-2, U1-4, U8-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.
19	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U7-4, U1-3, U14-13, U7-2, U1-4, U8-13.
	DS7	U4-6, U16-4, U5-4, .U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.
20	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.
21	DS1	L1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-1, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.
22	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.
23	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U6-10, U18-6, U17-11.
	DS3	K6-5, U12-8, U18-15, U13-1.
	DS4	K4-5, U6-8, U4-4, U10-3, U9-15.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-2, U2-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.
24	DS1	K1-5, U6-12, U18-4, U16-3.
	DS2	K2-5, U18-6, U6-10, U17-11.

Table 8-12. Alarm Monitor Fault/Safety Gate Component Fault Isolation Chart - Continued

Test No.	Lamp No.	Suspect Circuit Items
	DS3	K6-5, U12-8, U18-15, U13-1, U7-6, U7-15, U1-11, U1-10, U2-1, U8-1, U7-12, U7-10.
	DS4	K4-5, U6-8, U4-4, U10-3.
	DS5	K5-5, U12-10, U18-12, U10-10.
	DS6	K7-5, U12-6, U18-2, U10-4, U9-6, U13-13, U9-2, U2-13, U7-4, U1-3, U14-13, U7-2, U1-4, U8-13.
	DS7	U4-6, U16-4, U5-4, U11-3, U11-11, U17-10, U5-2, U17-3, U5-6, U22-4.
	DS8	U4-2, U16-11, U5-10, U11-10.
	DS9	U12-4, U18-10, U24-10.

8-16. Alarm Monitor Troubleshooting

a. The following assumptions are made prior to troubleshooting the alarm monitor unit:

(1) The power supply and fault/safety gate modules are known to be in good operating order including all the unit front panel indicators.

(2) The basic nature of the trouble in the unit is known.

b. Table 8-13 contains test procedures for troubleshooting the alarm monitor unit. Refer to figure 8-13 and then table 8-1 for the test equipment required to perform these procedures.

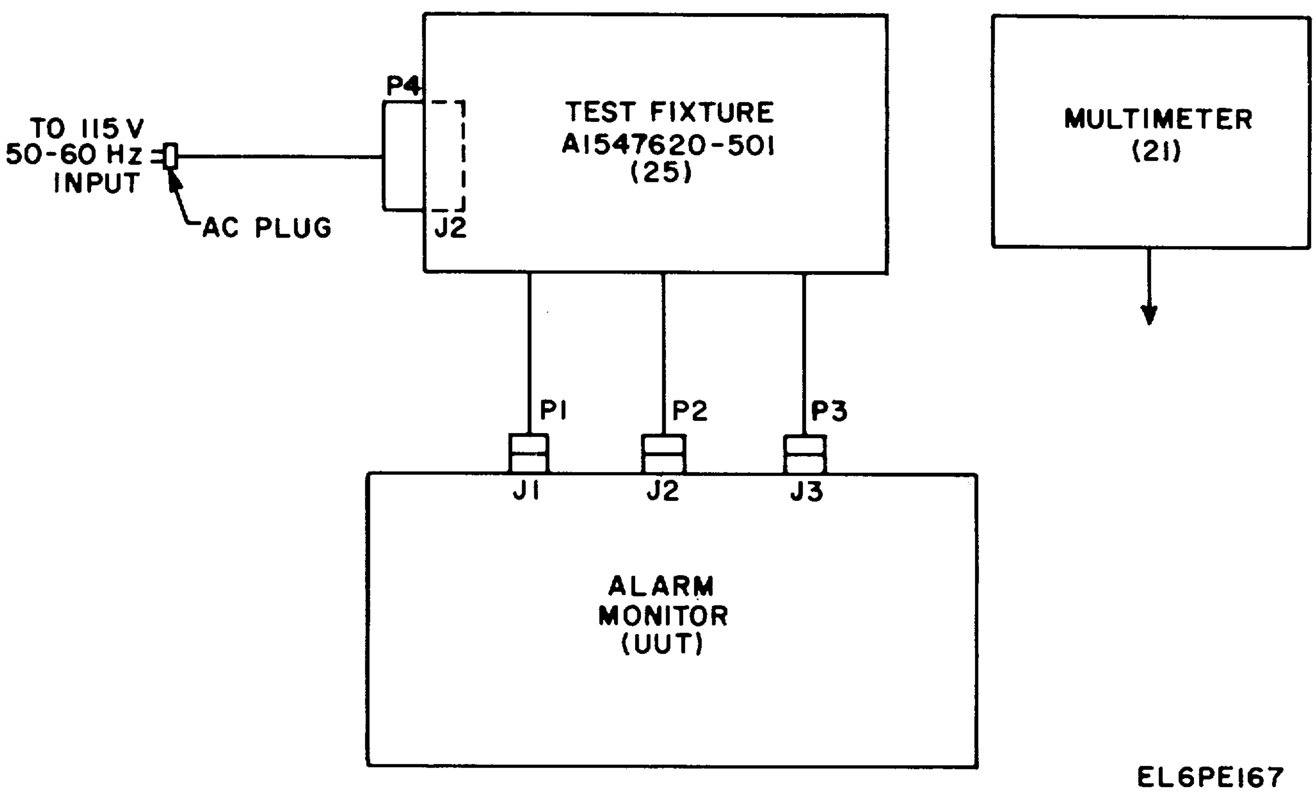

Figure 8-12. Alarm Monitor Test Setup.

c. Interconnect the test equipment as shown in figure 8-12. Do not connect the ac plug to the ac power source.

Table 8-13. Alarm Monitor, Troubleshooting Chart

WARNING
DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. Do not attempt any removal or replacement unless the equipment is in a non-operating condition and all power circuit breakers on the power distribution panel are in the OFF position.

Item of Check	Test Conditions	Normal Indications	Remarks
1. Preliminary setup.	*a.* Perform the procedures of para. 8, 16*c*, *d* and *e*.		
	b. Connect the P4 cable ac plug to a 115 volt, 50-60 Hz power source. Turn on the power source multimeter (set for ac volts) to the 115 V ac HI and LO test points. Observe the multimeter and then remove it.	115 volts approx. (test bench power source may vary from this indication).	As required, refer to figure FO-15, test fixture schematic.
	c. Place ac power (ac PWR) switch to the ON position. Press circuit breaker CB1 to close it. Observe power indicator line.	Line is ON.	
	d. On the alarm monitor (UUT) place POWER circuit breaker (CB1) to the ON position.	POWER/AC indicator is ON. (On the test fixture, DS7 and DS8 are on.)	If no indication, check unit wiring between J1, CB1, and DS1. See figure FO-20 unit schematic.
2. Power wiring.	*a.* On the test fixture connect the multimeter (set for dc volts) across the indicator de test point of P3 and any one of the following ground test points of P3: H, X, C, E. Change the ground test point with each measurement. **NOTE** **Reverse the polarity of the multimeter test leads for the - 15 V measurement.**	P3-W: + 24 V P3-Y: + 5 V P3-N: + 5 V P3-F: + 15 V P3-G: - 15 V	If no indication check unit wiring at the appropriate pins on J3. See figure FO-20.
	b. On the test fixture connect the multimeter (set for dc volts) across the indicated dc test point of P2 and each of these ground test points: P2-A, D, E. Observe the multimeter for an approximate indication.	P2-D: + 5 V	If no indication check unit wiring at the appropriate pins on J2. See figure FO-20.
	c. On the UUT connect the multimeter (set for DC volts) to XA1-1 (+) and XA1-2 (ground). Observe the multimeter for an approximate indication.	XA1-1: +5 V	If no indication, check unit wiring from XA1-1 to unit connector P2 and from XA1-2 to ground. See figure FO-20.
	d. On the UUT connect the multimeter to XA1-46 (ground) and the XA1 pins as listed in the Normal Indication column. Observe polarity.	XA1-47: + 5 V XA1-27: + 15 V XA1-23: - 15 V	If no indication check as above but of the associated wiring. See figure FO-20.
3. Audible alarm LS1.	*a.* On the UUT, place unit FAULT switch S1 to the TEST position and return to the indications.	Pulsating tone.	See figure FO-20. If the tone is not heard proceed to step *b*. If tone is heard proceed to step e.
	b. On the UUT, connect the multimeter (set for DC volts) to the (+) terminal of LS1 and ground (fig. 8-7). Observe the multimeter.	+ 15 V approx.	See figure FO-20. If no indication check wiring from LS1 (+) terminal to chassis connector P2. If indication is normal proceed to step *c*.

Table 8-13. Alarm Monitor, Troubleshooting Chart - Continued

Item of Check	Test Conditions	Normal Indications	Remarks
	c. On the UUT, connect one end of a test lead to ground and the other lead to the MINUS (-) terminal of LS1. Listen for the indications.	Pulsating tone.	If tone is not heard replace LS1.
	d. On the UUT place POWER circuit breaker (CB1) to the OFF position. Connect the multimeter (set for ohms) to ground terminal 9 of switch S1. After normal indication is obtained, turn on POWER switch S1. After normal indication is obtained, turn on POWER switch CB1.	Continuity.	See figure FO-20. Check wiring from S1-9 to chassis ground.
	e. On the UUT, place FAULT switch S1 to the NORMAL position. Connect one end of a test lead to ground and the other end to pin 8 of chassis connector XA-1. Listen for the indication.	Pulsating tone.	See figure FO-20. If no tone is heard, check wiring between XA1-8 and S1-8. If tone is heard proceed to step 4.
4. Fault and safety indicator wiring.	*a.* On the UUT front panel press-to-test all the lamp indicators (except ac indicators). Observe each indicator.	Momentarily ON.	See figure FO-20. If any indicator does not turn on check for + 24 V at pin 1 and pin 3 of the lamps socket. Check wiring and repair as required.
	b. On the UUT, connect one end of a test lead to ground. See figure 8-7 and figure FO-17. Momentarily connect the other end of the test lead to XA1-3. Observe indicator DS4 (WAVEGUIDE INTERLOCK).	XA1-3, DS4: momentarily ON. (waveguide)	If no indication, check wiring between XA1-3 and XD54-2.
	c. Repeat step b above but for the following pins and indicators as listed in the Normal indication column.	XA1-4, DS5 (ANT) XA1-5, DS6 (RSS) XA1-6, DS2 (DC PWR) XA1-7, DS3 (CSS Temp) XA1-9, DS7 (CSS) all momentarily ON.	If no indication, check wiring between associated pin on XA1 and 2 on the lamp socket.
5. Fault switch wiring.	*a.* Open the UUT access cover. See figure 8-7 and figure FO-17. Momentarily place fault switch 1 (S2) to the OVERRIDE position and return to NORMAL. Observe OVERRIDE indicator DS8.	DS8: Momentarily ON.	If no indication, check wiring between XDS8-2 and S2-6 and S2-2 and ground. Also check switch operation.
	b. Repeat step a above but for fault switches 2 through 12 (S3 through S13). Observe OVERRIDE indicator DS8.	DS8: Momentarily ON.	If no indication, check associated switch and wiring.
	c. On the UUT, connect the multimeter (set for dc volts) to XA1-26 (+) and ground. Momentarily operate switch S14 (fig. 8-12, SAFETY ALERT) to OVERRIDE and then release. Observe the multimeter.	+ 5 V ± 0.5 V	If no indication, check S14 operation, wiring to unit connector P2, and wiring to XA1-26.

Table 8-13. Alarm Monitor, Troubleshooting Chart

Item of Check	Test Conditions	Normal Indications	Remarks
	d. Place UUT fault switches 1 through 12 (S2 through S13) to the NORMAL position. Connect the multimeter (set for dc volts) to unit connector XA1 pin 34 (+) and ground. Momentarily place switch S3 to OVERRIDE and then return to NORMAL. Observe the multimeter for a momentary indication.	+ 5 V approx.	See figure FO-20. If no indication check switch operation, wiring from S3-1 to unit connector P2, and wiring from S3-5 to XA1-34.
	e. Repeat step d above for switches 3 through 12 (S4 through S13) and connect the (+) lead of the multimeter to XA1 as listed below:		If no indication check as above for the associated switch, wiring, and XA1 pin number (see fig. FO-20).
	S4:XA1-33	+5 V	
	S5:XA1-36	Gnd	
	S6:XA1-31	+ 5 V	
	S7:XA1-37	Gnd	
	S8:XA1-35	Gnd	
	S9:XA1-30	+ 5 V	
	S10:XA1-29	+5 V	
	S11:XA1-14	+5 V	
	S12:XA1-41	Gnd	
	S13:XA1-45	+ 5 V	
	f. Place UUT fault switches 1 through 12 (S2 through S13) to the NORMAL position. Connect the multimeter (set for dc volts)	+ 5 V	See figure FO-20.
	to XA1 34 (+) and ground.	+5 V	J2-E, S3-3
	On the test fixture momentarily place switch S20 to the 1 position and then return to the OFF position. Observe the multimeter for a momentary indication.		
	g. Connect the (+) lead of the multimeter to XA1 as listed below. On the test fixture momentarily place the appropriate switch (S no.) to the 1 position and then return to the OFF position.		If no indication, check figure FO-20 as above for the associated switch, wiring and unit connector J2 pin as listed below:
	XA1-33 (S19)	+5 V	J2-F, S4-3
	XA1-37 (S23)	+5 V	J2-G, S7-3
	XA1-31 (S17)	+5 V	J2-H, S6-3
	XA1-36 (S22)	+5 V	J2, J, S5-3
	XA1-35 (S21)	+5 V	J2-K, S8-3
	XA1-30 (S16)	+ 5 V	J2-F, S9-3
	XA1-29 (S15)	+5 V	J2-G, S10-3
	XA1-14 (S4)	+5 V	J2-Z, Sll-3
	XA1-41 (S24)	+5 V	J2-B, S12-3
	XA1-45 (S28)	+5 V	J2-R, S13-3
6. Safety wiring.	*a.* On the UUT connect one end of a test lead to unit ground. Connect the other end of this test lead to XA1-10. Observe indicator DS9 on the test fixture.	DS9:ON	If no indication, check wiring from XA1-10 to J3-P.
	b. On the UUT, connect one end of a test lead to XA1-25. Connect the other end of this test lead to ground. Observe indicator DS8 on the test fixture.	DS8:OFF	If there is an indication, check wiring from XA1-25 to J3-D.

Table 8-13. Alarm Monitor, Troubleshooting Chart - Continued

Item of Check	Test Conditions	Normal Indications	Remarks
	c. On the UUT, connect one end of a test lead to XAI-28 and the other end to ground. Observe indicator DS-7 on the test fixture.	DS7:OFF	If there is an indication, check wiring from XA1-28 to J3-B (see fig. FO-20).
	d. On the UUT, connect the multimeter to XA1-12 (+) and ground. On the test fixture momentarily place switch S2 to the 1 position and return to OFF. Observe the multimeter.	XA1-12: + 5 V	If no indication, check wiring from XA1-7 to J3-J. See figure FO-20.
	e. Repeat step d above but for the XA1 pins and test fixture switches, as listed in the Normal indication column. Observe the multimeter for a momentary + 5 V indication at each pin.	S3, XA1-13. S5, XA1-15. S6, XA1-16 S7, XA1-17. S8, XA1-18.	See figure FO-20. If no indcation check wiring from appropriate XA1 pin to J3 pin.
	f. On the test fixture connect one end of a test lead to P3-N and the other end to P3-Y (+ 5 V dc) set switch S9 to the 1 position.		
	g. On the UUT connect the multimeter between XA1-19 and ground check for + 5 Vdc.	XA1-19: + 5 V	If no indication, check wiring from X1-19 to P3-N.
	h. Remove the test lead from P3-N on the test fixture and multimeter from XA1-19 on the UUT and reconnect, respectively as listed in the Normal indication column. Observe the multimeter for + 5 V indication at each XA1 pin.	Connect P3Y to / Measure / SW to 1 pos: P3-P, XA1-21, S10 P3-R, XA1-22, S11 P3-M, XA1-24, S13 + 5 V	See figure FO-20. If no indication, check wiring from appropriate XA1 pin to P3 pin.
	i. Remove power and disconnect UUT from test setup.		

d. On the test fixture check for or perform the following:

(1) Switch AC PWR is in the OFF position. Circuit breaker CB1 is in the down (off) position.

(2) Switches S1 through S28 are in the 0 position.

e. On the alarm monitor check for or perform the following:

(1) The POWER circuit breaker (CB1) is in the down (off) position.

(2) The AUDIBLE SIGNAL/FAULT switch (S1) is in the OFF position.

(3) Open the access cover. Fault switches 1 through 12 (S2 through S13) are in the NORMAL (down) position.

(4) Remove the fault/safety gate module from chassis connector XA1 approximately one inch. Note the pin numbers on the module connector. Use these guides to locate pin numbers on XA1.

f. Proceed to table 8-13, step 1*b*.

APPENDIX A
REFERENCES

AR 55-38 NAVSUPINST 4610.33B AFR 75-18 MCO P4610.19C DLAR 4500.15	Reporting of Transportation Discrepancies in Shipments.
AR 385-11	Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).
AR 735-11-2 DLAR 4140.55 NAVSUPINST 4440.127E AFR 400-54 MCO 4430.3E	Reporting of Item and Packaging Discrepancies.
DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies and Equipment Used by the Army.
TB SIG 291	Safety Measures to be Observed When Installing and Using Ship Antennas, Field-Type Masts, Towers and Antennas and Metal Poles that are Used with Communications, Radar and Direction Finder Equipment.
TB 43-0116	Identification of Radioactive Items in the Army Supply System.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TB 43-0124	Maintenance and Repair Procedure for Shelters, Electrical Equipment S-141/G and S-141B/G (NSN 5410-00-752-9698), S-144/G, S-144A/G, S-144B/G, S-144C/G, and S-144D/G (5410-00-542-2532), S-250/G (5410-00-999-4935), S-250/G (Shielded) (5410-00-489-6076), S-280/G (5410-00-999-5269), S-280A/G (5410-00-999-6022), S-280B/G (5410-00-117-2868), S-280B/G (Shielded) (5410-00-001-4093), S-280C/G and S-318/G (5410-00-763-2339) and S-318A/G (5410-00-116-7086).
TM 5-232	Elements of Surveying (GPO SN: 0820-00388-3).
TM 5-4120-243-14	Operator's Organizational, Direct Support and General Support Maintenance Manual for Air Conditioner, Horizontal Compact: 18,000 BTU, 208 V, 3 Phase, 50/60 Hz (Trane Model MAC6H18-208-201-02); (Harvey W. Hottel Model CH20-6-08; (American Air Filter Model CH618-2) (NSN 4120-00-411-3730); 208 V, 3 Phase, 400 Hz (Trane Model MAC4H18-208-1201-03); (Harvey W. Hottel Model CH20-4-08); (KECO Model F18H-4) (4120-00-411-3731); 230 V, 1 Phase, 50/60 Hz (Trane Model MAC6H18-230-1201-01) and (KECO Model F18H) (4120-00-411-3729).
TM 5-4120-243-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists for Air Conditioner, Horizontal Compact; 18,000 BTU (Trane Models) 208 V, 3 Phase, 50/60 Hz (Model MAC6H18-208-1201-02) (NSN 4120-00-411-3730); 208 V, 3 Phase, 400 Hz (Model MAC4H18-108-1201-03) (4120-00-411-3731); 208 V, 1 Phase, 50/60 Hz (Model MAC6H18-230-1201-01) (4120-00-411-3729); (Harvey W. Hottel Models), 208 V, 3 Phase, 50/60 Hz

(Model CH20-6-06) (4120-00-411-3730); 208 3 Phase, 400 Hz (Model CH20-4-08) Phase, 50/60 Hz (4120-00-411-3730) and (KECO Model FI8H-4) 208 V, 3 Phase, 400 Hz (4120-00-411-3731).

TM 5-6115-465-12 NAVFAC P-8-625-12 TO 35C2-3-446-1 TM-06858B/06859D-12	Operator's and Organizational Maintenance Manual for Generator Set, Diesel Engine Driven, Tactical Skid MTD, 30 KW, 3 Phase, 4 Wire, 120/208 and 240/416 V (DOD Model MEP-005A), Utility Class, 50/60 Hz (NSN 6115-00-118-1240), (Model MEP-104A), Precise Class, 50/60 Hz (6115-00-118-1247), (Model MEP-114A), Precise Class, 400 Hz (6115-00-118-1248) Including Auxiliary Equipment (DOD Model MEP-005AWE) Winterization Kit, Fuel Burning (6115-00-463-9083), (Model MEP-005AWE), Winterization Kit, Electric (6115-00-463-9085), (Model MEP-005ALM), Load Bank Kit (6115-00-463-9088) and (Model MEP-005AWM), Wheel Mounting Kit (6115-00-463-9094).
TM 5-6115-465-12-HR	Hand Receipt Manual Covering the End Item/Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) for Generator Set, Diesel Engine Driven, Tactical Skid Mtd. 30 KW, 3 Phase, 4 Wire 120/208 and 240/416 V (DOD Model MEP-005A), Utility Class, 50/60 Hz (NSN 6115-00-118-1240), (Model Mep-104A), Precise Class, 50/60 Hz (6115-00-118-1247), (Model MEP-114A), Precise Class, 400 Hz (6115-00-118-1248) Including Auxiliary Equipment (DOD Model MEP-005AWE) Winterization Kit, Fuel Burning (6115-00-463-9083), (Model MEP-005AWE) Winterization Kit, Electric (6115-00-463-9085), (Model MEP-005 ALM), Load Bank Kit (6115-00-463-9088) and (Model MEP-005AWM), Wheel Mounting Kit (6115-00-463-9094).
TM 5-6115-465-24P TO 35C2-3-446-4 NAVFAC P-8-625-24P SL-4-06858B/06859D	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Generator Set, Diesel Engine Driven, Tactical Skid MTD, 30 KW, 3 Phase, 4 Wire, 120/208 and 240/416 V (DOD Model MEP-005A), Utility Class, 50/60 Hz (NSN 6115-00-118-1240); (Model MEP-104A), Precise Class, 50/60 Hz (6115-00-118-1247); (Model MEP-114A) Precise Class, 400 Hz (6115-00-118-1248); (Model MEP-005-AWF), Winterization Kit, Fuel Burning (6115-00-463-9083); (Model MEP-005-AWE) Winterization Kit, Electric (6115-00-463-9085); (Model MEP-005-ALM) Load Bank Kit (6115-00-463-9088) and (Model MEP-005-AWM) Wheel Mounting Kit (6115-00-463-9094).
TM 5-6115-465-34 NAVFAC P-8-625-34 TO 35C2-3-446-2 TM 06858B/06859D-34	Intermediate (Field) (Direct and General Support) and Depot Level Maintenance Manual: Generator Set, Diesel Engine Driven, Tactical Skid MTD, 30 KW, 3 Phase, 4 Wire, 120/208 and 240/416 V (DOD Model MEP-005A), Utility Class, 50/60 Hz (NSN 6115-00-118-1240) (Model MEP-104A), Precise Class, 50/60 Hz (6115-00-118-1247), (Model MEP-114A) Precise Class, 50/60 Hz (6115-00-118-1248) Including Optional Kits (Model MEP-005AWF) Winterization Kit, Fuel Burning (6115-00-463-9083), (Model MEP-005AWE) Winterization Kit, Electric (6115-00-463-9085) (Model

	MEP-005ALM) Load Bank Kit (6115-00-463-9088) and (Model MEP-005AWM) Wheel Mounting Kit (6115-00-463-9094).
TM 9-2330-275-14&P	Operator's, Organizational, Direct Support and General Support Maintenance Manual (Including Repair Parts and Special Tools List) for Dolly Set, Lift, Transportable Shelter, M689 (NSN 2330-00-266-6076); M689E1 (CRAIG), M689E1 (GICHNER) and M840 (2320-00-937-1175), M829 (NSN 2330-00-484-0861) and M832 (NSN 2330-00-221-4939).
TM 11-5805-601-15	Operator's Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tools list: Receiver-Transmitter, Order Wire RT-964(V)3/GRC.
TM 11-5805-667-14&P	Operator's, Organizational, Direct Support, and General Support Maintenance Manual: Plug-in Units, Frequency Signaling TA-941/FTC (STELMA Model SFSU-1600-UB) (NSN 6625-00-602-5128), TA-942/FTC (STELMA Model SFSU-2600-UB) (6625-00-602-5127), TA-943/FTC (STELMA Model SSU-3/1600) (6625-00-602-5149), TA-944/FTC (STELMA SSU-3/2600) (6625-00-602-5148); Extender, Printed Wiring Board MX-9664/FTC (6625-00-602-5151) and Universal Shelf, 90409000-000 (line Conditioning Equipment).
TM 11-5805-667-34P	Direct Support and General Support Maintenance Repair Parts and Special Tool Lists for Plug-in Units, Frequency Signaling, TA-941/FTC (NSN 5805-00-602-5128), TA-942/FTC (5805-00-602-5127), TA-943/FTC (5805-00-602-5149), TA-944/FTC (5805-00-602-5148); Extender, Printed Wiring Board, MX-9664/FTC (5805-00-602-5151) and Universal Shelf, 90409000-000.
TM 11-5805--668-14&P	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Plug-in Unit, Terminating Set TA-946/FTC (STELMA 4TS-2) (NSN 6625-00-602-5125) and TA-945/FTC (STELMA 4TS-2B) (6625-00-602-5124); Extender, Printed Wiring Board, MX-9664/FTC (6625-00-602-5151) and Universal Shelf, 90409000-000 (Line Conditioning Equipment).
TM 11-5805-668-34P	Direct Support and General Support Maintenance Repair Parts and Special Tool Lists for Plug-in Unit, Termination Impedance Matching, TA-945/FTC (NSN 5805-00-602-5124) and TA-946/FTC (5805-00-602-5125); Extender, Printed Wiring Board, MX-9664/FTC (5805-00-602-5151) and Universal Shelf, 90409000-000 (Line Conditioning Equipment) .
TM 11-5805-672-14&P	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Plug-in Unit, Line Signal Attenuator CN-1449/FTC (STELMA AT-2P) NSN 6625-00-602-5120); Plug-in Unit, Carrier Board MT-4722/FTC (STELMA CB-1) (5820-00-593-4790); Extender, Printed Wiring Board, MX-9664/FTC (6625-00-602-5151) and Universal Shelf, 90409000-000 (Line Conditioning Equipment).
TM 11-5805-672-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List for Plug-in Unit, Line Signal Attenuator, CN-1449/FTC (NSN 5805-00-602-5120) (STELMA AT-2P); Plug-in Unit, Carrier Board, MT-4722/FTC (5820-00-593-4790) (STELMA CB-1); Extender, Printed Wiring Board, MX-9664/FTC (5808-00-602-5151) and Universal Shelf, 90409000-000 (Line Conditioning Equipment).

TM 11-5805-675-14&P	Operator's, Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools Lists) for Plug-in Unit, Line Amplifier AM-6745/FTC (STELMA LA-3) (NSN 5820-00-557-1671); Plug-in Unit, Line Amplifier AM-6746/FTC (STELMA DLA-3) (6625-00-602-5119); Plug-in Unit, Carrier Board MT-4722/FTC (STELMA CB-1) (5820-00-593-4790); Extender, Printed Wiring Board MX-9664/FTC (6625-00-602-5151) and Universal Shelf 90409000-000 (Line Conditioning Equipment).
TM 11-5805-676-14&P	Operator's Organizational, Direct Support and General Support Maintenance Manual for Plug-in Unit, Ringdown Converter, CV-3250/FTC (STELMA RDC-4A) (NSN 6625-00-602-5159); Extender, Printed Wiring Board, MX-9664/FTC (6625-00-602-5151) and Universal Shelf, 90409000-000 (Line Conditioning Equipment).
TM 11-5805-676-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tool Lists for Plug-in Unit, Ringdown Converter, CV-3250/FTC (STELMA Model RDC-4A) (NSN 5805-00-602-5129), Extender, Printed Wiring Board, MX-9664/FTC (80409160-000) (5805-00-602-5151) and Universal Shelf, 90409000-000 (Line Conditioning Equipment).
TM 11-5805-711-13 NAVELEX 0967-LP-593-4060 Manual: TO 31W2-2FCC98-1	Operator's, Organizational and Direct Support Maintenance Multiplexer Sets, AN/FCC-98(V)1 (NSN 5820-01-072-0560) and ANIFCC-98(V)1X (5820-01-086-6217).
TM 11-5805-711-40 NAVELEX 0967-LP 593-4070 TO 31W2-2FCC98-2	General Support Maintenance Manual for Multiplexer Sets, AN/FCC-98(V)1 (NSN 5820-01-072-0560) and AN/FCC-98(V)1X (5820-01-086-6217).
TM 11-5815-602-12	Operator's and Organizational Maintenance Manual for Terminal, Communications AN/UGC-74A(V)3 (NSN 5815-01-062-8194).
TM 11-5815-602-20P	Organizational Maintenance Repair Parts and Special Tools List for Terminal, Communications AN/UGC-74A(V)3 (NSN 5815-01-062-8194).
TM 11-5815-602-34	Direct Support and General Support Maintenance Manual for Terminal, Communications AN/UGC-74A(V)3 (NSN 5815-01-062-8194).
TM 11-5815-602-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Terminal, Communications AN/UGC-74A(V)3 (NSN 5815-01-062-8194).
TM 11-5820-847-12 NAVELEX 0969-LP-169-5010 TO 31R5-2G-281	Operator's and Organizational Maintenance Manual: Modem, Digital Data MD-1002/G (NSN 5820-01-043-7646).
TM 11-5820-847-12-HR	Hand Receipt Manual Covering Content of Components of End Item (COEI) for Modem, Digital Data, MD-1002/G (NSN 5820-01-043-7646).
TM 11-5820-847-20P NAVELEX 0969-LP-169-5030 TO 31R5-2G-284-1	Organizational Maintenance Repair Parts and Special Tools Lists for Modem, Digital Data-QPSK/BPSK, MD-1002/G (NSN 5820-01-043-7646).
TM 11-5820-847-34 NAVELEX 0969-LP-169-5020	Direct Support and General Support Maintenance Manual for Modem, Digital Data, MD-1002/G (NSN)5820-01-043-7646).

TO 31R5-2G-282	
TM 11-5820-847-34P NAVELEX 0969-LP-169-5040 TO 31R5-2G-284-2 (NSN) 5820-01-043-7646).	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Modem, Digital Data, QPSK MD-1002/G
TM 11-5895-797-14 NAVELEX 0967-LP-547-0010 TO 31R5-2G-101	Operator's, Organizational, Direct Support, and General Support Maintenance Manual: Analog-Digital Converter CV-3034A/G (NSN 5805-01-018-0668).
TM 11-5895-797-24P NAVELEX 0967-LP-547-0020 TO 31R5-2G-104	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Analog-Digital Converter CV-3034A/G (NSN 5805-01-018-4668).
TM 11-5895-807-13 NAVELEX 0967-LP-594-2010 TO 31R5-2GSC-101	Operator's Organizational, and Direct Support Maintenance Manual: Encoder-Decoder, KY-801/GSC (NSN 5895-01-034-1061), KY-801A/GSC (5895-01-058-4585) and KY-801B/GSC (5805-01-099-5911).
TM 11-5895-807-13-HR	Hand Receipt Manual Covering Content of Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization Lists (AAL) for Encoder-Decoders, KY-801/GSC (NSN 5895-01-034-1061), KY-801A/GSC (5895-01-058-4585) and KY-801B/GSC (5895-01-099-5911).
TM 11-5895-807-23P	Organizational and Direct Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Encoder-Decoder KY-801/GSC (NSN-5895-01-034-1061).
TM 11-5895-843-14 TO 31R2-2TSC-142	Direct Support and General Support Maintenance Manual for Echo Suppressor, MX-9635/TSC (NSN 5895-01-041-5105).
TM 11-5895-843-24P TO 31R2-2TSC-144	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Echo Suppressor, MX-9635/TSC.
TM 11-5895-846-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Satellite Communications Terminal AN/TSC-86 (NSN 5895-01-083-6891).
TM 11-5895-846-24P	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Satellite Communications Terminal AN/TSC-86 (NSN 5895-01-083-6891).
TM 11-5895-1038-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Antenna Mounted Electronics, SM-D-775829 and Antenna, AS-3036/TSC (NSN 5895-01-056-1017).
TM 11-5895-1038-30 TO 31R2-2TSC-132	Direct Support Maintenance Manual: Antenna, AS-3036/TSC (NSN 5895-01-056-1017) and Antenna Mounted Electronics.

TM 11-5895-1041-24P TO 31R2-4-484-4	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for LNA Control/Translator Unit, Dual (NSN 5820-01-059-1814) and Single (5895-01-071-6257).
TM 11-5895-1041-34 TO 31R2-4-484-2	Direct Support and General Support Maintenance Manual: LNA Control/Translator (Dual LNA Control SM-D-775327 and Single SM-D-777167).
TM 11-5895-1090-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Amplifier-Mixer AM-6704/TSC (NSN 5895-01-083-0726).
TM 11-5895-1090-34	Direct Support and General Support Maintenance Manual for Amplifier-Mixer AM-6704/TSC (NSN 5895-01-083-0726).
TM 11-5895-1091-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Amplifier, Radio Frequency AM-6703/TSC (NSN 5895-01-083-0642) and Power Supply PP-7087/TSC.
TM 11-5895-1091-34	Direct Support and General Support Maintenance Manual for Amplifier, Radio Frequency AM-6703/TSC (NSN 5895-01-083-0642) and Power Supply PP-7087/TSC.
TM 11-5895-1092-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Converters, Frequency, Electronic CV-3199/TSC (NSN 5895-01-083-0638) and CV-3200/TSC (NSN 5895-01-083-0639) and Synthesizer, Frequency, Electronic 0-1678/TSC (NSN 5895-01-086-3278).
TM 11-5895-1092-34	Direct Support and General Support Maintenance Manual for Converters, Frequency, Electronic CV-3199/TSC (NSN 5895-01-083-0638) and CV-3200/TSC (NSN 5895-01-083-0639) and Synthesizer, Frequency, Electronic 0-1678/TSC (NSN 5895-01-086-3278).
TM 11-5895-1093-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Control, Antenna C-10273/TSC (NSN 5895-01-101-1980) and Control Antenna C-10817/TSC (NSN 5895-01-094-5491).
TM 11-5895-1093-34	Direct Support and General Support Maintenance Manual for Control, Antenna C-10273/TSC (NSN 5895-01-101-1980) and Control, Antenna C-10817/TSC (NSN 5895-01-094-5491).
TM 11-5895-1123-34	Direct Support and General Support Maintenance Manual for Communications Subsystem P/O Satellite Communications Terminal AN/TSC-86 (NSN 5895-01-083-6891).
TM 11-5985-359-13	Operator’s, Organizational, and Direct Support Maintenance Manual for Antenna AS-3199/TSC (NSN 5895-01-088-7337).
TM 11-5985-359-13-HR	Hand Receipt for Antenna AS-3199/TSC (NSN 5895-01-088-7337).
TM 11-5985-359-23P	Organizational and Direct Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts

	and Special Tools) for Antenna AS-3199/TSC (NSN 5895-01-088-7337).
TM 11-6625-602-12-1	Operator's and Organizational Maintenance Manual: Test Set, Telephone AN/USM-181B.
TM 11-6625-602-20P-1	Organizational Maintenance Repair Parts and Special Tool Lists for Test Sets, Telephone AN/USM-181B and AN/USM-181C (NSN 6625-00-740-,0344).
TM 11-6625-2737-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Dual Trace Amplifier AM 6785 (Tektronix 7A26) (when printed).
TM 11-6625-2737-24P NAVELEX 0967-LP-170-1140 TO 33A1-2-235-4	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists Including Depot Maintenance Repair Parts and Special Tools) for Dual Trace Amplifier AM-6785/U (NSN 6625-00-361-5318).
TM 11-6625-2772-12	Operator's and Organizational Maintenance Manual for TS-3580 (when printed).
TM 11-6625-2781-14-1	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Plug-in Unit, Electronic Test Equipment PL-1388/U (Hewlett-Packard Model 8552B) (NSN 6625-00-431-9939).
TM 11-6625-2781-14-4	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Plug-in Unit, Electronic Test Equipment PL-1400/U (Hewlett-Packard Model 8555A) (NSN 6625-00-422-4314).
TM 11-6625-2781-14-6	Operator's, Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List) for Filter, Variable F-1414/U (HP-8445B) (NSN 6625-00-253-4833).
TM 11-6625-2781-14&P	Operator's, Organizational, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools List for Spectrum Analyzer IP-1216(P)/GR (Hewlett-Packard Model 141T) (NSN 6625-00-424-4370).
TM 11-6625-2781-14&P-2	Operator's, Organizational, Direct Support and General Support Maintenance Manual Including Repair Parts and Special Tools Lists for Spectrum Analyzer RF Section PL-1399/U (NSN 6625-00-432-5055).
TM 11-6625-2781-24P-1	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for IF Plug-in PL-1388/U (Hewlett-Packard Model 8552B) (NSN 6625-00-431-9339).
TM 11-6625-2781-24P-4	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Plug-in Unit, Electronic Test Equipment PL-1400/U (Hewlett-Packard Model 8555A) (NSN 6625-00-422-4314).
TM 11-6625-2781-24P-6	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Filter, Variable, F-1414/U (HP Model 8445B) (NSN 6625-00-253-4833).
TM 11-6625-2839-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual for TS-3642 (Harris 7003) (when printed).

TM 11-6625-2839-24P	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List for TS-3642 (Harris 7003) (when printed).
TM 11-6625-2922-14&P	Operator's, Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools Lists) for Oscilloscope, Tektronix Model R7704 (NSN 6625-00-007-8487).
TM 11-6625-2924-14&P	Operator's, Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools Lists) for Universal Counter/Timer, Tektronix Model 7D15 (NSN 6625-00-392-2604).
TM 11-6625-2925-10	Operator's Manual for Dual Time Base, Tektronix Model 7B92A (NSN 6625-01-027-0265).
TM 11-6625-2925-24 TO 33A1-10-242-2	Organizational, Direct Support and General Support Maintenance Manual for Dual Time Base, Tektronix Model 7B92A (NSN 6625-01-027-0265).
TM 38-750	The Army Maintenance Management System.
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).
TO 31W2-2T-102	Service Instructions, Circuit Diagrams, and Illustrated Parts Breakdown for Frequency Shift Converter Type CV-2543(P)/T and Frequency Shift Keyer Type KY-664(P)/T (STELMA).
TO 31W4-2T-102	Service Instructions, Circuit Diagrams, and Illustrated Parts Breakdown for Telegraph Line Isolator, Type CU-1819/T (STELMA).

Section. I. INTRODUCTION

B-1. General
This appendix provides a summary of the maintenance operations for the AN/TSC-86. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Function Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act: of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

B-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for the purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3, This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of task-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C - Operator/Crew
O - Organizational
F - Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

B-4. Tool or Test Equipment Requirements (Sect. III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

B-5. Remarks (Section IV)

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

(Next printed page is B-3)

SECTION II MAINTENANCE ALLOCATION CHART FOR SATELLITE COMMUNICATIONS TERMINAL AN/TSC-86

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	SATELLITE COMMUNICATIONS TERMINAL AN/TSC-86 SM-F-935051	Inspect		1.0					
		Test		4.0					H
		Repair		1.0				112	A
		Service		8.0				112	
		Test				40.0		1,4,20,24, 25,28,33,38, 49,50,52,55, 62,103,104, 106,112,125, 132	
		Repair				16.0			I
		Overhaul					80.0	1,2,4,8,16, 19,20,23,24, 25,28,33,35, 38,44,49,50, 52,55,62,77, 91,99,100, 103,104,105, 108 thru 111, 120,123,125, 128,132,157	
01	ANTENNA CONTROL C-10273/TSC SM-F-936003	Inspect		0.1				112	
		Test		0.2					J
		Repair		0.2				112	A,B
		Replace		0.3				112	
		Test			0.2			94	C,J
		Repair			0.5			103,132	C
		Test					3.5	24,41,130, 132,142,200 thru 204,213	
		Repair					2.0		
0101	BINARY TO BCD, Al SM-D-936036	Test		0.2					D
		Replace		0.1				112	
		Test					0.5	41,53,64,71, 76,103,104, 130,132	
		Repair					0.5		I
0102	READOUT LOGIC, A2 SM-D-936056	Test		0.2					D
		Replace		0.1				112	
		Test					2.0	41,53,64,66, 71,103,104, 130,132	
		Repair					0.5		I
0103	SCAN LOGIC, A3 SM-D-936044	Test		0.2					D
		Replace		0.1				112	
		Test					0.5	41,64,66471, 103,104,130, 132	
		Repair					0.5		I
0104	AUTOTRACK, A4 SM-D-936052	Test		0.2					D
		Replace		0.1				112	
		Test					1.0	41,64,66,71, 103,104,130, 132	
		Repair					0.5		I
0105	MODE LOGIC, AS SM-D-936048	Test		0.2					D
		Replace		0.1				112	
		Test					1.0	64,66,71, 103,104,130, 132	
		Repair					0.5		I
0106	ANALOG, A6 SM-D-936040	Test		0.2					D
		Replace		0.1				112	
		Test					3.0	41,53,64,66, 71,76,94, 103,104,130, 132	
		Repair					0.5		I

SECTION II MAINTENANCE ALLOCATION CHART FOR SATELLITE COMMUNICATIONS TERMINAL AN/TSC-86

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
0107	POWER SUPPLY, A7 SM-F-936014	Test		0.2					D
		Replace		0.3				112	
		Test				0.5		71,88,103, 104,132,196	
		Repair				0.5			I
0108	POWER AMPLIFIER, A8,A9 SM-D-936019	Test		0.2					
		Replace		0.5				112	
		Test					2.0	41,66,71, 103,104,127, 130,132,191	
		Repair					0.5		I
010801	DRIVE ASSEMBLY, A8A1, A9A1 SM-D-936032	Test					1.0		D
		Repair					0.5		E
010802	CONTROLLER ASSEMBLY, A8A2, A9A2 SM-D-936028	Test					1.0		D
		Repair					0.5		E
010803	BLANKING, ABA3, A9A3 SM-D-936060	Test					1.0		D
		Repair					0.5		E
0109	POWER SUPPLY, PS1 SM-A-936064	Test		0.2					D
		Replace		0.2				112	
		Test				0.5		66,88,103, 104,132,193	
		Repair				0.5			I
0110	COMMUNICATION CHANNEL TRACKING ASSEMBLY SM-D-775360	Test		0.2					D
		Replace		0.2				112	
		Adjust		0.2				112	
		Test				2.9		19,41,48,55, 57,59,62,66, 71,75,88,91, 96,104,105, 132,140	
		Repair				3.8			I
011001	70 MHZ AMPLIFIER BOARD A12A1 SM-D-775364	Repair				2.0			E
011002	DETECTOR TRACKING BOARD, A12A2 SM-D-775365	Repair				2.0			E
0111	DISPLAY ASSEMBLY, A10 SM-D-936088	Test		0.1					D
		Replace			0.2			132	
		Test					0.5	64,71,88, 103,104,132	
		Repair					0.5		I
0112	SWITCH ASSEMBLY (MGC), All SM-D-936066	Test			0.2				D
		Replace			0.5			132	
		Test					0.5	88,132	
		Repair					0.5		I
02	ANTENNA CONTROL C-10817/TSC SM-D-936104	Inspect		0.1					
		Test		0.3					D
		Repair		0.1					B
		Replace		0.1				112	
		Test			1.0			71,84,88, 103,132	
		Repair			1.5				I
03	RADIO FREQUENCY AMPLIFIER AM-6793/TSC SM-F-935110	Inspect		0.6				112	
		Test		0.9					F
		Repair		0.7				112	A,B
		Replace		0.5				112	
		Repair			1.0			105,132	C
		Test					8.0	1,7,20,32, 38,47,52,54, 55,62,88, 102,103,105, 125,126,132	
		Repair					3.0		I

SECTION II MAINTENANCE ALLOCATION CHART FOR SATELLITE COMMUNICATIONS TERMINAL AN/TSC-86

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
0301	RF LOW POWER ALARM, Al SM-D-775384	Test		0.2					D
		Replace		0.3				112	
		Test				1.3		71,88,103, 104,132,168	
		Repair				1.6			I
0302	RF MONITOR ASSEMBLY, A2 SM-D-777203	Test		0.3					D
		Replace		0.3				112	
		Repair		0.8				112	A
		Test				1.5		46,55,62,63, 71,88,103, 104,105,132	
		Repair				1.8			I
030201	THERMOELECTRIC POWER MONITOR, A2A1 SM-A-775411	Test		0.3					J
		Replace		0.8				112	
		Test					0.3	1,20,47,55, 62,71,103, 104,130,132, 175,205	
		Repair					1.9		I
030202	RF MONITOR PC BOARD, A2A2 SM-D-775887	Repair				1.5			E
0303	KLYSTRON, V1 SM-A-775610	Test		0.3					D
		Replace		0.5				112	
		Repair		0.3				112	B
		Repair					80.0		G
0304	BLOWER, 81 SM-A-775408	Test		0.2					D
		Replace		0.4				112	
		Repair				1.5		103,132	
04	POWER SUPPLY PP-7087/TSC SM-F-935111	Inspect		0.6				112	
		Adjust		0.1				112	
		Test		0.8					F
		Repair		1.0				112	A,B
		Replace		0.4				112	
		Repair			1.0			132	C
		Test					8.0	57,71,87,88, 89,132,170	
		Repair					4.0		I
0401	CONTROL AND OVERLOAD, Al SM-D-777109	Test		0.2					D
		Replace		0.2				112	
		Test				1.6		71,88,103, 104,137	
		Repair				1.8			I
0402	LOW VOLTAGE ASSEMBLY, A2 SM-D-935063	Test		0.2					D
		Replace		0.2				112	
		Test				2.0		66,68,71,76, 86,88,104, 132,171	
		Adjust				0.5		103	
		Repair				2.0			I
0403	HIGH VOLTAGE ASSEMBLY, A3 SM-D-776895	Test		0.3					D
		Replace		0.3				112	
		Test					1.2	65,66,71,86, 88,103,104, 148,160	
		Repair					1.4		I
0404	PULSE SYNTHESIZER ASSEMBLY, A4 SM-D-777176	Test		0.2					D
		Replace		0.2				112	
		Test				2.4		66,71,76,85, 88,104,132, 39,171	
		Repair				2.6			I
040401	PULSE SYNTHESIZER BOARD, A4A1 SM-D-776850	Repair				1.9			E

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
040402	OSCILLATOR/PULSE SYNTHESIZER, A4A2 SM-D-776875	Repair				1.2			E
0405	HIGH VOLTAGE SWITCHING A5 THRU A12 SM-D-935064	Test		0.2					D
		Replace		0.2				112	
		Test				1.5		36,66,68,71, 76,88,92, 104,132,139, 171	
		Repair				1.4			I
0406	HIGH VOLTAGE OVERLOAD, A13 SM-D-776888	Test		0.2					D
		Replace		0.2				112	
		Test				1.5		57,66,71,88, 104,132,149, 160	
		Adjust				0.5		132	
		Repair				1.8			I
0407	HIGH VOLTAGE TRANSFORMER/RECTIFIER, A14 THRU A17 SM-C-775402	Test		0.2					D
		Replace		0.4				112	
		Test				1.2		55,66,69,71, 76,86,88, 132,138,139, 171	
		Repair				1.4			I
0408	FILAMENT ASSEMBLY, A18 SM-D-935065	Test		0.2					D
		Replace		0.3				112	
		Test				1.5		66,71,76,86, 88,104,132, 139,171	
		Repair				1.7		139,171	
0409	START ASSEMBLY, A19 SM-D-936374	Test		0.2					
		Replace		0.3				112	
		Test				1.5		57,85,88, 104,132,186	
		Repair				1.7			
0410	RECTIFIER ASSEMBLY SM-C-936425	Test			0.2				D
		Replace			0.3			94,132	
05	ELECTRONIC FREQUENCY CONVERTER CV-3200/TSC (DOWNCONVERTER) SM-F-935001	Inspect		0.8					
		Test		0.5					J
		Adjust		0.5				112	
		Repair		0.7					A,B
		Replace		0.4				112	
		Repair			1.0			94,132	C
		Test					8.0	2,9,17,21, 24,28,29,30, 37,42,47,49, 50,55,62,71, 77,81,88,90, 104,105,106, 132,158,159, 207,208	
		Repair					4.5		I
0501	SYNTHESIZER O-1678/TSC, Al SM-F-935109	Test		0.3					D
		Repair		0.4					A,B
		Replace		0.3				112	
		Repair			1.0			132	
		Test					8.0	4,5,9,18,23, 26,28,40,46, 55,57,58,62, 71,76,90,91, 96,104,105, 108,116,117, 132,147,158, 159	
		Repair	6.0						I

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
050101	FIXED FREQUENCY GENERATOR, AlA1 SM-D-937543	Test		0.2					D
		Replace		0.3				112	
		Test					2.4	9,16,46,52, 55,57,62,71, 88,90,104, 105,108,132, 154,158,159	
		Repair					3.0		A,I
05010101	MULTIPLIER/FILTER, AlAlAl SM-D-937544	Replace					0.3	132	
		Test					1.3	19,71,90, 104,108,132, 151	
		Repair					2.0		I
05010102	630 MHZ GENERATOR, A1AlA2 SM-D-937547	Replace					0.3	132	
		Test					1.3	9,19,24,27, 44,71,90, 104,132,153, 158	
		Repair					2.0		I
05010103	SPECTRUM GENERATOR, AlAIZ1	Replace					0.3	132	
		Test					1.7	9,44,52,55, 62,71,88, 104,105,132, 146,158,159	
		Repair					2.3		G
050102	1 MHZ MODULE, AiA2 SM-D-935078	Test		0.3					D
		Replace		0.4				112	
		Test				3.0		10,11,12,48, 57,66,71,88, 90,104,105, 106,132,173	
		Repair				1.0			I
050103	1 KHZ MODULE, AiA3 SM-D-935079	Test		0.3					D
		Replace		0.4				112	
		Test				3.0		13,24,48,51, 57,66,71,88, 90,104,105, 106,132,174	
		Repair				4.0			I
050104	MAIN LOOP MODULE, A1A4 SM-D-935077	Test		0.3					D
		Replace		0.4				112	
		Test					4.0	10,11,12,23, 28,44,46,48, 57,66,71,76, 88,90,104, 105,108,117, 120,132,141, 172	
		Repair					5.0		I
050105	YIG FILTER/DRIVER, AIFL1 SM-A-935191	Test		0.2					D
		Replace		0.4				112	
		Test					1.7	9,24,28,37, 49,55,62,70, 71,88,104, 105,132,159, 181	
		Repair					2.3		G
050106	CRYSTAL OSCILLATOR, AlY1 SM-A-935190	Test		0.2					D
		Replace		0.3					
		Test					1.5	23,55,62,71, 88,104,105, 108,132,152	
		Repair					2.1		G

SECTION II MAINTENANCE ALLOCATION CHART FOR SATELLITE COMMUNICATIONS TERMINAL AN/TSC-86

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
050107	GUNN EFFECT OSCILLATOR, A1Y2 SM-A-776982	Test		0.2					D
		Replace		0.4				112	
		Test					2.1	2,9,13,21, 24,28,48,55, 57,62,71,76, 88,104,105, 121,124,132, 159,188,189	
		Repair					2.5		G
0502	70 MHZ CHANNEL, A2 SM-D-935061	Test		0.3					
		Adjust		0.3				112	
		Replace		0.4				112	
		Test				3.0		24,25,27,45, 48,52,71,88, 90,99,104, 105,132,187, 192,197	
		Repair				4.0			I
050201	700/70 MHZ MIXER, A2A1 SM-D-935502	Repair				2.0			E
050202	70 MHZ AMPLIFIER, A2A2 SM-D-935504	Repair				2.0			E
050203	700/70 MHZ BITE, A2A3 SM-D-777023	Repair				2.0			E
0503	700 MHZ CHANNEL, A3 SM-D-935062	Test		0.3					D
		Adjust		0.3				112	
		Replace		0.4				112	
		Test				3.0		16,17,19,24, 27,28,47,48, 52,71,88,90, 93,99,104, 105,132,187, 192,197	
		Repair				4.0			I
050301	SHF DOWNCONVERTER/IF PREAMP, A3A1 SM-A-935153	Test				2.0			D
		Replace				0.5		132	
		Test					2.0	23,28,47,71, 88,105,124, 132,192,197	
		Repair					2.5		G
050302	700 MHZ PREAMP, A3A2 SM-D-935525	Test				1.0			D
		Repair				2.0			E
050303	700 MHZ AMPLIFIER, A3A3 SM-A-935216	Test				1.0			D
		Replace				1.0		132	
050304	700 MHZ AMPL/DETECTOR, A3A4 SM-D-935570	Test				1.0			D
		Repair				2.0			E
050305	700 MHZ BITE, A3A5 SM-D-935530	Test				1.0			D
		Repair				2.0			E
0504	700 MHZ BANDPASS FILTER (WB) SM-A-935150	Test		1.0					D
		Replace		1.0				112	
0505	700 MHZ BANDPASS FILTER (NB) SM-A-935151	Test		1.0					
		Replace		1.0				112	
0506	POWER SUPPLY, PS1 SM-A-935154	Test		0.2					D
		Replace		0.4				112	
		Test				4.0		15,57,85,88, 91,104,132, 138	
		Repair				5.0			I

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
06	ELECTRONIC FREQUENCY CONVERTER CV-3799/TSC	Inspect		0.6					
	(UPCONVERTER) SM-F-935108	Test		0.4					J
		Adjust		0.4				112	
		Repair		0.8					A,B
		Replace		0.5					
		Repair			1.0			94,132	C
		Test					8.0	5,9,14,16, 19,24,25,28, 34,40,43,44, 45,48,49,55, 58,60,62,71, 77,91,93,99, 100.104,105, 108,116,128, 132,158,159, 182	
		Repair					12.0		I
0601	SYNTHESIZER, AI SM-F-935109 (SAME AS GROUP 0501)								
0602	70/700 UPCONVERTER, A2	Test		0.3					D
	SM-D-935075	Replace		0.3				112	
		Test					4.0	3,19,24,25, 27,44,48,49, 52,55,56,62, 71,77,78,88, 93,95,100, 104,105,132, 183,209	
		Repair					5.0		I
060201	70/700 MIXER, A2A1 SM-D-777106	Repair					1.3		E
060202	700 MHZ AMPLIFIER, A2A2 SM-D-935506	Repair					1.3		E
0603	GROUP DELAY EQUALIZER, A3	Test			0.3				D
	SM-D-935594	Replace			0.4			112	
		Test					4.0	104,105,132, 176 thru 180	
		Repair					5.0		I
060301	EQUALIZER BOARD ASSEMBLY, A3A1 SM-D-936300	Repair					5.0		E
0604	IF AMPLIFIER, A4	Test			0.3				D
	SM-A-776969-1	Replace			0.4			112	
		Test					3.0	1,6,20,47, 49,55,62,71, 77,88,101, 104,105,128, 132,169	
		Repair					20.0		G
0605	FILTER/MONITOR/IPA, AS	Test		0.3					D
	SM-D-935076	Replace		0.4				112	
		Test					4.0	6,14,19,24, 28,31,49,50, 55,62,71,77, 88,104,105, 132,184	
		Repair					6.0		I
060501	MON AMPL RD ASSEMBLY, A5A1	Test					1.7		D
	SM-D-776835	Replace					0.3	132	
		Test					1.7	71,88,104, 132,184	
		Repair					2.1		I
0606	POWER SUPPLY, PS1 SM-A-935154 (SAME AS GROUP 0506)								

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
0607	BANDPASS FILTER, FL1	Test		0.3					D
	SM-A-935255	Replace		0.3				112	
07	ANTENNA AS-3036/TSC	Inspect		2.0					
	SM-F-890000	Repair		2.3				112	A,B
		Repair			2.5			94,132	
	ALTERNATE ANTENNA AS-3199/TSC (SEE TM 11-5985-359-13)	Repair							
0701	ANTENNA FEED TUBE	Inspect		0.1					
	SM-F-890035	Replace		0.2				112	
		Inspect					0.3		
		Test					1.9	1,33,49,50, 80,164	
		Repair					3.0		I
0702	REFLECTOR (QUARTER SECTION)	Replace		0.3				112	
	SM-E-890050	Inspect					0.5		
		Repair					3.0		K
0703	REFLECTOR GIMBAL ASSEMBLY SM-F-890080 (LISTED FOR REFERENCE ONLY: NOT A MAINTENANCE ITEM)								
070301	ANTENNA CENTER SECTION	Inspect		0.2					
	SM-E-890100	Replace		1.4				112	
		Inspect					0.2		
		Repair					4.5	132	K
070302	ORTHOMODE TRANSDUCER	Inspect		0.2					
	SM-C-890190	Replace		0.5				112	
		Inspect					0.3		
		Test					2.2	1,33,49,50, 67,72,73,80, 163,165,166	
070303	WAVEGUIDE ASSEMBLY (POLARIZER)	Inspect		0.1					
	SM-C-890180	Replace		0.5				112	
		Inspect					0.3		
		Test					2.2	1,33,49,50, 74,80,161, 162	
		Repair					2.0		I
0704	CROSS ELEVATION ACTUATOR	Test		0.3					
	SM-F-890204	Repair		1.0				112	A
		Replace		0.5				112	
		Test					1.5	57,76,94, 132,155,156	
		Repair					3.0		I
070401	MOTOR-BRAKE-TACHOMETER W/PINION	Replace		0.9				112	
	SM-F-890224	Test					1.5	57,76,94, 132,144	
		Repair					2.0		I
0705	ELEVATION ACTUATOR SM-F-890205 (SAME AS GROUP 0704)								
08	ANTENNA MOUNTED ELECTRONICS SM-D-775829 (LISTED FOR REFERENCE ONLY: NOT A MAINTENANCE ASSEMBLY) (SEE TM 11-5895-1038-30)	Inspect		1.0					

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
0801	PARAMETRIC AMPLIFIER AM-6700/TSC (LNA), A1,A2 SM-D-890300	Test		1.0					J
		Replace		0.6				112	
		Align		1.5				112	
		Test					2.7	1,2,7,20,34, 49, 50,54,55,62,66, 88,104,105, 115,132,136, 143, 194,195	
		Adjust					0.3	132,143	
		Repair					2.0		I
080101	RF AMPLIFIER ASSEMBLY, A1A1 SM-D-890302	Test					3.2	1,2,7,20,34, 49,50,54,55, 62,66,68, 104,105,113, 115,118,119, 132,136,143, 194,195	
		Repair					2.0		I
08010101	REFERENCE VOLTAGE BOARD A1A1A1 SM-D-890310	Test					2.3	7,66,71,76, 86,88,104, 113,115,132, 135,194,195	
		Replace					0.5	7,132	
		Repair					2.6		I
08010102	PARAMP AMPLIFIER BOARD, AIAIAR1 SM-D-890325	Test					2.0	1,2,7,20,34,49, 50,54,55,62,66, 113,115,132, 135,136,143, 194,195	
		Replace					0.5	7,105,132	
		Repair					2.4		G
08010103	FET AMPLIFIER BOARD, A1AIAR2 SM-A-890326	Test					2.1		D
		Replace					0.5	7,105,132	
08010104	HEATER PLACE, A1AIHR1 SM-D-890306	Test					0.8	7,94,132	
		Replace					1.5	7,132	
080102	LNA POWER SUPPLY ASSEMBLY, A1A2 SM-D-890303	Test					2.0	7,66,88,115 132,135,194, 195	
		Repair					1.5		I
08010201	TEMPERATURE CONTROLLER BOARD, A1A1A2 SM-D-890311	Test					3.0	7,66,71,76,86, 88,104, 132, 133,134	
		Replace					0.5	7,132	
		Repair					2.7		I
08010202	RECEIFIER BOARD, A1A2A3 SM-D-890312	Test					1.6		D
		Replace					0.5	7,132	
		Repair					1.9		E,I
0802	LNA BITE ASSEMBLY, A3 SM-D-775322	Test		0.6					J
		Adjust		0.3				112	
		Replace		0.4				112	
		Test					2.0	2,21,24,28, 47,55,62,71, 79,88,94, 104,105,114, 115,132,194	
		Repair					2.4		I
080201	FAULT DETECTOR ASSEMBLY, A3A1 SM-D-775405	Replace					0.3	132	
		Test					1.6	19,41,66,71, 83,88,104, 132	
		Repair					1.9		I
08020101	FAULT DETECTOR BOARD, A3AIAI SM-D-775768	Repair					1.6		E

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
080202	GUNN EFFECT OSCILLATOR, A3Y1 SM-A-776921	Replace					0.4	132	
		Test					1.7	9,24,28,55, 62,71,88, 104,105,132, 159	
		Repair					2.0		G
0803	WIDEBAND PRESELECTOR FILTER, FLI SM-A-776192	Replace		0.4				112	
		Test					1.6	2,3,39,49, 50,80,98, 105,132	
0804	WAVEGUIDE SWITCH, K1 SM-A-776191	Replace			0.4			112	
		Test					1.7	2,3,10,11, 12,39,49,50, 76,80,83,98, 132	
		Repair					8.0		G
09	AMPLIFIER/MIXER AM-6704/TSC	Inspect		0.5				112	
		Test		0.8					J
		Repair		0.6				112	A,B
		Replace		1.0				112	
		Repair			0.5			132	C
		Test					6.0	1,2,3,6,7, 21,24,28,33, 47,52,55,62, 86,88,104, 105,126,132	
		Repair					8.0		I
0901	SHF COMBINER, Al SM-D-935052	Test		0.2					D
		Replace		0.4				112	
		Repair			1.0			105,132	A
		Test					2.0	1,2,3,6,21, 24,28,33,47, 49,50,52,55, 62,71,80, 105,132,150	
		Repair					3.0		I
090101	SHF CHANNEL ASSEMBLY, A1A1 THRU A1A4 SM-D-935053	Test				0.2			D
		Replace				0.5		105,132	
		Test					1.0	1,2,3,6,21, 24,28,33,47, 52,55,62, 105,132	
		Repair					2.0		I
0902	SHF DRIVE ASSEMBLY, A2 SM-D-935081	Test		0.2					D
		Replace		0.3				112	
		Test					1.5	1,2,3,6,21, 24,28,33,47, 52,55,62, 105,132	
		Repair					2.0		I
0903	AMPLIFIER ASSEMBLY (FET), A3 SM-C-937563	Test		0.2					D
		Replace		0.4				112	
		Test					1.0	7,47,105, 130,132,192, 97,208	
		Repair					2.0		I
090301	AMPLIFIER SHF FET SM-A-937287	Repair					2.0		I
		Test					1.0		D
		Repair					2.0		E
09030101	AMPLIFIER 105463	Test					1.0		D
		Replace					1.0	105,132	
		Repair					40.0		G

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
ALTERNATE 0903	AMPLIFIER ASSEMBLY (TWT), A3	Test		0.2					D
	SM-C-937562	Replace		0.4				112	
		Test					1.0	47,105,130, 132,192,197, 208	
		Repair					2.0		I
090301	AMPLIFIER SHF TWT	Test					1.0		D
	SM-A-775715	Replace					1.0	105,132	
		Repair					80.0		G
0904	TRANSIENT SUPPRESSOR, A4	Test		0.2					D
	SM-D-935507	Replace		0.4				112	
		Test				1.0		71,88,104, 132,185	
		Repair				1.5			I
0905	RF LOW POWER ALARM, AS	Test		0.2					D
	SM-D-775384	Replace		0.3				112	
		Test				1.3	-	71,88,103, 104,168	
		Repair				1.6			I
0906	SHF OUTPUT, A6	Test		0.2					D
	SM-D-935082	Replace		0.4				112	
		Test					4.0	1,2,3,6,21, 24,28,33,47, 49,50,52,55, 62,80,88, 105,132	
		Repair					6.0		I
0907	POWER SUPPLY PS2, PS1	Test		0.2					D
	SM-A-935200	Replace		0.4				112	
0908	POWER MONITOR, THERMOELECTRIC, A7	Test		0.2					J
	SM-A-916470	Replace		0.4				112	
		Test					0.3	1,20,47,55, 62,71,88, 104,132,175, 205	
		Repair					1.9		I
10	LNA CONTROL/TRANSLATOR	Inspect		0.3					
	SM-D-775327	Text		0.4					
		Align		0.3				112	
		Repair		0.5				112	A,B
		Replace		0.4				112	
		Repair			1.0			94,105,132	C
		Test					4.0	1,3,8,9,20, 22,24,27,28, 29,35,48,49, 50,52,56,66, 70,78,82, 103,105,158, 159,192,197	
		Repair					3.0		I
		Adjust					0.5	132	
1001	LNA CONTROL (1 AND 2), Al, A2	Replace		0.2				112	
	SM-D-890301	Test			1.2			94,132	
		Repair			1.4				I
1002	TRANSLATOR ASSEMBLY, A3	Test		0.2					D
	SM-A-777029	Replace		0.3				112	
		Test					1.9	1,9,20,24,27, 28,48,105, 132,159,192, 197	
		Repair					2.2		I

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100201	TRANSLATOR MIXER, A3A1 SM-A-776907	Replace					0.3	105,132	
		Test					1.5	1,9,20,24,27, 28,48,105,132, 159,192,197	
		Repair					4.0		G
1003	725 MHZ SOURCE ASSEMBLY, A4 SM-B-774991	Test		0.2					D
		Replace		0.2				112	
		Test					1.8	9,24,27,48, 55, 62,66,71, 88, 104,105,106, 132,158, 167, 198,199	
		Repair					2.1		I,K
100301	725 MHZ SOURCE SUBASSEMBLY, A4A1 SM-A-934937	Repair					4.0		G
1004	POWER SUPPLY, PS1 SM-A-777781	Test		0.2					D
		Replace		0.2				112	
		Test				0.9		57,85,88,91,97, 104,132,138	
		Repair				2.4			I
11	ALARM MONITOR SM-D-936383	Inspect			0.4				
		Test			0.7				J
		Repair			0.4			112	A,B
		Replace			0.3			112	
		Repair				1.0		132	C
		Test					3.5	85,94,132, 190	
		Repair					2.6		I
1101	FAULT/SAFETY GATE, Al SM-D-936369	Replace		0.2					
		Test				1.4		71,94,104, 132,190	
		Repair				2.3			I
1102	POWER SUPPLY, PS1 SM-A-777752	Replace		0.2				112	
		Test				1.6		57,71,85,88, 91,104,107, 132	
		Repair				2.4			I
12	WAVEGUIDE SWITCH SM-A-776172	Inspect		0.2					
		Replace		0.8				112	
		Test					2.2	1,3,39,49, 50,80,94,98, 122,132	
		Repair					2.5		G
13	COMMUNICATIONS TRACK PATCH PANEL SM-D-935073	Inspect		0.2					
		Test		0.8				112	D
		Repair			1.5			94,132	
14	WIRED SHELTER ASSEMBLY SM-F-935004	Inspect		0.8					
		Test		1.0				94,112	
		Repair		2.0					I
		Test			1.0			94,132	
		Repair			2.0				I
		Test					8.0	94,132	
		Repair					6.0		I,K
1401	EMI POWER ENTRY PANEL SM-0-936380	Repair			1.0				E
1402	TTY/VF ENTRY PANEL SM-F-935010	Repair			2.0				E
140201	SURGE ARRESTOR ASSEMBLY SM-C-936428	Repair			1.5				E
140202	SURGE ARRESTOR ASSEMBLY SM-C-936787	Repair			1.5				E

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(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
1403	ANTENNA ENTRY PANEL SM-F-935501	Repair			1.5				E,L
1404	SHF INPUT ENTRY PANEL SM-D-935070	Repair			1.0				E,L
1405	DATA SIGNAL ENTRY PANEL SM-F-935100	Repair			1.0				E
1406	IF/FREQ STANDARD/TELEPHONE ENTRY PANEL SM-F-935719	Repair			1.0				E
1407	POWER DISTRIBUTION PANEL SM-F-935007	Inspect		0.2					
		Test		1.0					
		Replace			1.0			132	
		Repair			1.5			94,132	
140701	VOLTAGE/FREQ TRIP/PHASE MONITOR SM-A-935082	Replace			1.5			132	
		Repair					8.0		G
1408	TRANSMIT PATCH SM-F-935105	Repair			1.5			132	E
1409	RF TEST SIGNAL PATCH SM-D-936339	Repair			1.5			132	E
1410	FREQ STANDARD AMPL HP-5087A SM-A-935860-1	Replace		0.5				112	
		Test				2.0		10,11,24,25, 51,66,71,88, 91,96,103, 104,129,132	
		Repair				1.5			I
1411	AIR CONDITIONER (SEE TM 5-4120-243-14)	Replace			0.7			132,206	
15	COMMUNICATION SUBSYSTEM (NOT A MAINTENANCE ITEM: LISTED FOR REFERENCE ONLY)								
1501	TELETYPE AN/UGC-74A(V)3 (SEE TM 11-5815-602-12)	Replace		1.0				112	
1502	OSCILLOSCOPE R7704 (SEE TM 11-6625-2922-14&P	Replace		1.0				112	
150201	TIMEBASE 7B92A (SEE TM 11-6625-2925-24&P)	Replace		0.5				112	
150202	DUAL TRACE AMPLIFIER AM-6785/U (SEE TM 11-6625-2737-14)	Replace		0.5				112	
150203	COUNTER 7D15 (SEE TM 11-6625-2924-14&P)	Replace		0.5				112	
1503	POWER METER HP-436A SM-A-935859 (SEE TM 11-6625-2969-14	Test					2.0	24,55,62,66, 103,104,130, 131,132,145	
		Repair					1.5		I
1504	PATTERN GENERATOR PG-404 SM-A-935827	Replace		0.5				112	
1505	DATA ANALYZER DA-404 SM-A-935826	Replace		0.5				112	
1506	CENTRAL DISTRIBUTION FRAME ASSEMBLY SM-F-935726	Inspect		0.3					
		Test		1.0					
		Repair		0.5				112	B
		Repair			1.5			132	
1507	C/N TEST SET TS-3580/G SM-F-859790 (SEE TM 11-6625-2772-12)	Replace			0.5			112	

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1508	REGULATOR, AC LINE	Test		0.5					J
	SM-C-936847	Replace		1.0				112	
		Test				0.5		88,104	
		Repair				3.0		132	I
1509	MONITOR PANEL, AC REGULATOR	Test		0.5					D
	SM-D-936692	Repair			1.0			88,132	
1510	IF PATCH PANEL	Inspect		0.3					
	SM-F-935727	Test		0.5					D
		Repair			1.5			112	
1511	MODEM MD-1002 (SEE TM 11-5820-847-12)	Replace		0.5					
1512	ENCODER-DECODER KY-801A/GSC (SEE TM 11-5895-807-13)	Replace		0.5				112	
1513	SPECTRUM ANALYZER IP-1216/PRC SM-A-935887-1 (HP-141T) (SEE TM 11-6625-2781-14)	Replace		1.0				112	
151301	TUNING SECTION PL-1399/U SM-A-935887-2 (HP8553B)	Replace		0.5				112	
151302	IF SECTION PL-1388/U SM-A-935887-3 (HP-8552B)'	Replace		0.5				112	
151303	POWER CABLE SM-A-935887-4 (HP-8120-137B)	Replace		0.5				112	
1514	DIGITAL TEST SET TS-3642(V)1/G SM-A-935852 (HARRIS 7003) (SEE TM 11-6625-2839-14)	Replace		0.5				112	
1515	ORDERWIRE RT-964(V)/GRC SM-A-935823 (FARINON 70100) (SEE TM 11-5805-601-15	Replace		0.5				112	
151501	ORDERWIRE UNIT SM-A-935815 (FARINON 70193/002)	Replace		0.5				112	
151502	MONITOR SPEAKER SM-A-935816 (FARINON 70104/001)	Replace		0.5				112	
151503	HOOKSWITCH RECPT W/HANDSET SM-A-935817 (FARINON 70107 M3/001)	Replace		0.5				112	
151504	SIGNALING UNIT SM-A-935818 (FARINON 70119 M3/001)	Replace		0.5				112	
151505	4 WAY/4 WIRE BRIDGE SM-A-935819 (FARINON 70106/001	Replace		0.5				112	
151506	LOW PASS FILTER SM-A-935820 (FARINON 70109/001)	Replace		0.5				112	
151507	AMPLIFIER ATTENUATOR UNIT SM-A-935821 (FARINON 70114/004)	Replace		0.5				112	
151508	POWER SUPPLY SM-A-935822 (FARINON 11205)	Replace		0.5				112	
1516	A/D CONVERTER CV-3034A/G (SEE TM 11-5895-797-14)	Replace		0.5				112	
1517	PCM MULTIPLEXER AN/FCC-98 (SEE TM 11-5805-711-13)	Replace		0.5				112	
1518	COMMUNICATION DATA PATCH PANEL	Inspect		0.5					
	SM-A-936517	Test		0.5					D
		Repair			1.0			94,132,210, 211,212	
1519	TELEPHONE TEST SET	Test		0.5					J
	SM-F-935746 (AN/USM-181B) (SEE TM 11-6625-602-12-1)	Repair		0.8				112	

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151901	SIGNAL GENERATOR SG-543B/U SM-A-935885	Replace		0.5				112	
151902	VOLTMETER, ANALOG ME-260B/U SM-A-935886	Replace		0.5				112	
151903	ATTENUATOR, IMPEDANCE CN-947B/USM-181 SM-A-935884	Replace		0.5				112	
1520	TELETYPE LOOP MONITOR SM-D-936640	Test		0.5					D
		Repair			1.0			94,132	
1521	KEY GENERATOR KG-81 (SEE TM 11-5810-293-12P)	Replace		0.6					
1522	POWER SUPPLY FOR KG-81 SM-A-935807 (LAMBDA LMG-28-M-R-7229-2)	Replace		0.6					
1523	LINE ISOLATION EQUIPMENT								
152301	ISOLATOR TELEGRAPH CU-1819/T SM-A-935838 (STELMA 90281163-000) (SEE TO 31W4-2T-102)	Replace		0.5				112	
152302	POWER SUPPLY SM-A-935837 (STELMA LIU-PS-6)	Replace		0.5				112	
1524	COMM TTY/LOW LEVEL PATCH PANEL SM-A-935861	Inspect		0.5					
		Test		0.5					D
		Repair			1.0			94,132	
		Replace			0.4			132	
1525	KEY/CONVERTER (NOT A MAINTENANCE ITEM, LISTED FOR REFERENCE ONLY)	Repair				1.5		94,132	
152501	KEYER, FREQ SHIFT TK-201F SM-A-935286 (STELMA 90416001-100)	Replace		0.5				112	
152502	CONVERTER FREQ SHIFT TC-301F SM-A-935287 (STELMA 90416002-100)	Replace		0.5				112	
1526	FILTER BRIDGE SM-A-935292-1 THRU -16 (STELMA 82520020-201 THRU 216)	Replace		0.5				112	
1527	ECHO SUPPRESSOR ES-3B SM-A-935237	Replace		0.3				112	
1528	COMMUNICATION/VF PATCH PANEL SM-A-935851	Inspect		0.5					
		Test		0.3					D
		Repair			1.0			94,132	M
		Replace			0.4			132	
		Repair				2.0		94,132	
1529	LINE CONDITIONING EQUIPMENT (NOT A MAINTENANCE ITEM, LISTED FOR REFERENCE ONLY)								
152901	48 VDC SUPPLY SM-F-935778	Replace		0.5				112	
		Test				0.5		66,85,88, 132,214	
		Repair				0.5			I
152902	RINGDOWN CONVERTER 20 MH, CV-3250/FTC SM-A-935273 (STELMA 82350020-001) (SEE TM 11-5805-676-14)	Replace		0.5				112	
152903	CARRIER BOARD MT-4722/FTC (CB-1) SM-A-935275 (STELMA 80409140-001) (SEE TM 11-5805-672-14)	Replace		0.5				112	
152904	LINE SIGNAL ATTN CN-1449/FTC (AT-2P) SM-A-935277 (STELMA 80409150-001) (SEE TM 11-5805-672-14	Replace		0.5				112	

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152905	LINE AMPLIFIER AM-6745/FTC (LA-3) SM-A-935276 (STELMA 81120060-003) (SEE TM 11-5805-675-14)	Replace		0.5				112	
152906	TERMINATING SET TA-945/FTC (4TS-2B) SM-A-935274 (STELMA 82350080-001) (SEE TM 11-5805-668-14)	Replace		0.5				112	
152907	FREQ SIGNAL UNIT TA-941/FTC SM-A-935278 (SFSU-1600-U/B) (STELMA 82350010-002) (SEE TM 11-5805-667-14)	Replace		0.5				112	
152908	FREQ SIGNAL UNIT TA-942/FTC SM-A-935279 (SFSU-2600-U/B) (STELMA 82350010-003) (SEE TM 11-5805-667-14)	Replace		0.5				112	
152909	SIGNALING SUPPLY TA-943/FTC SM-A-935280 (SSU-3/1600) (STELMA 82350030-002) (SEE TM 11-5805-667-14)	Replace		0.5				112	
152910	SIGNALING SUPPLY TA-944/FTC SM-A-935281 (SSU-3/2600) (STELMA 82350030-003) (SEE TM 11-5805-667-14)	Replace		0.5				112	
152911	20 HZ RINGING SUPPLY ASSEMBLY SM-F-935784	Replace		0.5				112	
		Test			0.5			24,66,68,88, 91, 132,138, 215	
		Repair				0.5			I
152912	CONTROL MONITOR ASSEMBLY SM-D-937511	Replace				0.5		112	
		Repair			0.5			94,132	C
		Test				0.5		66,88,132, 138,216	
		Repair				0.5			I
1530	COMM/TTY/FSK PATCH PANEL SM-A-935888	Repair			0.5			94,132	
16	POWER PALLET SM-F-935003 (NOT A MAINTENANCE ITEM: LISTED FOR REFERENCE ONLY)								
1601	DOLLY SET M832 (SEE TM 9-2330-275-14)	Repair							
1602	PALLET ASSEMBLY SM-A-775508	Repair			2.0			132,206	
1603	GENERATOR SET, 30 KW (NSN 6115-00-118-1240) (SEE TM 5-6115-465-12)	Repair							
1604	SWITCH BOX SM-F-935716	Inspect		0.5					
		Test		0.5					D
		Repair			1.5			94,132	

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TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	H,D	ADAPTER, COAX UG-1054(HP-H281A)	5985-00-295-9824	
2	H,D	ADAPTER, COAX UG-1849/U (HP-J281A)	5985-00-329-4620	
3	H,D,	ADAPTER, APC-7 UG-1851/U (HP-11525A)	6625-00-463-6037	
4	H,D	AMPLIFIER, AUDIO AM-4825-A (HP-461A)	6625-00-982-2977	
5	D	ANALYZER, PHASE NOISE (FEL-8OOB)		
6	D	AMPLIFIER, TWT AM-6806/U (HP-495A)	6625-00-084-1106	
7	D	KEY, SOCKET HEAD SCREW, ALLEN TYPE 7/64 INCH	5120-00-899-2162	
8	D	ANALYZER, NETWORK FRAME (HP-8410A)	6625-00-351-0031	
9	D	OSCILLOSCOPE FRAME (TEK-7613)		
10	H,D	ANALYZER, SPECTRUM FRAME IP-1216/PGR (HP-141T)	6625-00-424-4370	
11	H,D	ANALYZER, SPECTRUM TUNING PL-1388/U (HP-8552B)	6625-00-431-9339	
12	H,D	ANALYZER, SPECTRUM TUNING PL-1400/U (HP-8555A)	6625-00-422-4314	
13	H,D	ANALYZER, WAVE (HP-3590A)	6625-00-401-5353	
14	H,D	ATTENUATOR (O/S-20600-3)	5985-00-239-1011	
15	H	TEST FIXTURE, POWER SUPPLY U&D CONV (RCA-A1545804-7)		
16	H,D	ATTENUATOR (O/S-10600-10)	5985-00-976-3304	
17	H,D	ATTENUATOR (O/S-20600-20)	5985-00-256-0902	
18	H,D	ATTENUATOR (NARDA-4778-6)	5985-00-236-7984	
19	H,D	ATTENUATOR, STEP CN-970/U (HP-355C)	5985-00-993-1377	
20	H,D	ATTENUATOR, VARIABLE CN-1367/U (HP-H382A)	6625-00-679-0625	
21	H,D	ATTENUATOR, VARIABLE CN-1048/U (HP-J382A)	6625-00-679-0627	
22	H,D	CONVERTER, FREQ CV-2595/USM-307(V) (HP-8411A)	6625-00-441-1998	
23	D	COUNTER, COMPUTING (HP-5360A)	6625-00-432-5011	
24	F,H,D	COUNTER, FREQ CP-772A/U (HP-5245L)	6625-00-973-4837	
25	H,D	COUNTER, PLUG IN CV-2002/U (HP-5253B)	6625-00-266-3483	
26	D	COUNTER, KEYBOARD MX-9735/U (HP-5375A)	6625-00-432-5044	
27	H,D	COUNTER PLUG IN CV-2003B/U (HP-5254C)	6625-00-941-8474	
28	H,D	COUNTER PLUG IN CV-3059/U (HP-5255A)	6625-00-058-3042	
29	D	COUPLER, DIREC (NARDA-3004-10)	5985-00-788-6962	
30	D	COUPLER, DIREC (NARDA-3004-20)	5985-00-714-3247	
31	D	COUPLER, DIREC (NARDA-3045-20)	5985-00-604-8557	
32	D	COUPLER, DIREC CU-1984/U (HP-H752C)	5985-00-773-3418	
33	H,D	COUPLER, DIREC CU-1971/U (HP-H752D)	5985-00-814-4721	
34	H,D	DETECTOR, CRYSTAL (HP-423B)	6625-01-035-0626	
35	H,D	DISPLAY, PHASE-MAG (HP-8412A)	6625-00-161-4174	
36	H,D	DIVIDER, CURRENT MX-8899/U (HP-11028A)	5895-00-242-4031	
37	H,D	DIVIDER, POWER (AERTECH-M6201)		
38	H,D	COUPLER, DIRECT (OMEGA-297)		
39	H,D	FILTER, LP (MICROLAB-LA-90N)	5915-00-154-0162	
40	D	FILTER, SHF TUNE (FEL-A-600C)		

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SATELLITE COMMUNICATIONS TERMINAL AN/TSC-86

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
41	H,D	GENERATOR, FUNCTION (HP-3311A)	7050-01-015-6062	
42	H,D	GENERATOR, NOISE (AILTECH-07616)	6625-00-489-4312	
43	D	GENERATOR, SIGNAL AN/URM-25D (HP-606B)	6625-00-494-8565	
44	H,D	GENERATOR, SIGNAL AN/USM-44B (HP-608E-02)	6625-00-176-5708	
45	H,D	GENERATOR, SIGNAL AN/URM-49A (HP-612A)	6625-00-533-7386	
46	H,D	GENERATOR, SIGNAL AN/URM-170 (HP-618C)	6625-00-883-3256	
47	H,D	GENERATOR, SIGNAL SG-944/U (HP-620B)	6625-00-107-8173	
48	H,D	GENERATOR, SIGNAL AM/FM (HP-8640B-002)	6625-01-014-8425	
49	H,D	GENERATOR, SWEEP MX-8364-A (P) (HP-8690B)	6625-00-442-3470	
50	H,D	GENERATOR, SWEEP RF UNIT PL-1304/USM (HP-8694B)	6625-00-444-2327	
51	H,D	GENERATOR, AUDIO AN/USM-264 (HP-652A)	6625-00-935-4214	
52	H,D	LOAD, 50 OHM (HP-908A)	5935-00-813-9111	
53	D	PRECISION POWER SUPPLY (PD-PD2005A)	6130-00-131-3202	
54	H,D	METER, FREQ. FR-194/U (HP-H532A)	6625-00-730-8570	
55	H,D	METER, POWER ME-441/U (HP-432A)	6625-00-436-4883	
56	H,D	METER, VECTOR IMP. TS-3351/U (HP-4815A)	6625-00-061-0225	
57	H,D	MILLIAMMETER, CLIP ON ME-488/U (HP-428B)	6625-00-816-9324	
58	D	MIXER (HP-934A)	6625-00-829-3422	
59	H,D	MIXER, DOUBLE BAL. CB-2343/U (HP-10514A)	5985-00-087-4714	
60	D	MIXER, DOUBLE BAL. (AERTECH-MX-1007)		
61		NOT USED		
62	H,D	MOUNT, THERMISTOR MX-7772/U (HP-478A)	5840-00-726-3173	
63	H	TEXT FIXTURE RF POWER MONITOR (RCA-A1545879)		
64	D	TEXT FIXTURE, ANTENNA CONTROL MODULES (HARRIS 437523)		
65	D	HI-POT TESTER (SORENSEN TYPE 230GP-R AND D)		
66	H,D	OSCILLOSCOPE 05S-261/U (TEK-475) 6625-00-127-0079		
67	D	SHORT, SLIDING (HP-H920A 5985-00-621-6564		
68	H,D	PROBE, CURRENT (HP-456A) 6625-00-076-0806		
69	H,D	PROBE, HV (TEK-P6013A) 6625-00-101-8759		
70	D	GENERATOR, SWEEP RF UNIT PL-1240A/USM (HP-8693B-HO1)	6625-00-165-1263	
71	H,D	POWER SUPPLY (HP-6202B) 6625-00-439-5080		
72	D	SHORT, SLIDING (HP-J920A)	6625-00-679-0644	
73	D	TERMINATION, WAVEGUIDE, DA-2/UP (HP-J910A)	5985-00-777-2000	
74	D	PROBE, BROADBAND MX-929( )/U (HP-442B)	5985-00-892-5579	
75	H	TEST FIXTURE COMM. CHAN. TRACK (RCA-A1545800)		
76	F,H,D	POWER SUPPLY (HP-6291A)	6625-00-179-7718	
77	H,D	RECORDER, X-Y RO-458(V) I/U (HP-7035B)	6625-00-463-6042	
'78	D	ADAPTER, FLEXIBLE ARM (HP-11605A)	6625-00-470-8445	
79	D	TEST FIXTURE LNA BITE ASSEMBLY (RCA-A1545801)		
80	D	TEST SET, FREQ. RESP. (HP-8755M)	6625-00-620-9207	

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TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
81	H,D	TEST SET, NOISE FIG (AILTECH-136LN35)	6625-00-846-2696	
82	H,D	TEST UNIT, REFLECT./TRANS (HP-8743A)	6625-00-193-2215	
83	D	TEST FIXTURE W/G SWITCH/FAULT DET	(RCA-A1545802)	
84	H	TEST FIXTURE - REMOTE CONTROL (RCA-A1545868)		
85	H,D	VARIAC (GR-3060-5110)	5950-00-948-6988	
86	H,D	VARIAC (GR-3120-5110)	5950-00-078-1145	
87	D	VARIAC 3 PHASE (GR W30G3M)		
88	F,H,D	MULTIMETER, DIGITAL (FLUKE-8000A)	6625-00-322-8715	
89	D	VOLTMETER, ELECTROSTATIC ME-147/U (SEN RES-ESH)	6625-00-557-5672	
90	H,D	VOLTMETER, RF (BOONTON-92A)	6625-00-160-1120	
91	H,D	VOLTMETER, RMS AN/USM-224 (HP-3400A)	6625-00-727-4706	
92		NOT USED		
93	H,D	VOLTMETER, VECTOR (HP-8405A)	6625-00-929-1897	
94	F,H,D	MULTIMETER AN/USM-223	6625-00-999-7465	
95	H,D	COUPLER, DIREC (NARDA-3020A)	5985-00-442-3015	
96	H,D	ATTENUATOR, STEP CN-1128/U (HP-355D)	5985-00-957-1860	
97	H	TEST FIXTURE, POWER SUPPLY, LNA/TRANS (RCA-A1545804-3)		
98	D	COUPLER, DUAL DIREC (HP-11692D)		
99	H,D	DIVIDER, POWER (HP-11549A)	6625-00-918-5803	
100	H,D	GENERATOR, SWEEP RF UNIT PL-1241B/USM (HP-86988-001)	5895-00-415-6338	
101	H,D	GENERATOR, SWEEP RF UNIT PL-1242/USM-308(V) (HP-8699B)	6625-00-251-5212	
102	D	POWER SUPPLY, HV (RCA-SM-F-935111) PP-7087/TSC-86		
103	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/U	5180-00-605-0079	
104	H,D	KIT, PCB REPAIR MK-772/U	5999-00-757-5042	
105	F,H,D	WRENCH, TORQUE (O/S-T8438)	5120-00-169-5772	
106	H,D	ATTENUATOR COAXIAL (HP-8491B-010)	5985-00-454-6923	
107	H	TEST FIXTURE POWER SUPPLY SYS MON (RCA-A1545804-5)		
108	H,D	STANDARD, FREQ FR-206/H (HP-5065A)	6625-00-484-6335	
109	D	ANALYZER, NETWORK (HP-8407A)	6625-00-161-4175	
110	H,D	COUPLER, DIREC	(WAVE-574-40)	
111	H,D	RATIOMETER (FE-5511A)		
112	O,F,H,D	KIT, TOOL (RCA-SMA-777797)		
113	D	POWER SUPPLY ASSEMBLY (RCA-SMD-890303)		
114	D	LNA UNIT (RCA-SM-D-890300)		
115	D	LNA CONTROL UNIT (RCA-SM-D-890301)		
116	D	GEN., FIXED FREQ (RCA-SMD-888137)		
117	D	METER, MOD (RCA-SMA775649)		
118	D	DIGITAL THERMOMETER (TTC-9300AC-04-15)		
119	D	THERMO PROBE (ITC-P1OO)		
120	D	COUNTER, PLUG IN ADAPTER (HP-10536A)	6625-00-354-9730	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
121	D	MIXER (AERTECH-MX-800)	6625-01-059-6978	
122	D	TEST FIXTURE, WAVEGUIDE (RCA-A1545840)		
123	D	TEST SET, REC PHASE LIN (RCA-A1545877)		
124	0	FREQUENCY SYNTHESIZER (RCA-SMF-935109)		
125	H,D	DUMMY LOAD, WAVEGUIDE (RCA-SMA-916398)		
126	H,D	ISOLATOR, COAXIAL (PRD-1212-C)	5985-00-453-5560	
127	H,D	POWER SUPPLY (HP 6274B)	6625-00-160-0827	
128	D	TEST SET, TRANS PHASE LIN (RCA-A1545876)		
129	H	FEED THROUGH LOAD (HP 11048C)		
130	D	MULTIMETER, DIGITAL (FLUKE-8800A)	6625-01-052-0915	
131	D	RANGE CALIBRATOR (HP 11683A)		
132	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-105/G	5180-00-610-8177	
133	D	TEST, SET, TEMP CONTROL CARD (SMD-890378)		
134	D	RESISTANCE DECADE BOX (EICO-1171)	6625-00-031-3717	
135	D	RF AMP ASSEMBLY SIMULATOR (RCA-SM-D-890440)		
136	D	TEST FIXTURE, WAVEGUIDE INTERFACE (RCA-SM-D-890444)		
137	H	TEST FIXTURE, CONTROL/OVERLOAD (RCA-A1545810)		
138	H	POWER SUPPLY (SORENSEN DCR300-3B)		
139	H	TEST FIXTURE, 280V POWER SUPPLY USE W/171 (RCA-A1547608)		
140	H,D	ATTENUATOR STEP (KAY 1/500)		
141	D	OSCILLATOR, GUNN (RCA-SM-A-776982)		
142	D	STRIP CHART RECORDER (GULTON TR-44) REQUIRES 4 EA TSC-801 PLUG-INS, ITEM 213		
143	H,D	MODIFIED NUT DRIVER (RCA-SM-B-890374)		
144	D	TEST FIXTURE, MOTOR-BRAKE TRACK (RCA-A1545869)		
145	D	LOGIC ANALYZER (HP 1601L)		
14b	D	TEST FIXTURE, SHF SPECTRUM GEN (RCA-A1545832)		
147	D	TEST FIXTURE, SYNTHESIZER TYPE II (RCA-A1547611)		
148	D	TEST FIXTURE, HIGH VOLTAGE (RCA-A1545811)		
149	H	TEST FIXTURE, H.V OVERLOAD (RCA-A1545812)		
150	D	TEST FIXTURE, SHF COMBINER (RCA-A1547615)		
151	D	TEST FIXTURE, MULTI-FILTER (RCA-A1545815)		
152	D	TEST FIXTURE, 5 MHZ CRYSTAL OSCIL (RCA-A1545829)		
153	D	TEST FIXTURE, 630 MHZ GENERATOR (RCA-A1545817)		
154	D	TEST FIXTURE, COMPARATOR TEST, FFG & CONTROL (RCA-A1545818)		
155	D	TEST FIXTURE, ACTUATOR (XEL) (RCA-A1545862-1)		
156	D	TEST FIXTURE, ACTUATOR (EL) (RCA-A1545862-2)		
157	D	DELAY LINE, VARIABLE (RCA-A1545565)		
158	D	ANALYZER, SPECTRUM TUNING (TEK-7L13)	6625-00-538-9809	
159	D	ANALYZER, SPECTRUM TUNING (TEK-7L18)		
160	H,D	BRIDGE, RESISTANCE ZM-4B	6625-00-500-0937	

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TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
161	D	RECTANGULAR-TO-ROUND TAPER SECTION (TASKER-TSM-D-890180-TF-3)		
162	D	ROUND TERMINATION (TASKER-TSM-C-890180-TF-2)		
163	D	ROUND TERMINATION (TASKER-TSM-C-890190-TF-1)		
164	D	RECTANGULAR-TO-ROUND TAPER SECTION (TASKER-TSM-F-890035-TF-2)		
165	D	TERMINATION, WAVEGUIDE MX-8426/U (HP-H910OA)	5985-00-888-5511	
166	D	COUPLER, DIRECTIONAL (HP-J752D)	5985-00-679-0639	
167	D	TEST FIXTURE, 725 MHZ SOURCE (RCA-A1545820)		
168	H	TEST FIXTURE, LOW RF ALARM (RCA-A1545821)		
169	D	TEST FIXTURE, 700/SHF MIXER (RCA-A1545822)		
170	D	TEST FIXTURE, HV POWER SUPPLY (RCA-A1547610)		
171	H	TEST FIXTURE, HV P.S. MODULES (RCA-A1547609)		
172	D	TEST FIXTURE, MAIN LOOP ASSEMBLY (RCA-A-1547613)		
173	H	TEST FIXTURE, 1 MHZ STEP ASSEMBLY (RCA-A1547614)		
174	H	TEST FIXTURE, 1 KHZ STEP ASSEMBLY (RCA-1547612)		
175	D	TEST FIXTURE, POWER MONITOR THERMO (RCA-1545828)		
176	D	IF/BB RECEIVER (HP 3702B) R-2049(V) I/G	6625-00-520-5023	
177	D	PHASE DETECTOR, PLUG IN (HP 3705A) PL-1394/U	6625-00-520-5055	
178	D	IF/BB TRANSMITTER (HP 3710A) T-1353(V) I/U	6625-00-520-4992	
179	D	75 TO 50 OHM ADAPTER (ANZAC TP75)		
180	D	ANALYZER (HP 3716A) PL-1405(V) I/U	6625-00-520-5059	
181	D	TEST FIXTURE, YIG FILTER/DRIVER (RCA-A1545831)		
182	D	TEST FIXTURE, CONV FREQ ELEC (U/CII) (RCA-A1545803)		
183	D	TEST FIXTURE, 70/700 MIXER ASSEMBLY (RCA-A1547617)		
184	D	TEST FIXTURE, SHF F11/MON/IPA ASSEMBLY (RCA-A1547618)		
185	H	TEST FIXTURE, TRANSIENT SUPPRESSOR (RCA-A1547616)		
186	H	TEST FIXTURE, START MODULE (RCA-A1545814)		
187	H	TEST FIXTURE, D/CII, 70 & 700 MHZ CHAN (RCA-A1547619)		
188	D	METER, FM DEVIATION (MAR-TF-2300A)	6625-01-045-2788	
189	D	TEST FIXTURE, GUNN EFFECT OSC (RCA-A1545830)		
190	H,D	TEST FIXTURE, ALARM MONITOR, FAULT SAFETY GATE (RCA-A1547620)		
191	H,D	TEST FIXTURE, POWER AMPLIFIER (HARRIS 437520)		
‘192	H,D	METER, MICROWATT (BOONTON-428D W/OPT 01:09)	6625-01-050-8800	
193	H	TEST FIXTURE, POWER SUPPLY, ANT CONT (HARRIS 437522)		
194	D	CABLE, POWER LNA (RCA-SMC-890375)		
195	D	CABLE, LNA BREAKOUT BOX (RCA-SMD890445)		
196	H	TEST FIXTURE, POWER SUPPLY, ANT CONT (HARRIS 437521)		
197	H,D	DETECTOR POWER (BOONTON 41-48)		
198	D	TORQUE SCREWDRIVER (APCO MOSSBERG B25R)	5120-00-568-4742	
199	D	BIT, SCREWDRIVER, PHILLIPS NO 0 POINT, 1/4" HEX DRIVE (USE WITH 198) (APEX 4910)		
200	D	REMOTE CONTROL UNIT SM-D-936104		

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SATELLITE COMMUNICATIONS TERMINAL AN/TSC-86

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
201	D	TEST FIXTURE, ANTENNA SIMULATOR (HARRIS T-15919)		
202	D	TEST FIXTURE, COMM TRACK SIMULATOR (HARRIS T-15923)		
203	D	TEXT FIXTURE, BEACON RECEIVER INTERFACE (HARRIS T-15922)		
204	D	TEST FIXTURE, ALGORITH CHECKER (HARRIS T-15924)		
205	D	TOOL KIT TK-1 (GENERAL MICROWAVE CORP TK-1)		
206	F,D	WRENCH SET SOCKET 3/8" DRIVE	5120-00-322-6231	
207	H,D	ATTENUATOR COAXIAL (HP-8491B-003)		
208	H,D	ATTENUATOR COAXIAL (HP-8491B-020)		
209	D	BANDPASS FILTER 700 MHZ (CMI-42-015965-01)		
210	F,H,D	TPS TOOL 12" (TROMPETER RT4L)		
211	F,H,D	TPS TOOL 6" (TROMPETER RT4S)		
212	F,H,D	SCREW STARTER (HJJ 3X-8)		
213	D	AMPLIFIER TSC-801 (4 EA USED WITH ITEM 142)		
214	H	TEST FIXTURE, POWER SUPPLY 'RCA-A1547908)		
215	H	TEST FIXTURE, POWER SUPPLY (RCA-A1547910)		
216	H	TEST FIXTURE, CONTROL, MONITOR ASSEMBLY (RCA-A1547912		

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	REPAIR IS BY REPLACEMENT OF THE NEXT LOWER TIER COMPONENTS/ASSEMBLIES. TERMINAL TOOL KIT(112) REQUIRED.
B	LAMPS, FUSES, AND KNOBS ARE REPLACED AT THE ORGANIZATIONAL LEVEL.
C	REPAIR TO THE CHASSIS/FRAME IS BY REPLACEMENT OF METERS, SWITCHES, AND CONNECTORS, AND OTHER CHASSIS/FRONT PANEL MOUNTED PIECE PARTS.
D	TESTED AS PART OF THE NEXT HIGHER ASSEMBLY.
E	REPAIRED AS PART OF THE NEXT HIGHER ASSEMBLY.
F	THE POWER AMPLIFIER AND HIGH VOLTAGE POWER SUPPLY ARE TESTED BY THE BITE AS ONE FUNCTIONAL UNIT.
G	REPAIRED BY THE MANUFACTURER.
H	OPERATIONAL TEST.
I	THE TMDE FOR REPAIR IS THE SAME AS LISTED FOR TEST IN COLUMN 5.
J	TESTED USING BITE.
K	DEPOT FACILITIES.
L	THE NUMBERED ASSEMBLY LISTED CONSISTS OF THE METAL PANEL WITH OR WITHOUT MOUNTING HARDWARE. ALL CONNECTORS, CABLES, OTHER PIECE PARTS ASSOCIATED WITH THE FUNCTION OF THIS PANEL ARE LISTED AS SEPARATE PARTS OF THE WIRE SHELTER ASSEMBLY AND NOT AS A SUB-PART TO THIS ASSEMBLY.
M	IF IT IS EXPECTED THAT THE REPAIR PROCEDURES WILL REQUIRE EXCESSIVE TIME, REMOVE THE PATCH PANEL AND REPLACE WITH A SPARE UNIT SO THAT TERMINAL OPERATION MAY CONTINUE. IF NECESSARY THE DEFECTIVE PANEL MAY THEN BE REFERRRED TO HIGHER LEVEL MAINTENANCE FACILITIES FOR REPAIR.

APPENDIX C
RECEIVE FIELD ALIGNMENT (AS-3199)

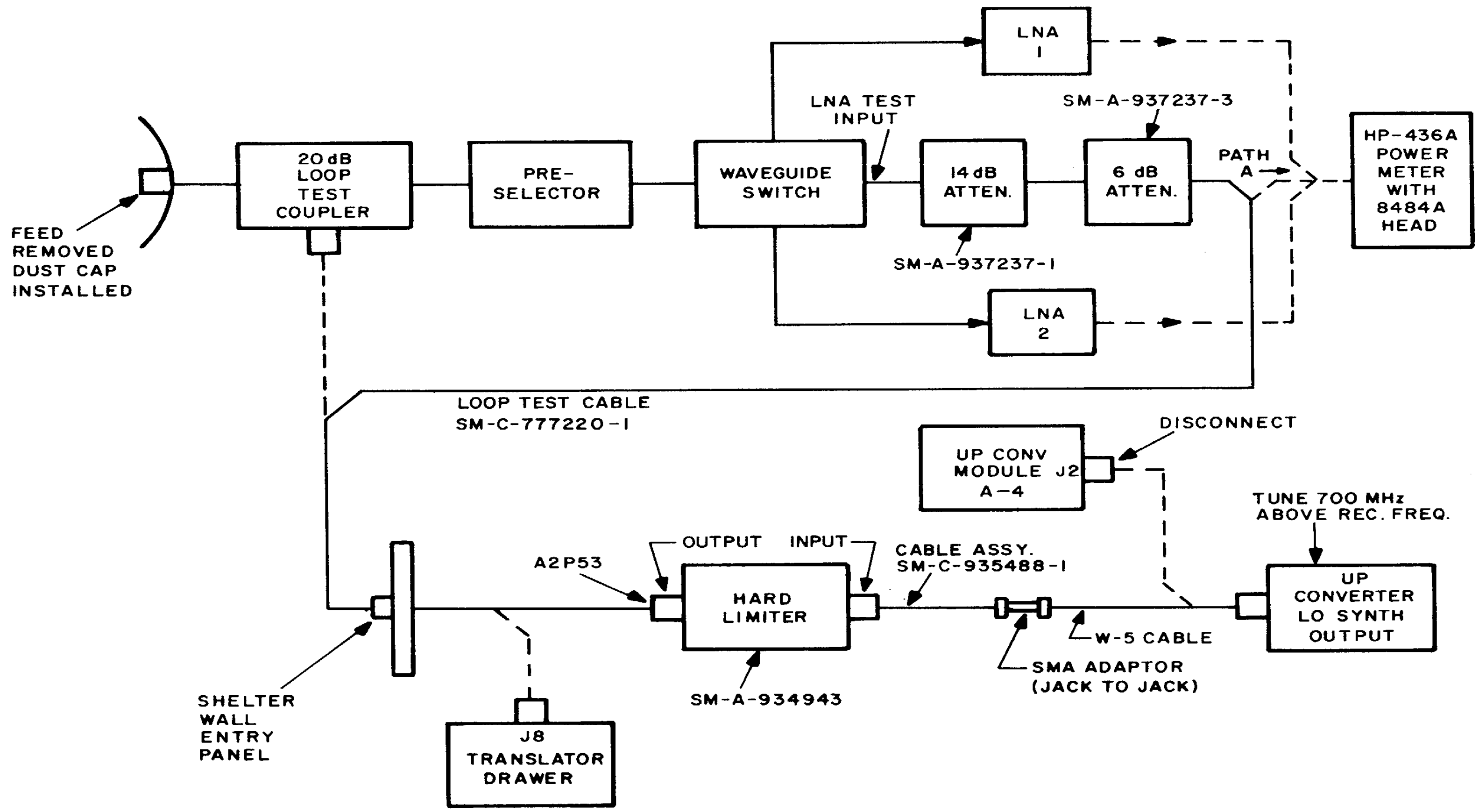
For field alignment of the receive, the following test equipment and cables are required:

Hard Limiter, SM-A-934943
Cable Assembly, SM-C-935488-1
6 dB Attenuator, SM-A-937237-3
14 dB Attenuator, SM-A-937237-1
Power Meter, HP-436A with HP-8484A Head and HP-8481A Head

C-1. Low Noise Gain/Slope Adjustment

NOTE

The low noise gain/slope is adjusted using signal sources within the terminal in conjunction with precision attenuators and a low level SHF hard limiter as shown in figure C-1. A signal at the local receiver frequency is obtained from the SHF local oscillator output (A1A1J2) of the frequency synthesizer in the upconverter drawer. The output level of signal is between the limits of +6 and +12 dBm. The signal is passed through the SHF hard limiter and attenuators to provide a -66 dBm signal at the low noise amplifier (LNA 1 or LNA 2) test port of the waveguide switch on the antenna mounted electronic subassembly and at the LNA input.



r

Figure C-1. Low Noise Amplifier, Gain/Slope Adjustment Diagram.

a. Turn off power to the upconverter and turn on power to the LNA. Allow one hour for warm-up.

b. Remove the screw fasteners on the front panel of an upconverter drawer and pull the drawer forward on its slides.

c. Disconnect cable W5 going from the synthesizer of the upconverter at J2 on module A4 and connect the same to the hard limiter test assembly (SM-A-934943) through the test cable assembly (SM-C-935488-1), and the SMA adapter provided in the test kit.

d. Remove the screw fasteners on the front panel of the LNA control/translator drawer and pull the drawer forward on its slides.

e. Disconnect connector A2P53 going to recepticle J8 (SHF OUT) at the rear of the LNA control/translator drawer, and connect it to the output of the hard limiter test assembly (SM-A-934943).

f. At the AME assembly, disconnect the terminal loop test cable (W15P2) from the bulkhead connector and connect the cable to the RF power meter with low power head (HP-8484A) using a UG-29B/U adapter.

g. Configure the shelter for normal operation and turn the power ON except that the power amplifiers are left on STBY.

h. Tune the upconverter synthesizer test signal source to 8399.000 MHz and measure and record the signal level.

i. Repeat step h above at 8300.300 MHz.

j. Repeat step h above at 8200.000 MHz.

k. Repeat step h above at 7950.000 MHz.

l. Disconnect the loop test cable from the RF power meter and connect same to the waveguide switch test input through the 14 dB and 6 dB series attbnuators provided (SM-A-937237-1, and -3).

m. Disconnect the output cable from the LNA to be tested and connect the HP-436A power meter with HP-8484A power head using a UG-27D/U adapter to the LNA-1 or LNA-2 output port as the case may be, as selected at the LNA control/translator.

NOTE

With the test signal applied to the LNA test port of the W/G switch, the signal is input to LNA-2 with selector switch on the LNA-1 on the LNA control/translator.

n. Tune the synthesizer in the upconverter drawer to 7950.000 MHz. Read and record the output level on the HP-436A power meter.

o. Repeat step n above at 8200.000 MHz.

p. Repeat step n above at 8300.000 MHz.

q. Repeat step n above at 8399.00 MHz.

r. Calculate and record the LNA input level for each frequency by decreasing the measured levels of steps h through k above by 20 dB.

s. Calculate and record the LNA gain by taking the algebraic difference between the levels of step r above and the LNA output levels of steps n through q above.

t. The gain should be within the limits of 39 + 2.0 dB. If such is the case, proceed to the overall receiver gain calibration. If not, proceed to step u below.

u. Plot the power output reading vs. frequency on a graph. It is desireable to have a flat or slightly positive slope of the LNA gain characteristic.

v. The LNA gain/slope may be adjusted by removing the access covers and weatherproofing plugs on the side of the LNA as shown in figure C-2. A special thin wall socket nut driver is required to loosen the locknut on the screwdriver adjustment for the LNA pump power and bias controls which affect the gain/slope of the LNA. A CW rotation of the adjustment screw produces a negative slope and vice versa; the adjustment sensitivity is approximately 5 dB/quarter turn. The bias control mainly affects the low frequency gain; however both controls interact and therefore may require alternate repeated adjustments.

w. If the gain of the LNA at the four frequencies is not within + 2 dB of 39 dB adjust the bias control until such is achieved. It also may be necessary to adjust the pump control slightly. To expedite the adjustment procedure, calculate and record the output level range limits in dBm for each frequency by adding 37 and 41 dB. For example an input level of 64 dBm will have an LNA output range of 27 to 23 dBm.

x. The adjustment should be performed in accordance with conditions and procedures shown in table C-1.

NOTE

It may be necessary to perform the adjustment procedures several times 'to obtain the correct limits. It is better to make several slight adjustments to the controls instead of attempting one large adjustment.

y. After the gain is correctly adjusted, lock the controls in accordance with the following:

(1) Set the synthesizer at 8399 MHz and note the reading on the power meter. This reading must be maintained when locking the controls.

(2) Insert the screwdriver into the handle of the nut driver such that the screwdriver can be applied to the pump power adjustment screw while the nut driver is engaging the locknut.

(3) While observing the power meter, gently rock the adjustment screws back and forth very lightly and slowly tighten the locknut. Keep the gain at the desired level while performing this step.

(4) After the locknut has been tightened, gently tap the adjustment screw with the tip of the screwdriver to relieve internal stress in the locking mechanism.

(5) Tighten the bias voltages control in a similar manner.

(6) Replace the weatherproof access caps, remove all test cables and attenuators, restore all drawers to normal and return the terminal to normal operation.

Table C-1 LNA Response Adjustment

Condition	Corrective Action
1. *a.* Gain relatively flat for all frequencies *b.* Gain below minimum for all frequencies	*a.* Set the synthesizer to 8399 HMz. *b.* Adjust the gain upward by rotating power pump control slightly CCW until the gain is within the required level (39 + 2 dB) *c.* Set the synthesizer to 7950 MHz. *d.* Using the bias voltage control adjust the gain up (CW) or down (CCW) to the same level as that in step b above. *e.* Repeat steps a and b above as necessary to obtain the desired level. *f.* Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
2. *a.* Low frequency gain within limits *b.* High frequency gain below limits	*a.* Set the synthesizer to 8399 MHz. *b.* Slightly adjust the pump power control CCW so that the gain equals that previously measured with the synthesizer set at 7950 MHz. *c.* Remeasure the gain with the synthesizer set at 7950 MHz; if necessary adjust the bias voltage and pump power controls to obtain the desired gain. *d.* Repeat steps a, b and c above as necessary. *e.* Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
3. *a.* Response has a negative tilt *b.* Gain is low for all readings.	*a.* Set the synthesizer to 8399 MHz. *b.* Adjust the gain by rotating the pump power control CCW to reach the desired level. *c.* Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
4. *a.* Response is relatively flat *b.* Gain is high at all frequencies	*a.* Set the synthesizer to 8399 MHz. *b.* Reduce the gain by slightly rotating the power pump control CW until the correct level is reached. *c.* Set the synthesizer to 7950 MHz. *d.* Use the bias voltage control to set the gain at the same level measured in step b above. *e.* Repeat steps a and b above and adjust the gain to the same level as first time. *f.* Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
5. *a.* Low frequency gain is within limits *b.* High frequency gain is higher than limits	*a.* Set the synthesizer to 8399 MHz. *b.* Adjust the pump power control in a CW direction to reduce the gain to that measured for the low frequency (synthesizer set at 7950 MHz) *c.* Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe conditions and compare with this table. Proceed accordingly.
6. *a.* Response has a positive tilt *b.* Gain is higher at all frequencies	*a.* Set the synthesizer at 8399 MHz. *b.* Adjust the pump power control in a CW direction to decrease the gain to the desired level. *c.* Set the synthesizer at 7950 MHz and adjust pump power and bias voltage controls to obtain the same gain as obtained in step b above. *d.* Measure the gain with the synthesizer set at 7950, 8200, 8300 and 8399 MHz. If satisfactory, adjustment is complete; if not satisfactory, observe the conditions and compare with this table. Proceed accordingly.

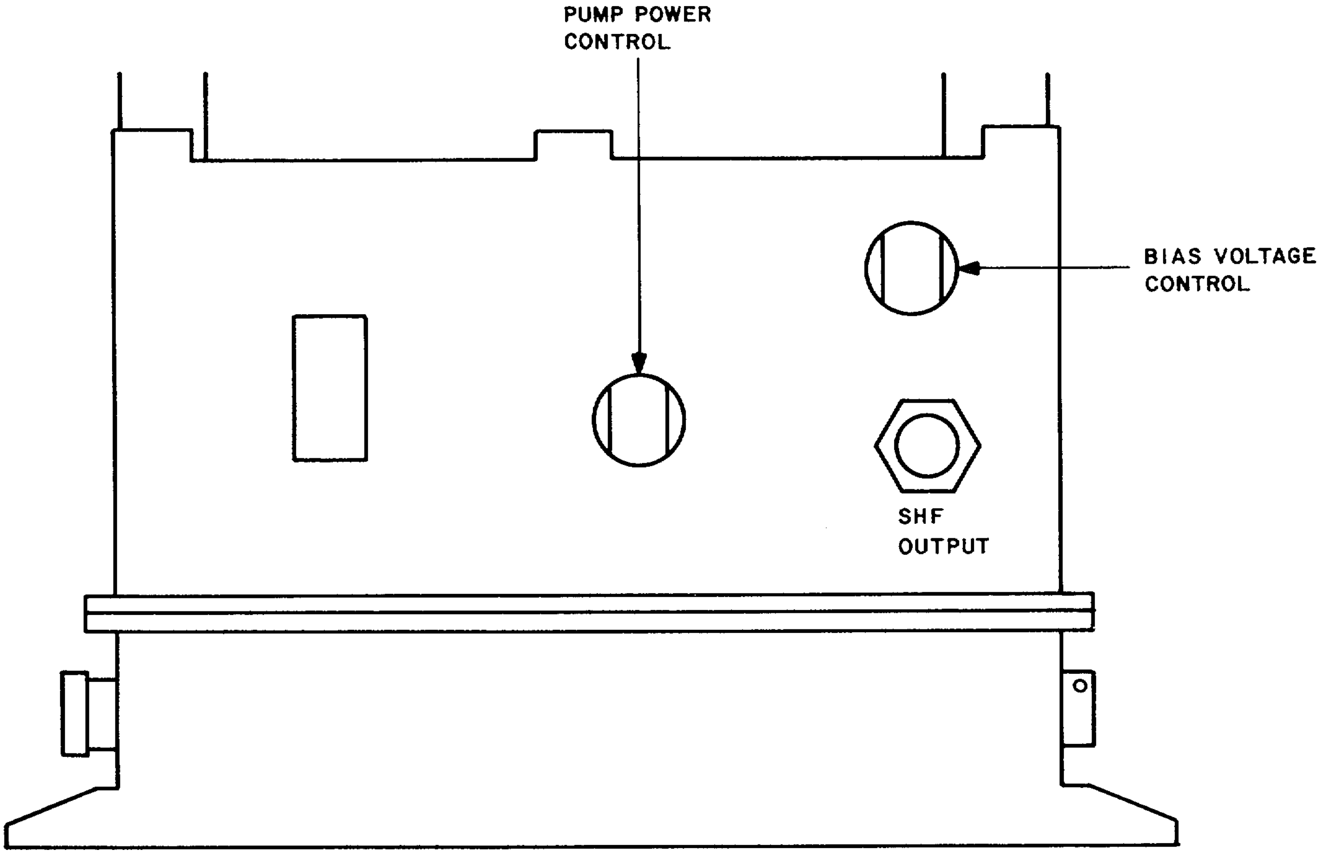
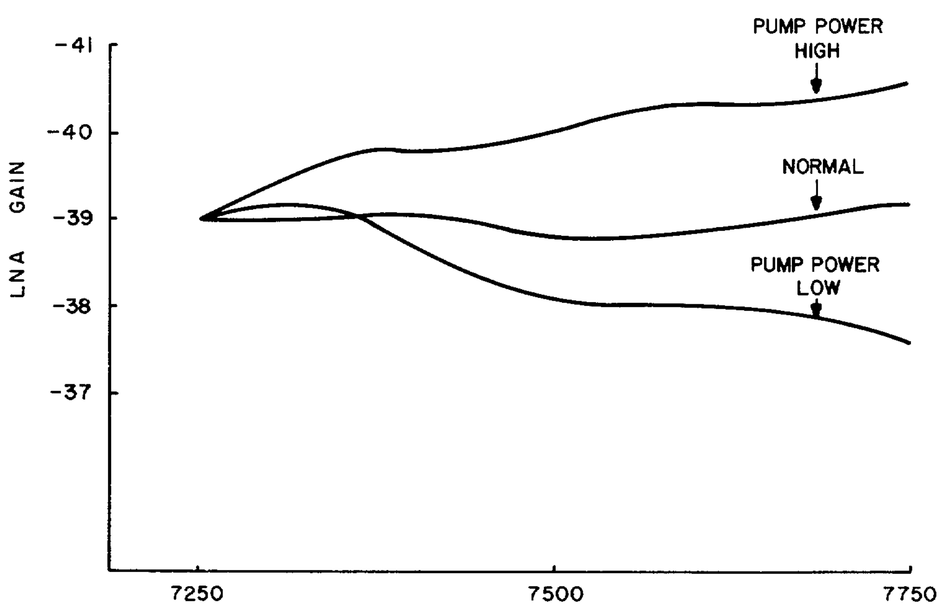


Figure C-2. LNA Adjustment Locations.



C-2. Overall Receiver Gain.

NOTE

The overall receiver gain is calibrated using signal sources within the terminal in conjunction with precision attenuator and a low level SHF hard limiter as shown in figure C-4. A signal at the local receiver frequency is obtained from the SHF local oscillator output of the frequency synthesizer in the upconverter drawer. The output level of this signal is between the limits of + 6 and + 12 dBm and is passed through the SHF hard limiter and attenuator to provide a -52 dBm signal at the 20 dB coupler on the AME subassembly, which gives a nominal 72 dBm signal at the LNA input.

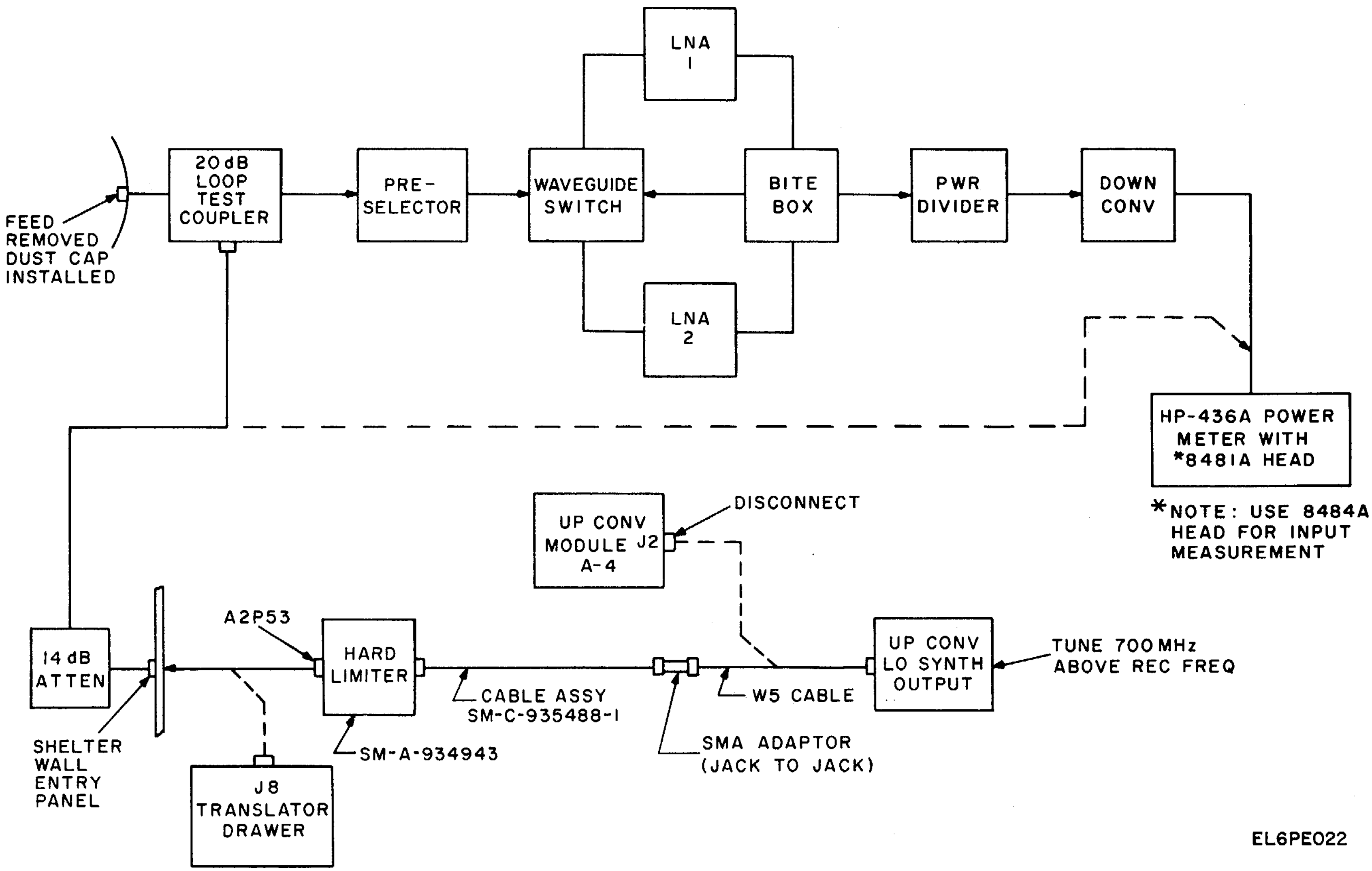


Figure C-4. LNA, Overall Receiver Gain Calibration Diagram.

a. Aim the antenna at a quiet spot in the sky.

b. Remove the screw fasteners on the front panel of the upconverter drawer and pull the drawer forward on its slides.

c. Disconnect cable W5 going from the synthesizer of the upconverter at J2 on module A4 and connect the cable to the hard limiter test assembly (SM-A-934943) through the test cable assembly (SM-C-935488-1), and the SMA adapter provided in the test kit.

d. Remove the screw fasteners on the front panel of the LNA control/translator drawer, and pull the drawer forward on its slides.

e. Disconnect the connector A2P53 going to receptacle J8 (SHF OUT) at the rear of the LNA control/translator drawer and connect it to the output of the hard limiter test assembly.

f. Configure the shelter for normal operation and turn the power ON. The power amplifiers are left on standby.

g. At the antenna mounted assembly, disconnect the terminal loop test cable (W15P2) from the bulkhead connector and connect the cable to the RF power meter with low power head (HP-8484A) using a UG-29B/U adapter.

h. Set the synthesizer to 8399.000 MHz and measure and record the signal level.

i. Repeat step *h* above at 8200.000 MHz.

j. Repeat step *h* above at 7950.000 MHz.

k. Disconnect the loop test cable from the power meter and connect it through the 14 db attenuator to the bulkhead connector.

l. Calculate and record the input levels for each frequency by subtracting 14 dB from the measured levels of steps *h, i*, and *j* above.

m. Connect the power meter with the HP-8481A head to the 70 MHz OUTPUT (J4) of the downconverter to be measured.

n. Read and record the measured level. The level should be at least 60 dB above the level calculated in step *l* above.

o. The output level may be adjusted if necessary at the 700/70 MHz mixer assembly, A3A2, in the downconverter drawer, with the receiver gain adjustment control R5 or MDL gain control R6.

p. The overall receiver gain may be measured for receive frequencies of 7250 MHz and 7699 MHz by tuning the upconverter synthesizer to 7950 MHz and 8399 MHz, respectively. Output levels should be at least 60 dB above input at bulkhead connector.

q. Repeat the above steps for all other downconverters, as required.

r. Remove all test cables, and restore all normal connections on the drawers to return the shelter to normal operation.

APPENDIX D
STRAPPING REQUIREMENTS FOR COMMUNICATIONS SUBSYSTEM

Following are the strapping requirements for the CSS.

1. ANIFCC-98: A13 and A29

a. Power Supply: E2 to E3.

b. Data Timing Group: See TM 11-5805-711-13.

c. VF Modules:

(1) 0 dBm VF input level: B strap in.

(2) 0 dBm VF output level: C strap in.

(3) Tanden E-lead Signaling: D2 strap in.

d. 50 kb/s Data Modules:

(1) Balanced (78 ohms): S1 (all sections) closed; S2 (all sections) open.

e. Multirate Data Modules: See TM 11-5805-711-13.

2. A26 Line Conditioning Units

a. SFSU-1600 U/B:

E2-E3
E5-E6
E8-E9
E14-E16
E 15-E34
E17-E18
E23-E24
E25-E26
E30-E31
E32-E33
SA--8
GA--8

b. SFSU-2600 U/B:

E1-E3
E4-E6
E8-E9
E14-E16
E 15-E34
E17-E18
E23-E24
E25-E26
E30-E31
E32-E33
SA--8
GA--8

c. 4TS-2B:

A-G
F-H
M-P
S-T
E2-R
E8-E9
E11-E12
E14-E15
E17-E18
E22-E23
E24-E26

3. A27 Line Conditioning Units

a. RDC-4A:

2-3
4-5
7-8
9-10
11-13
12-14
15-17
16-18
19-21
23-24
25-26
28-30
29-31

b. LA-3: A-B-C and F-G.

c. AT-2P: Top and Bottom. 5-1-2-4-8-16.

4. Filter Bridge, FB-1

a. TX: A-B; E-F; G-H; 1-2; 10-17; 20-27; 30-31; 40-41; Att-0; Cal-5.

b. RX: A-B; E-F; G-H; 1-2; 10-12; 20-22; 30-37; 40-47; Att--12; Cal-5.

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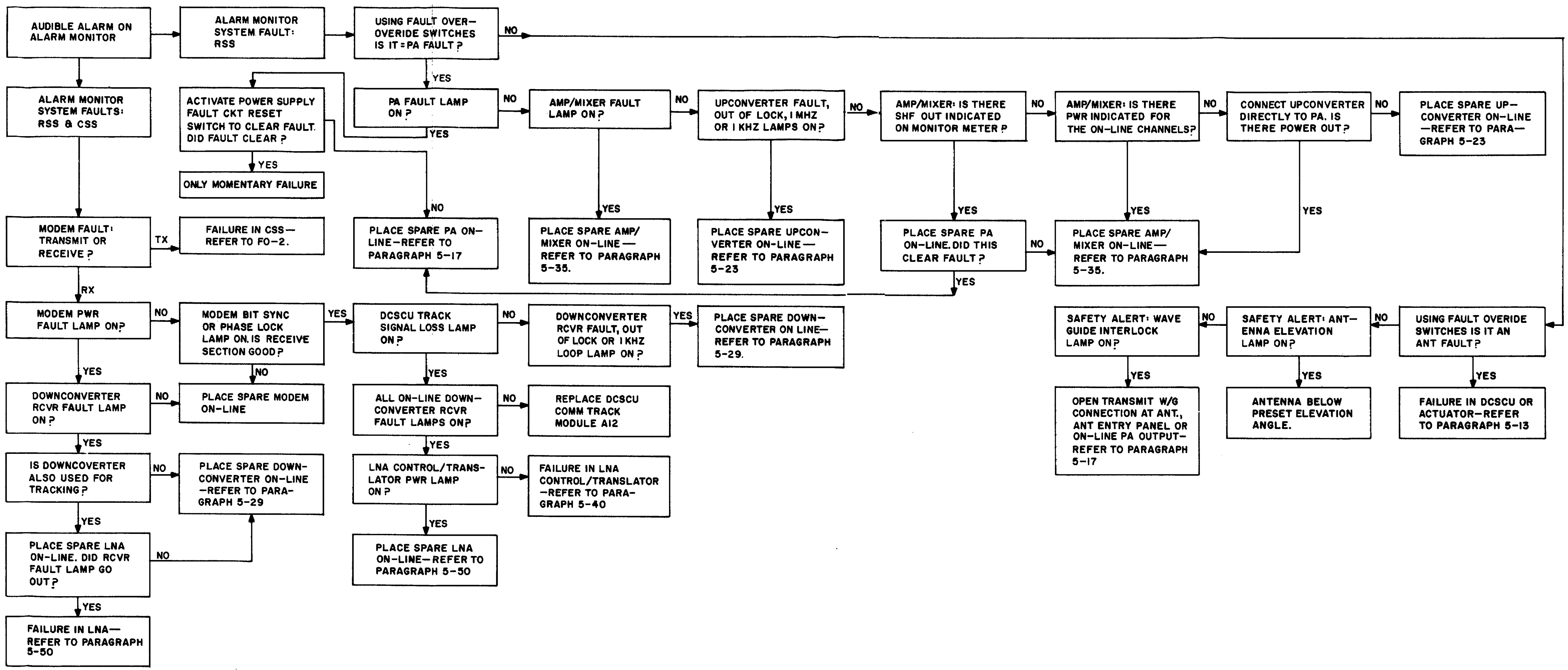


Figure FO-1. RSS System Fault, Troubleshooting Chart.

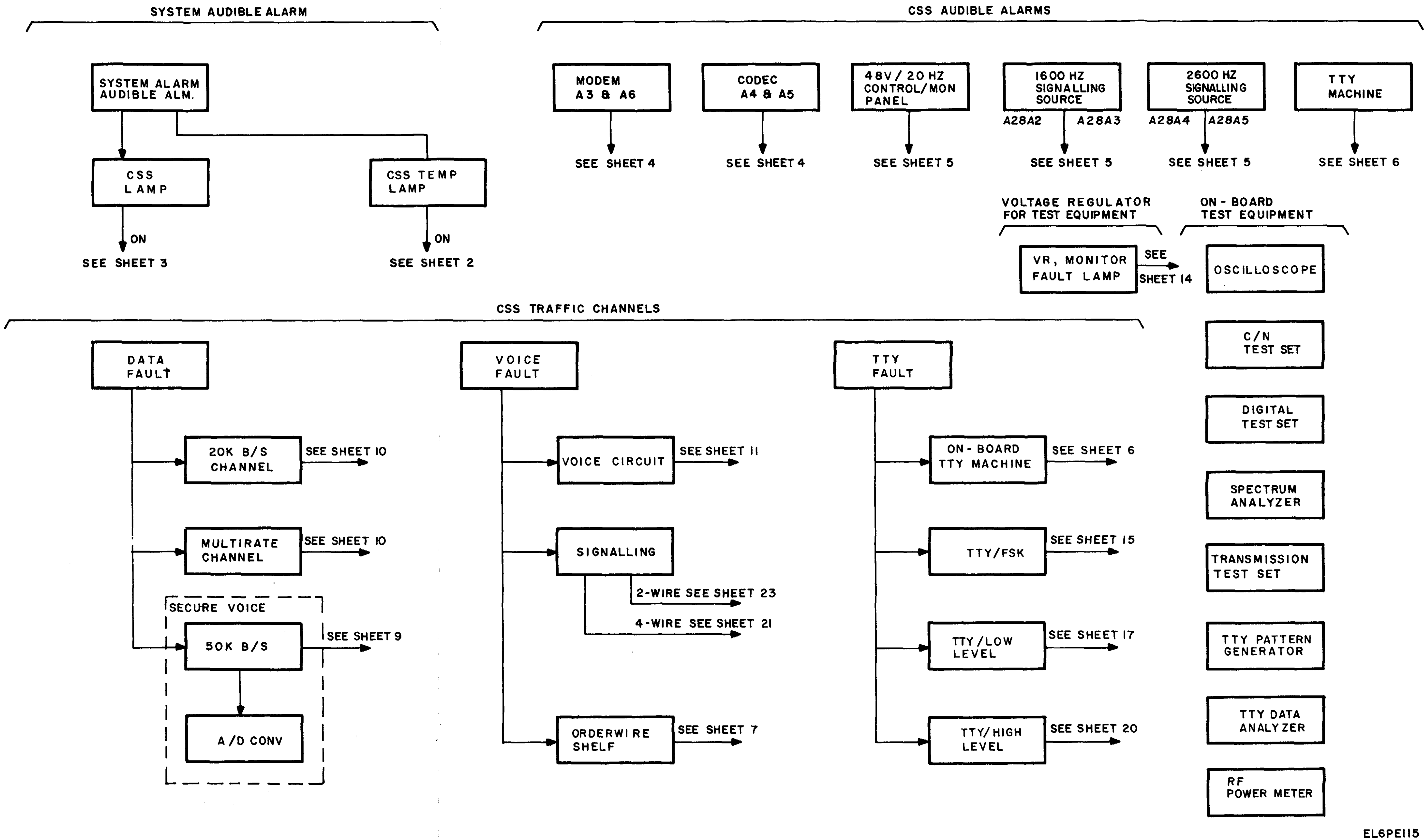


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 1 of 23).

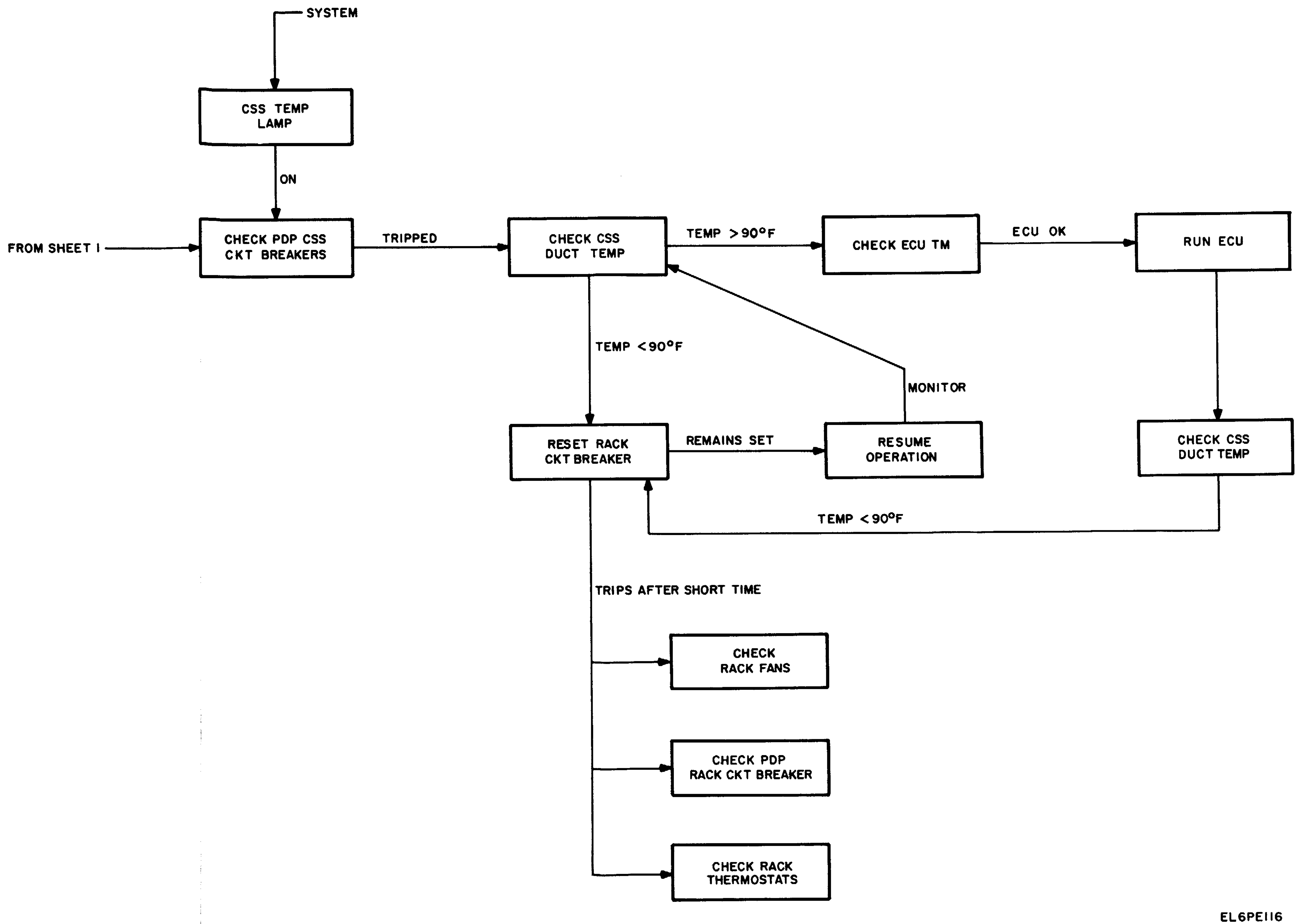


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 2 of 23).

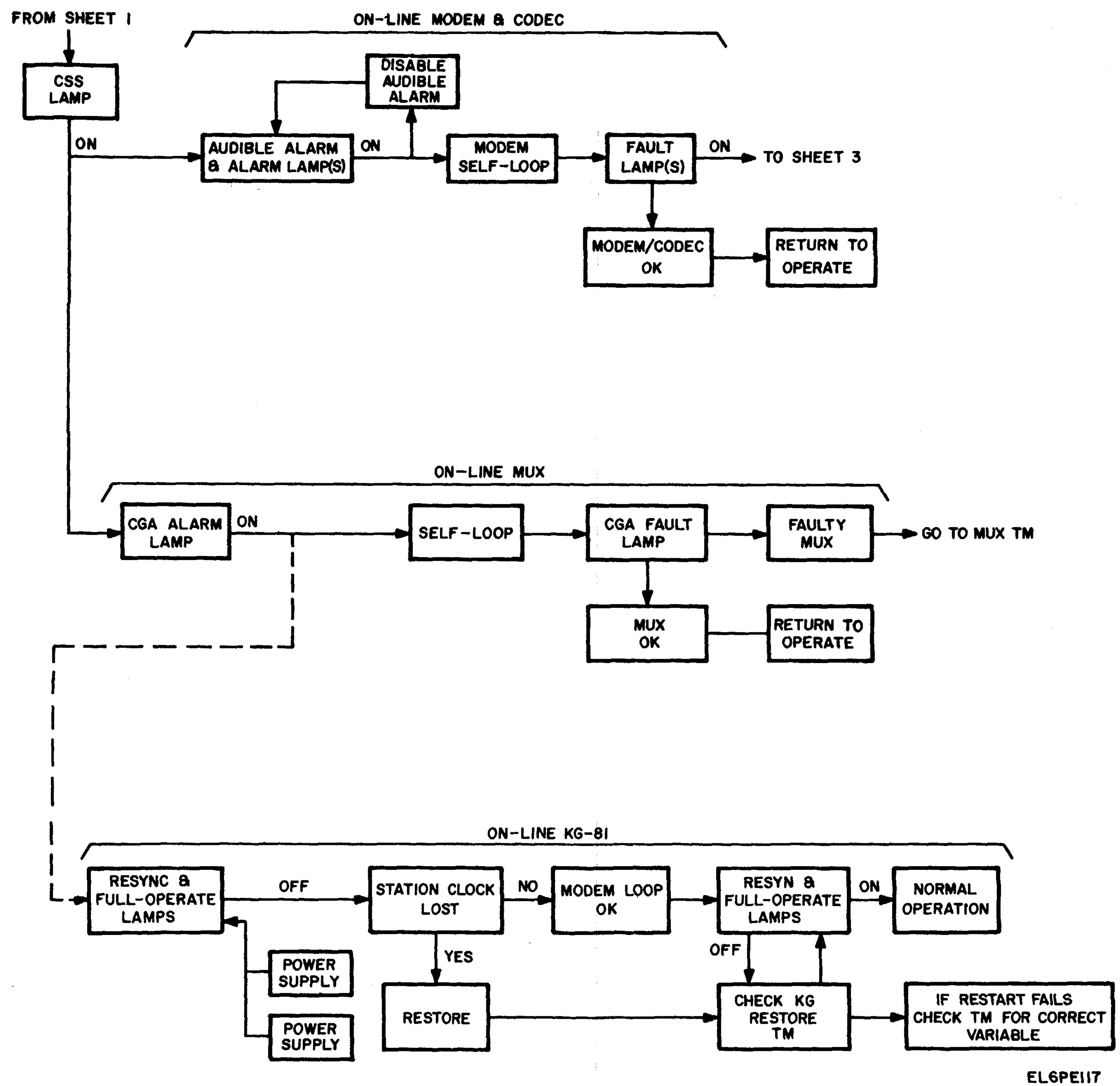


Figure FO-2. CSS System Fault, Troubleshooting Chart
(Sheet 3 of 23).

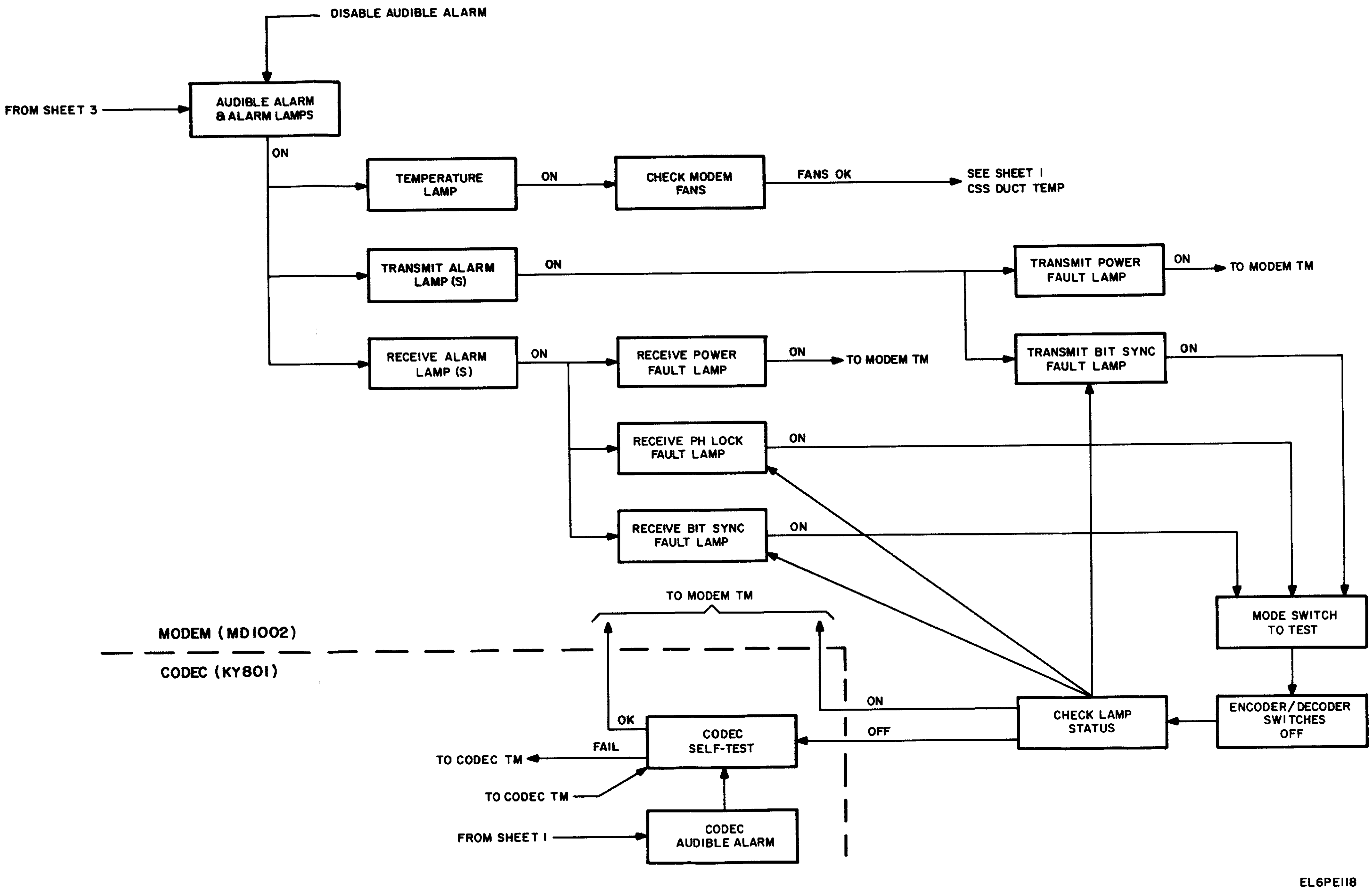


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 4 of 23).

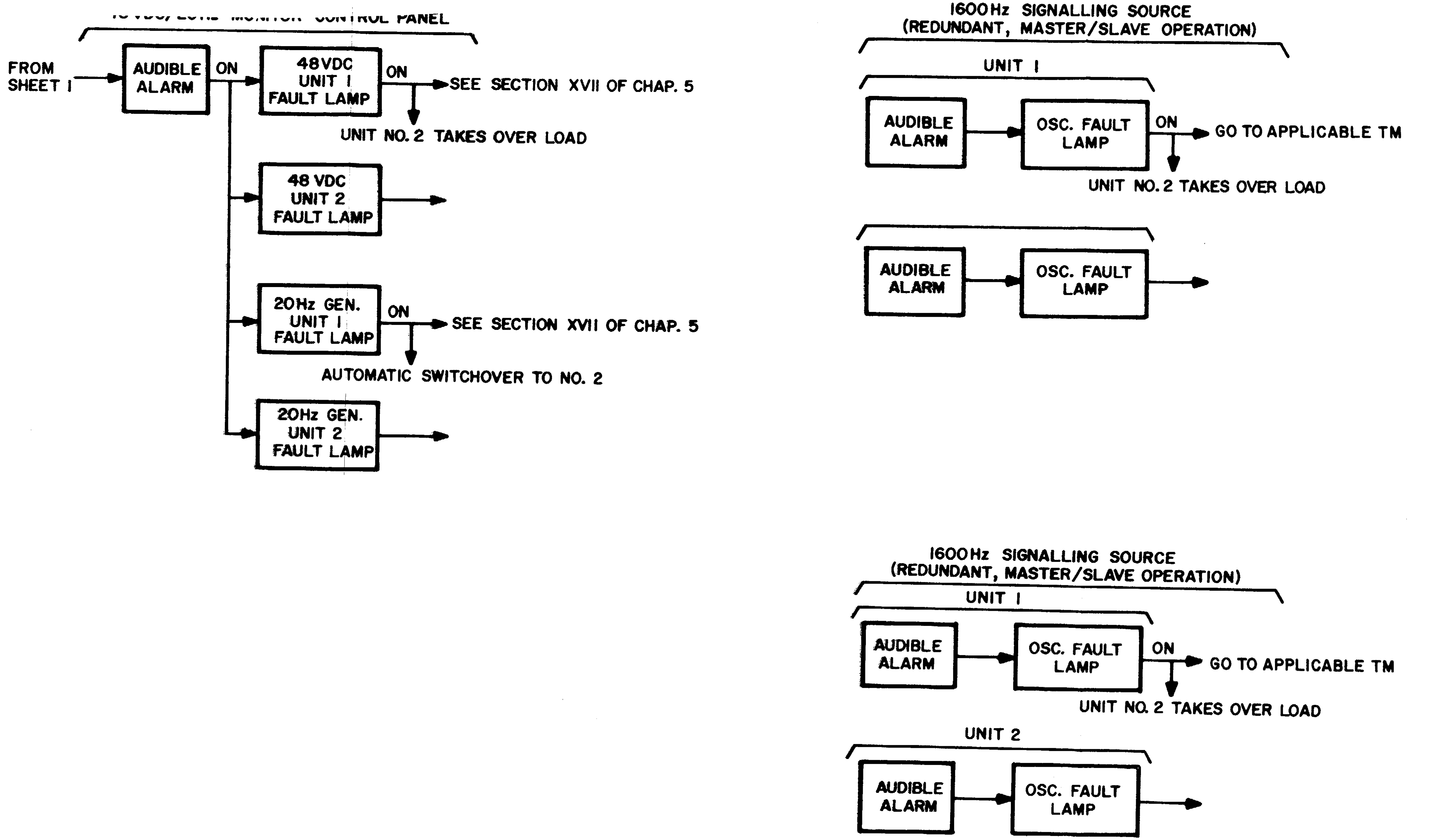


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 5 of 23).

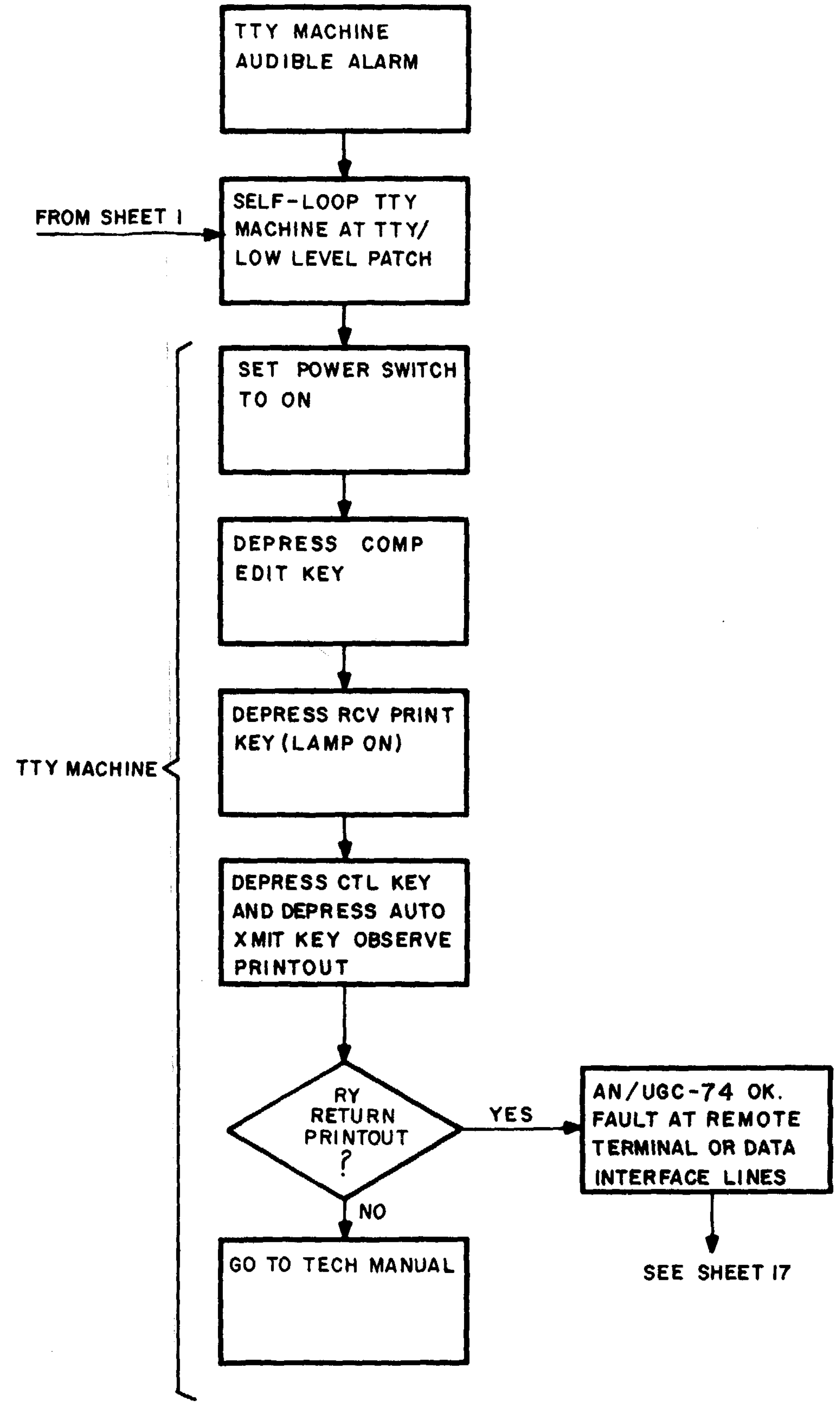


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 6 of 23).

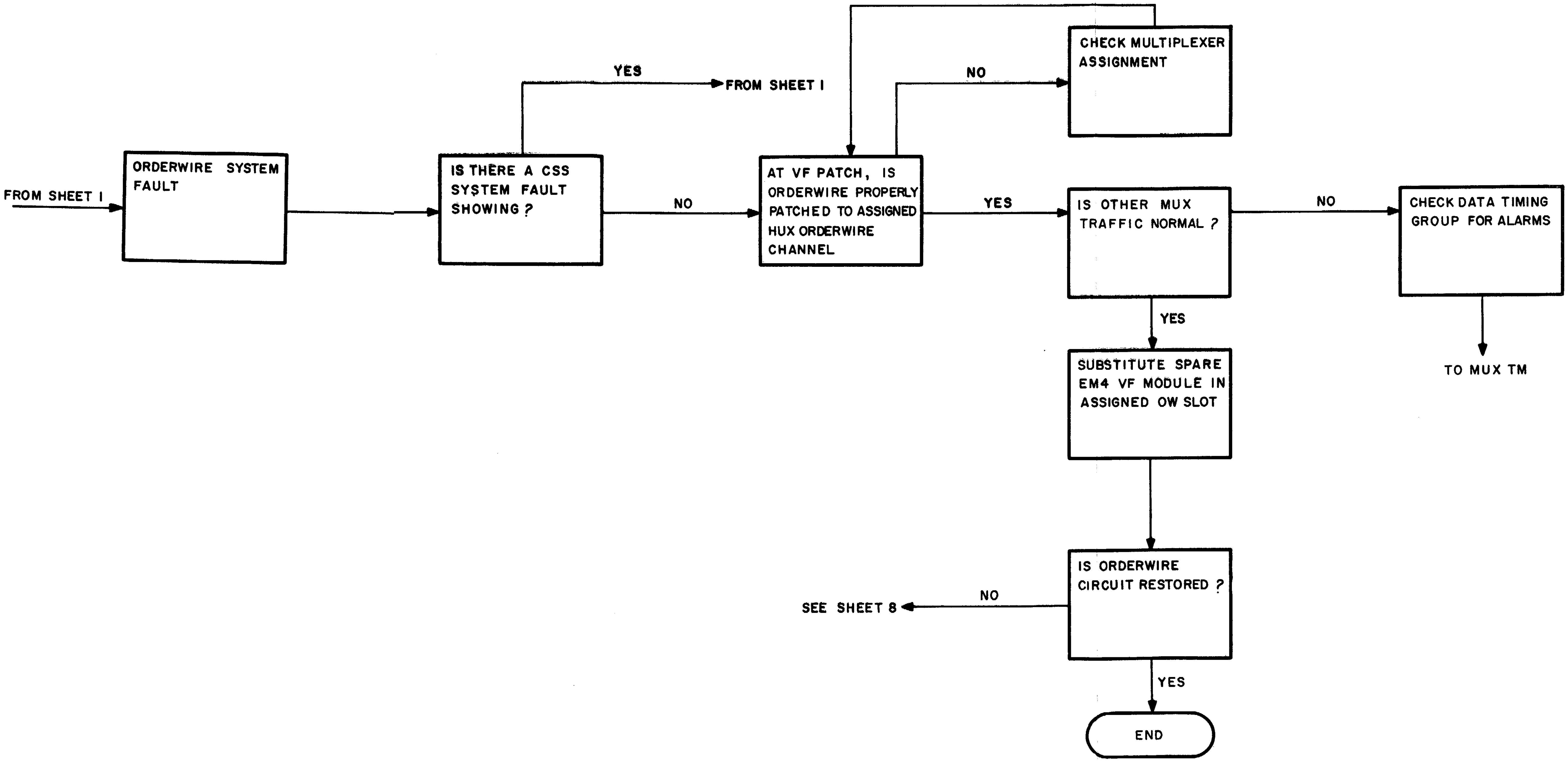


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 7 of 23).

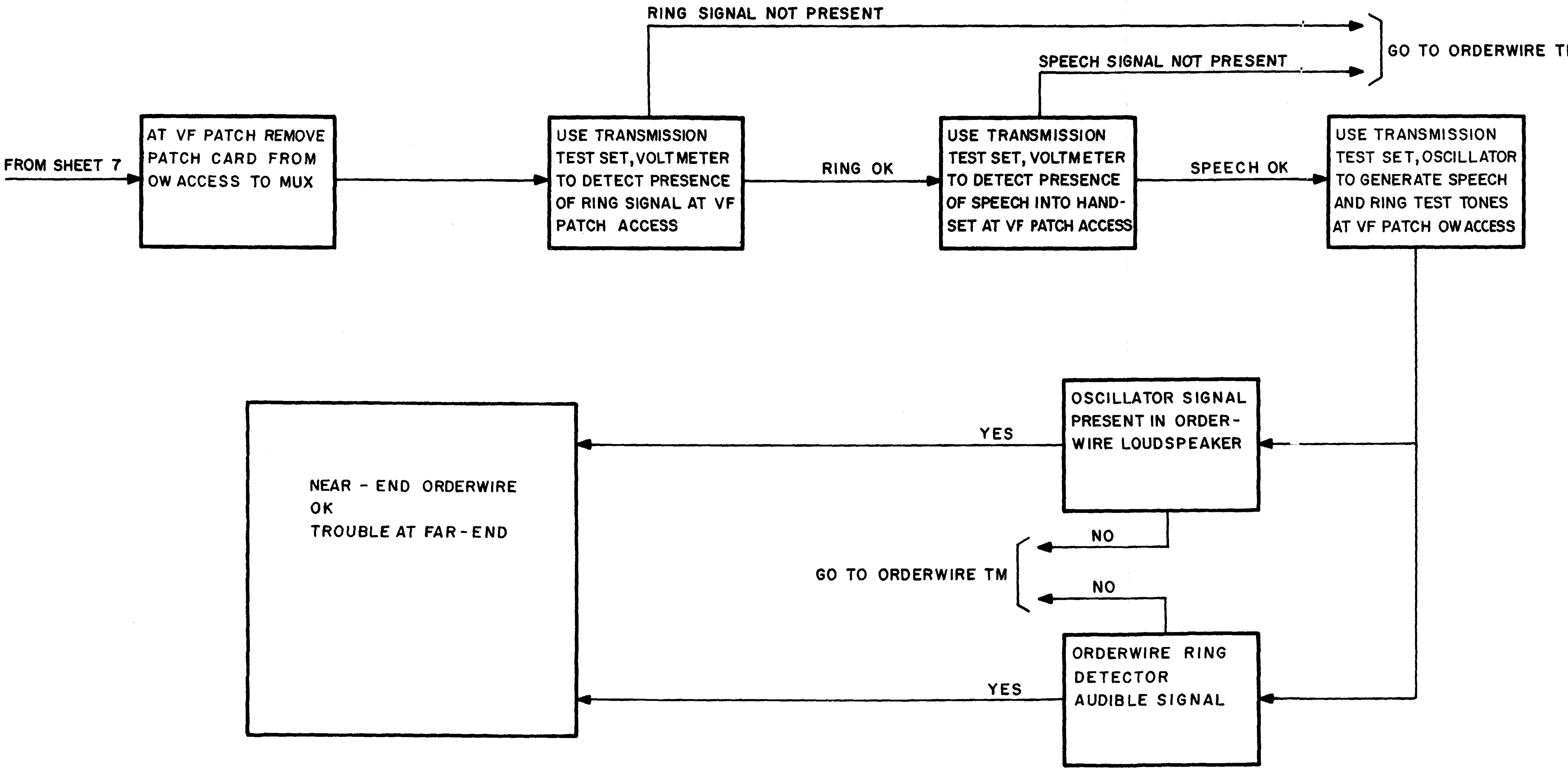


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 8 of 23).

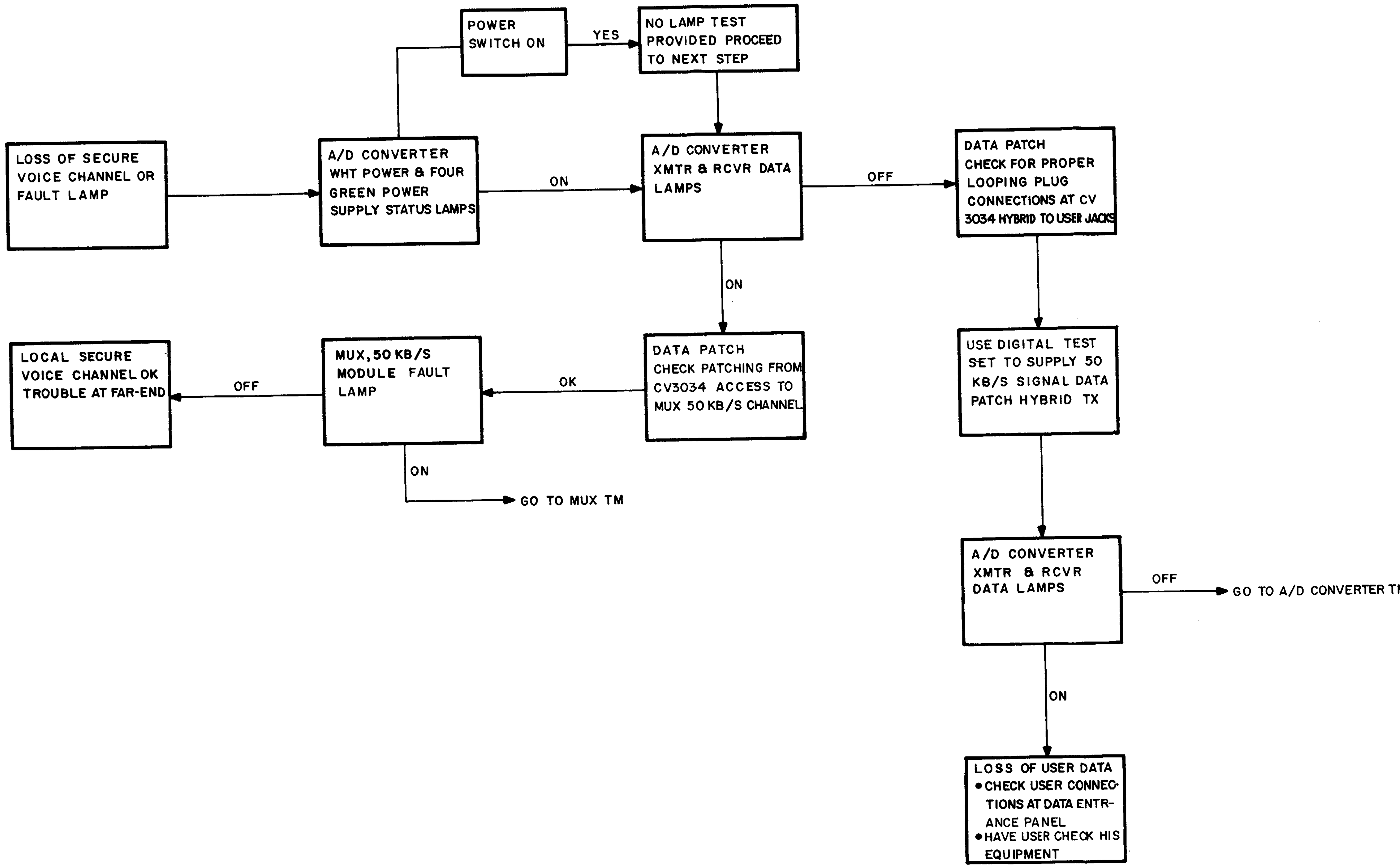


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 9 of 23).

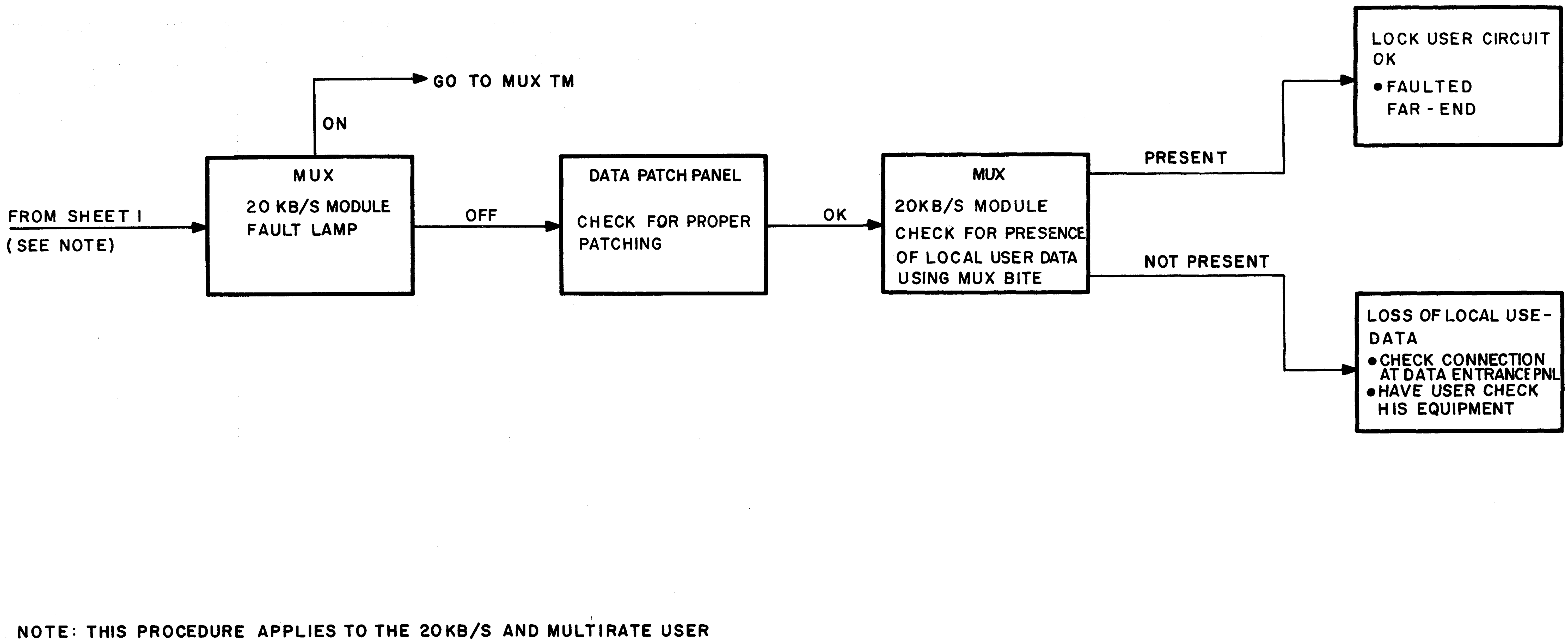


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 10 of 23).

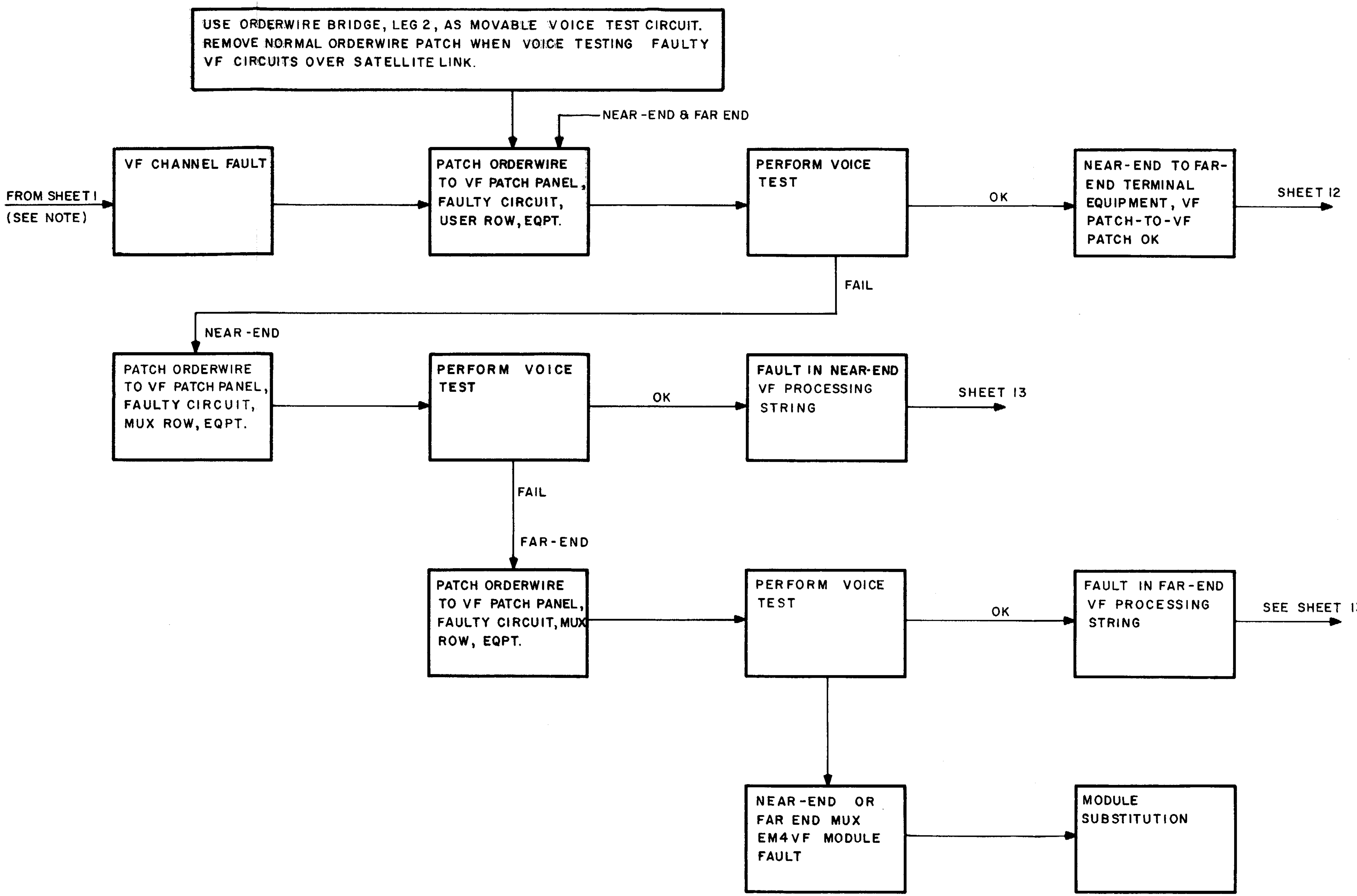


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 11 of 23).

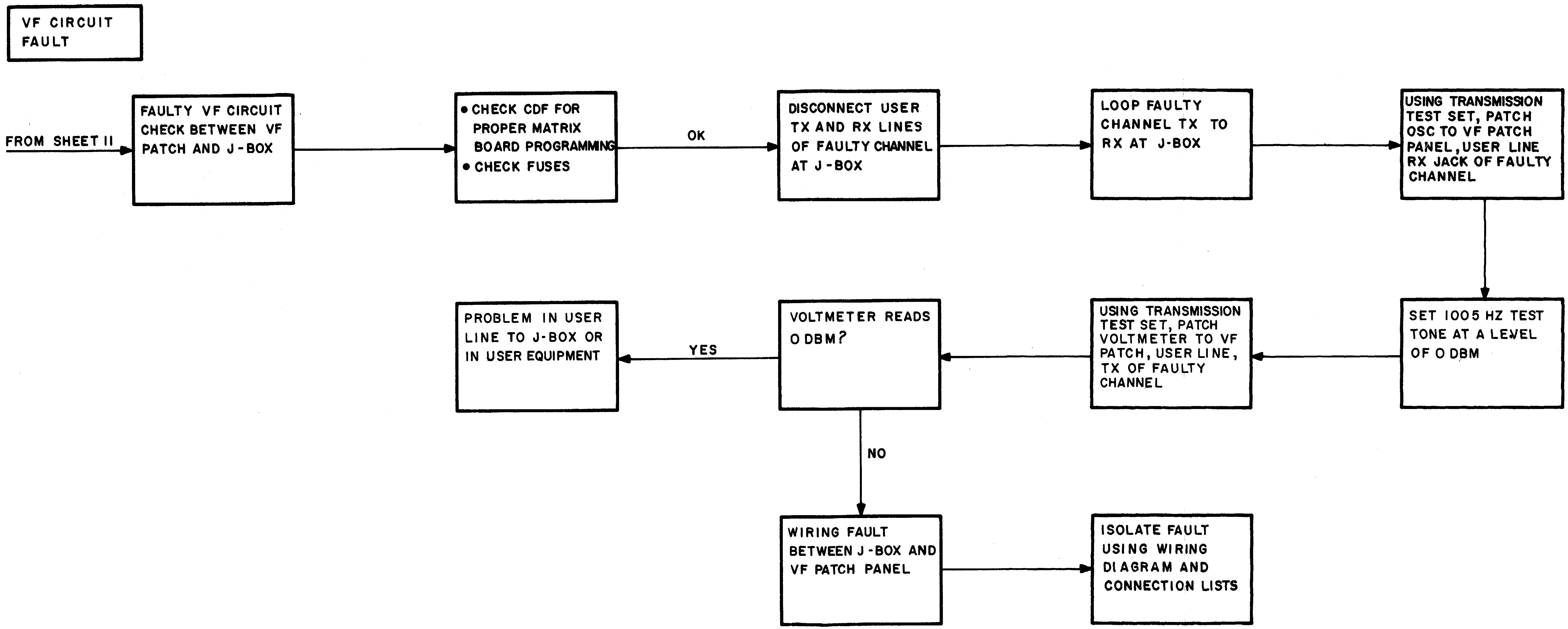


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 12 of 23).

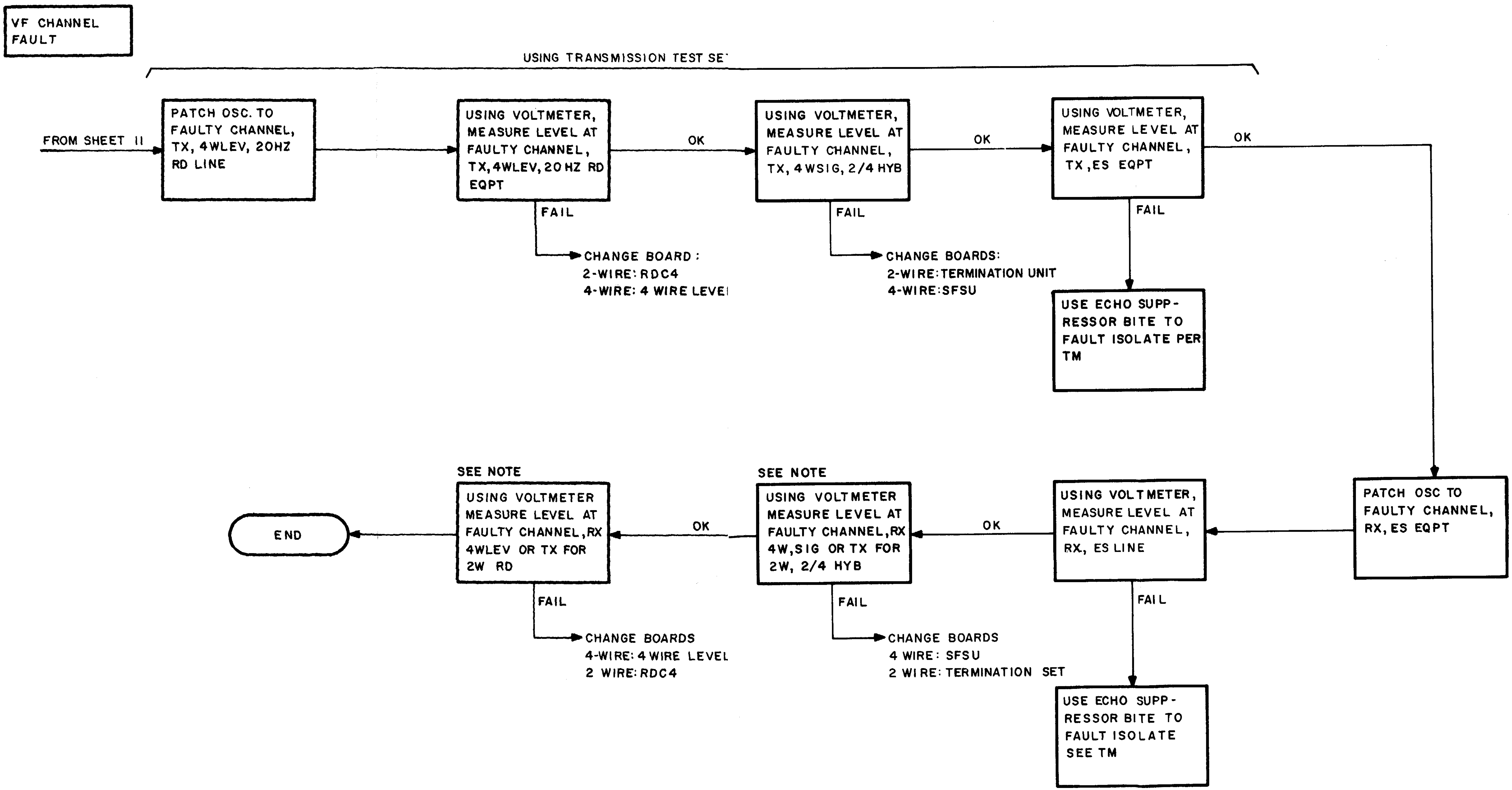


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 13 of 23).

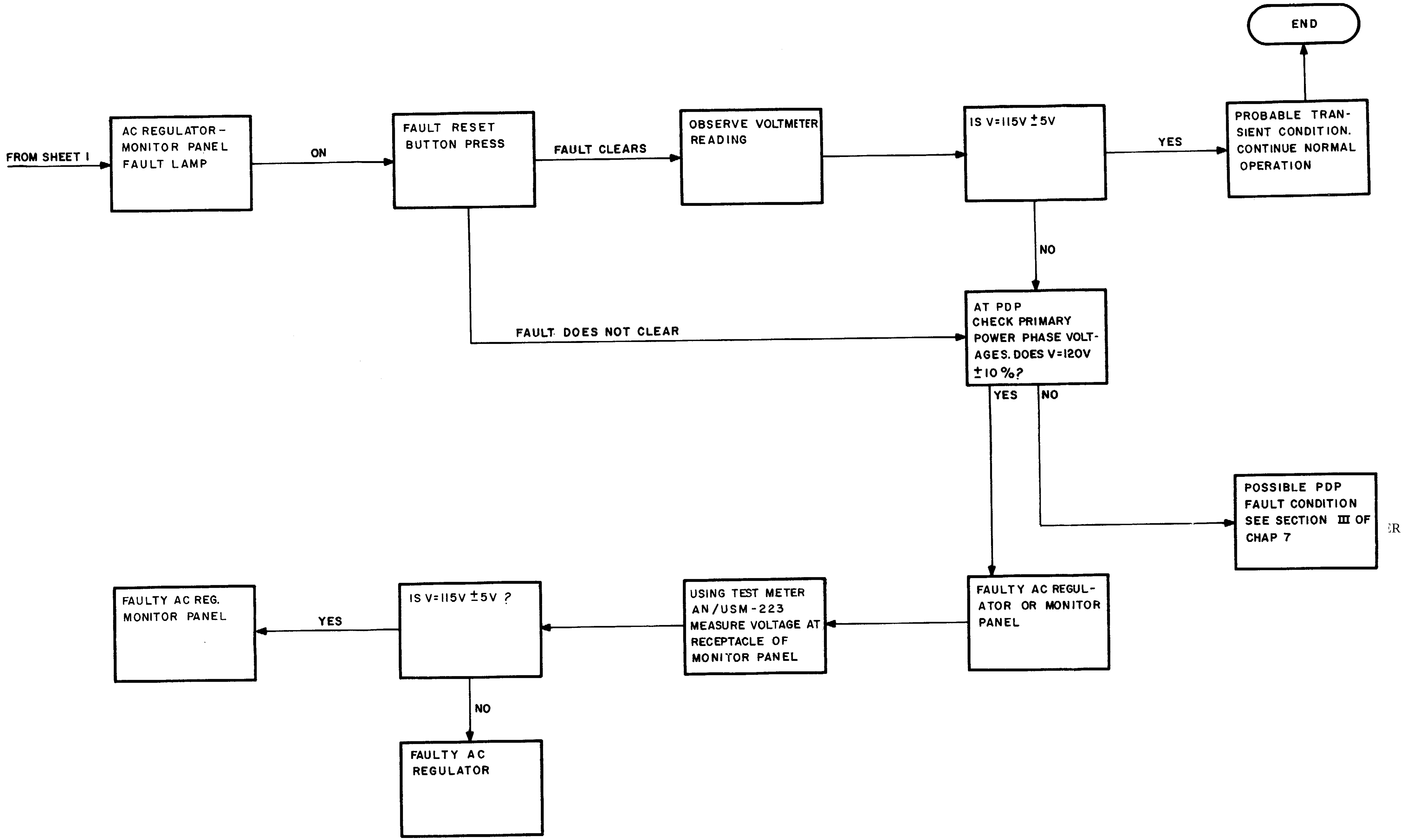


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 14 of 23).

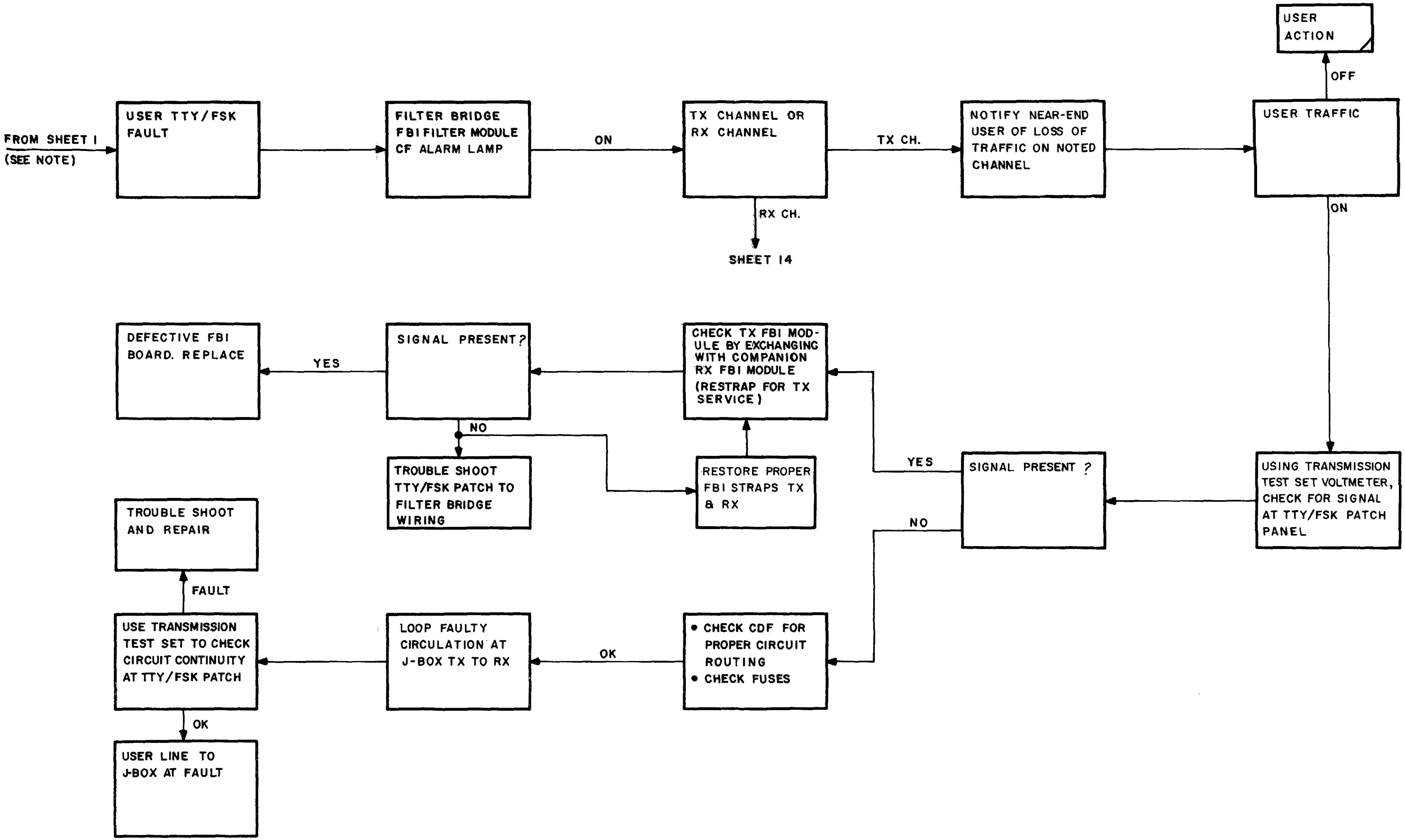


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 15 of 23).

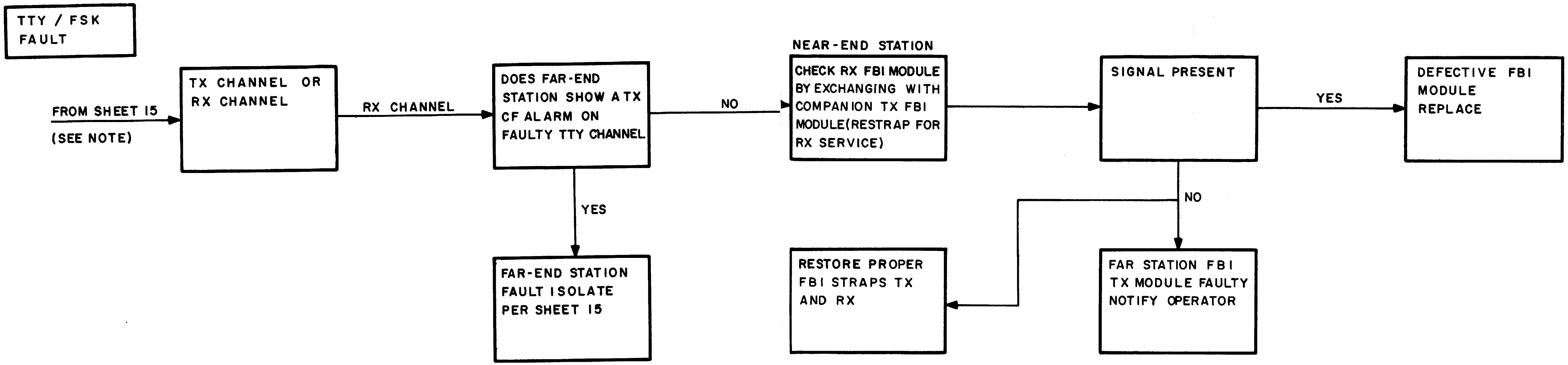
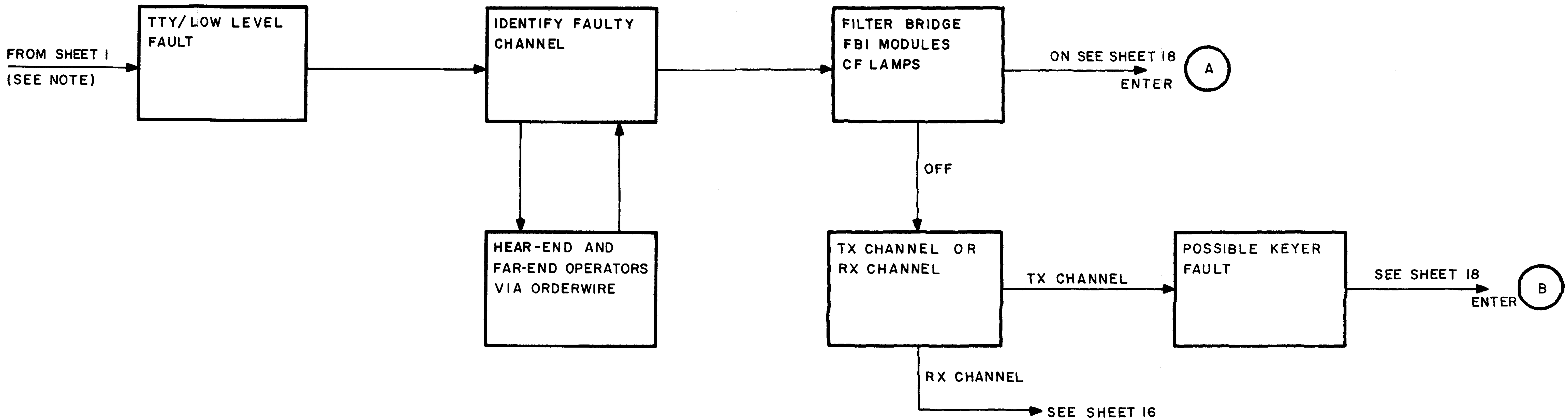


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 16 of 23).



NOTE: INITIAL TROUBLE SHOOTING OF A TTY/LOW LEVEL FAULT WILL INVOLVE COOPERATIVE MEASURES BETWEEN THE NEAR-END AND FAR-END OPERATORS USING THE TERMINAL ORDERWIRE.

EL6PE131

Figure FO-2. CSS System Fault. Troubleshooting Chart (Sheet 17 of 23).

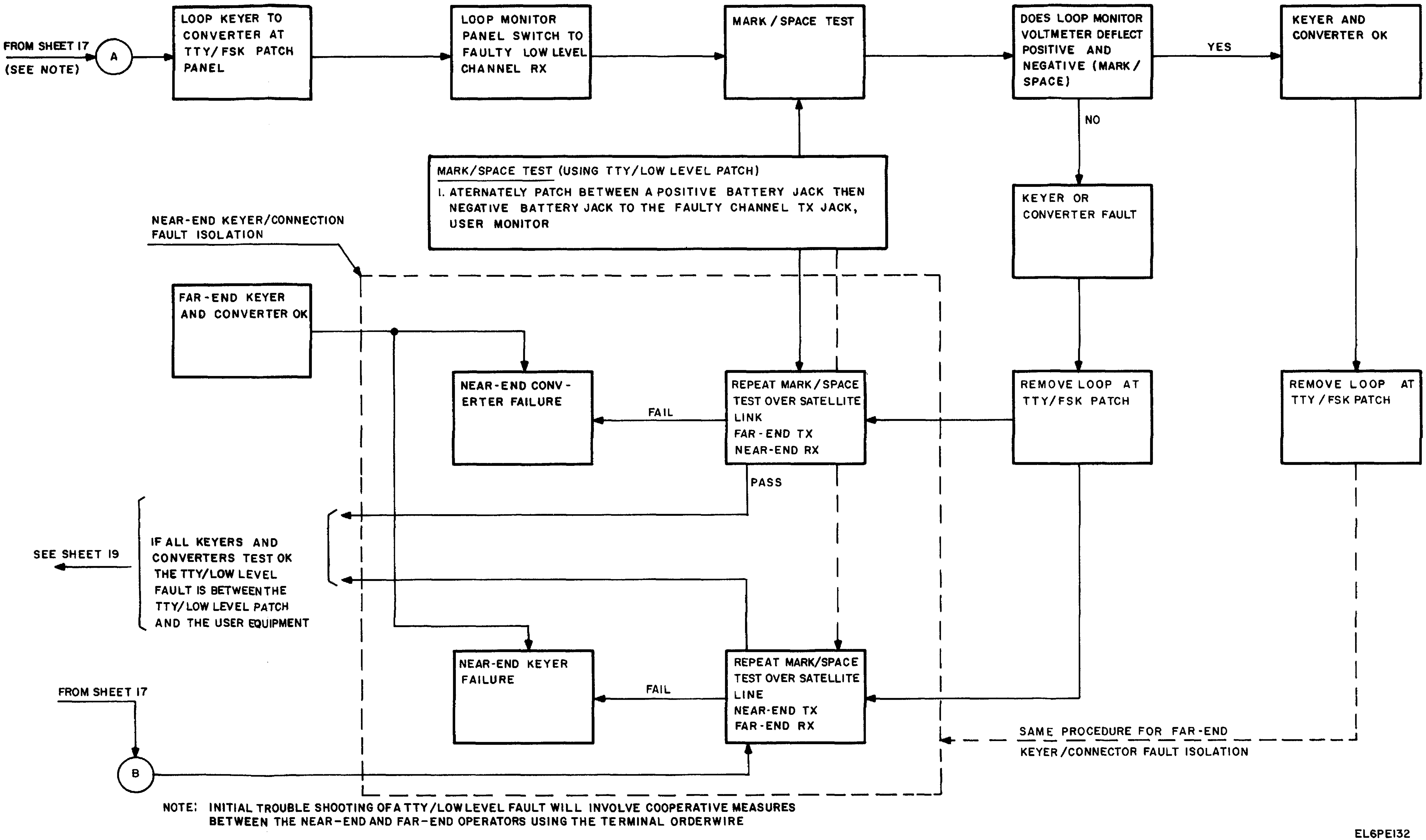


Figure FO-2. CSS System Fault. Troubleshooting Chart (Sheet 18 of 23).

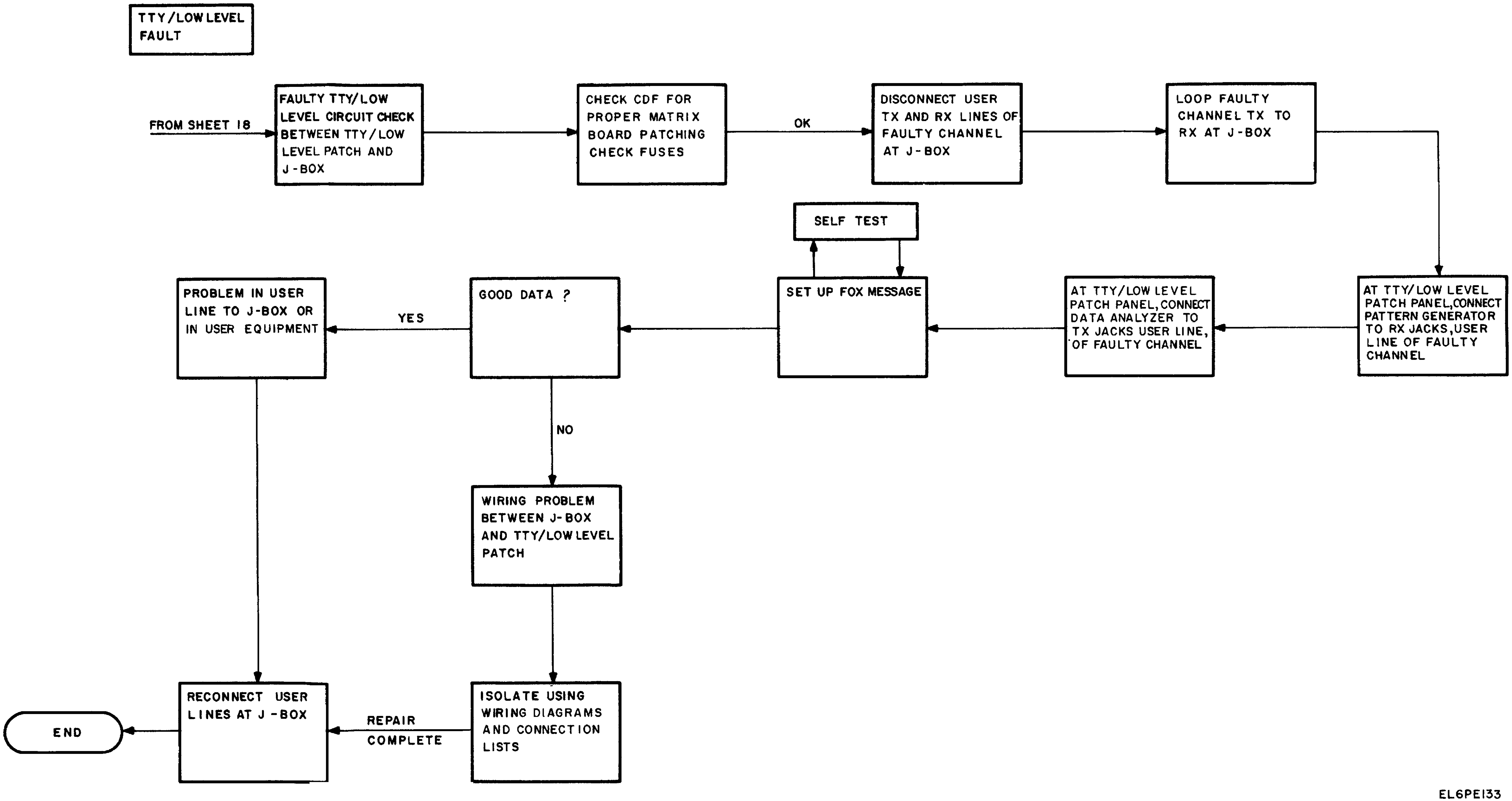


Figure FO-2. CSS System Fault. Troubleshooting Chart (Sheet 19 of 23).

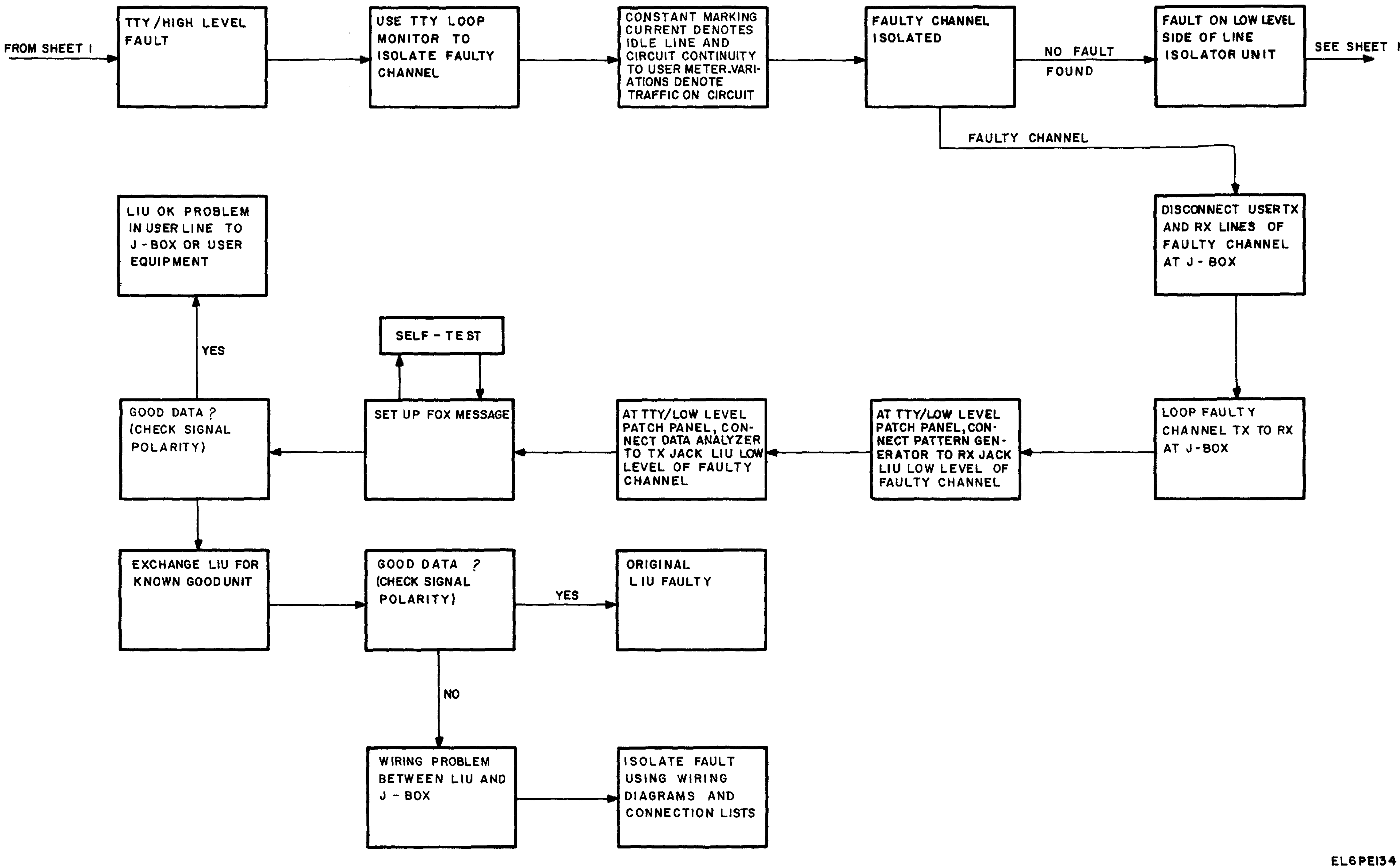


Figure FO-2. CSS System Fault. Troubleshooting Chart (Sheet 20 of 23).

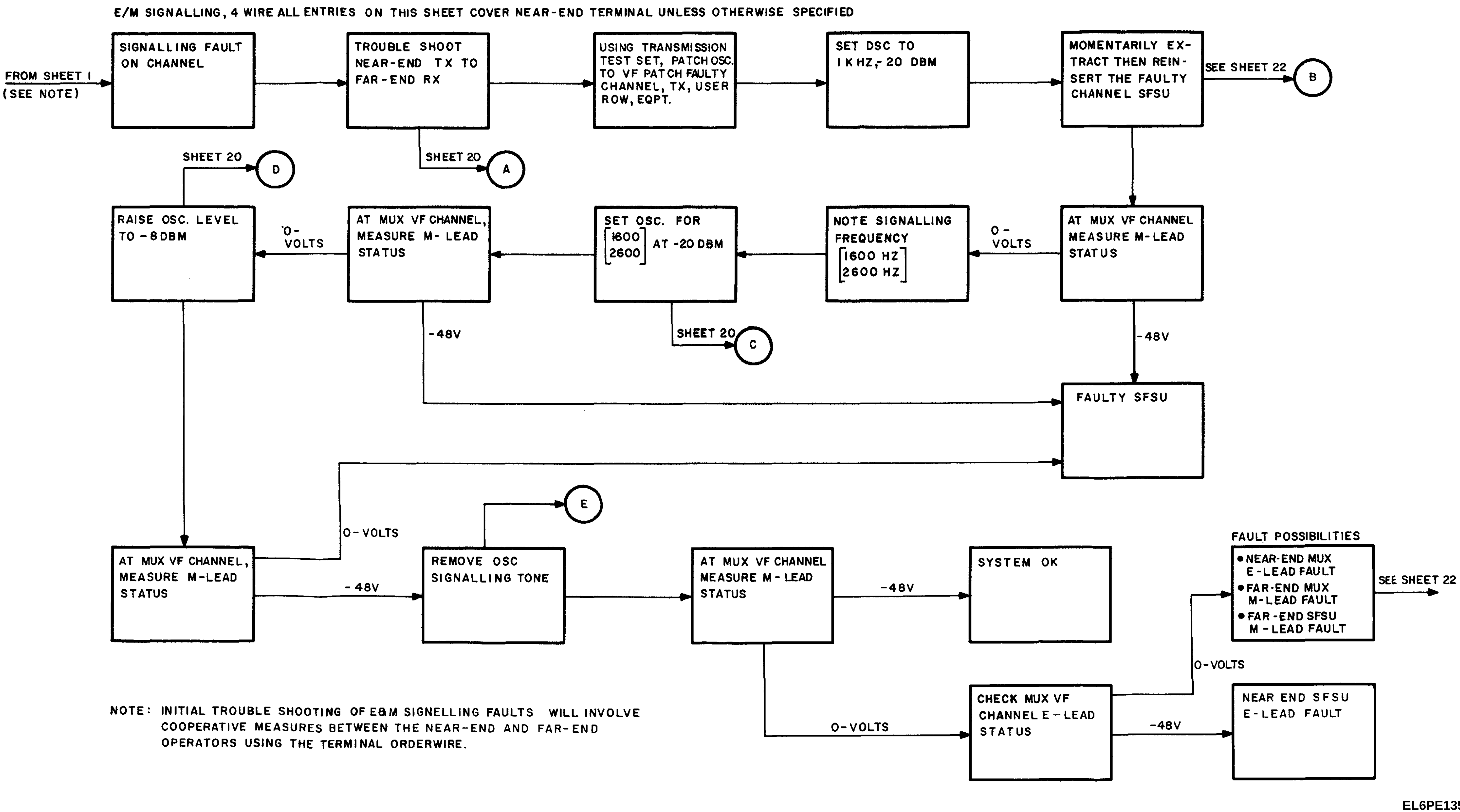
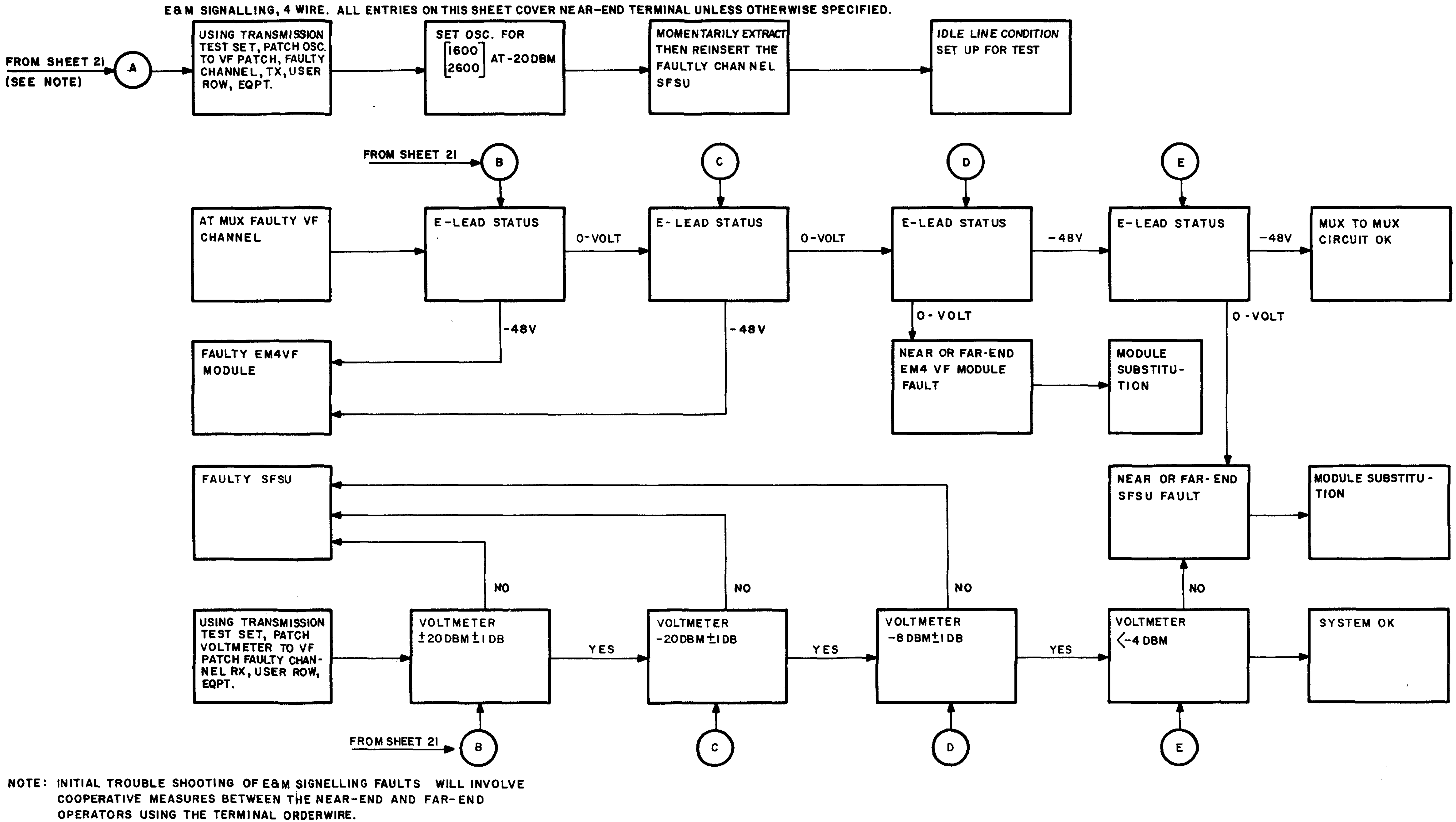


Figure FO-2. CSS System Fault. Troubleshooting Chart (Sheet 21 of 23).



EL6PE136

Figure FO-2. CSS System Fault. Troubleshooting Chart (22 of 23).

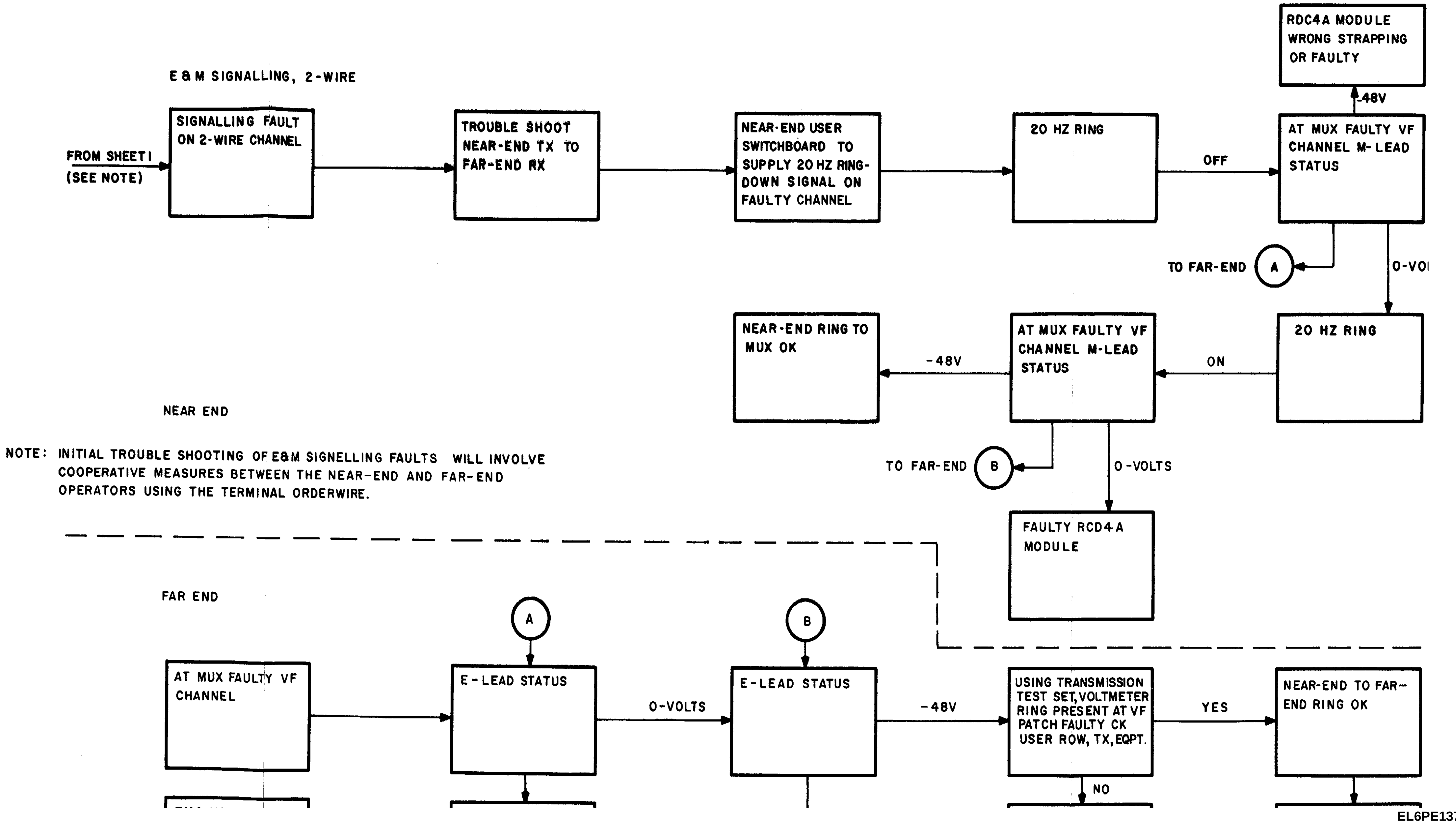
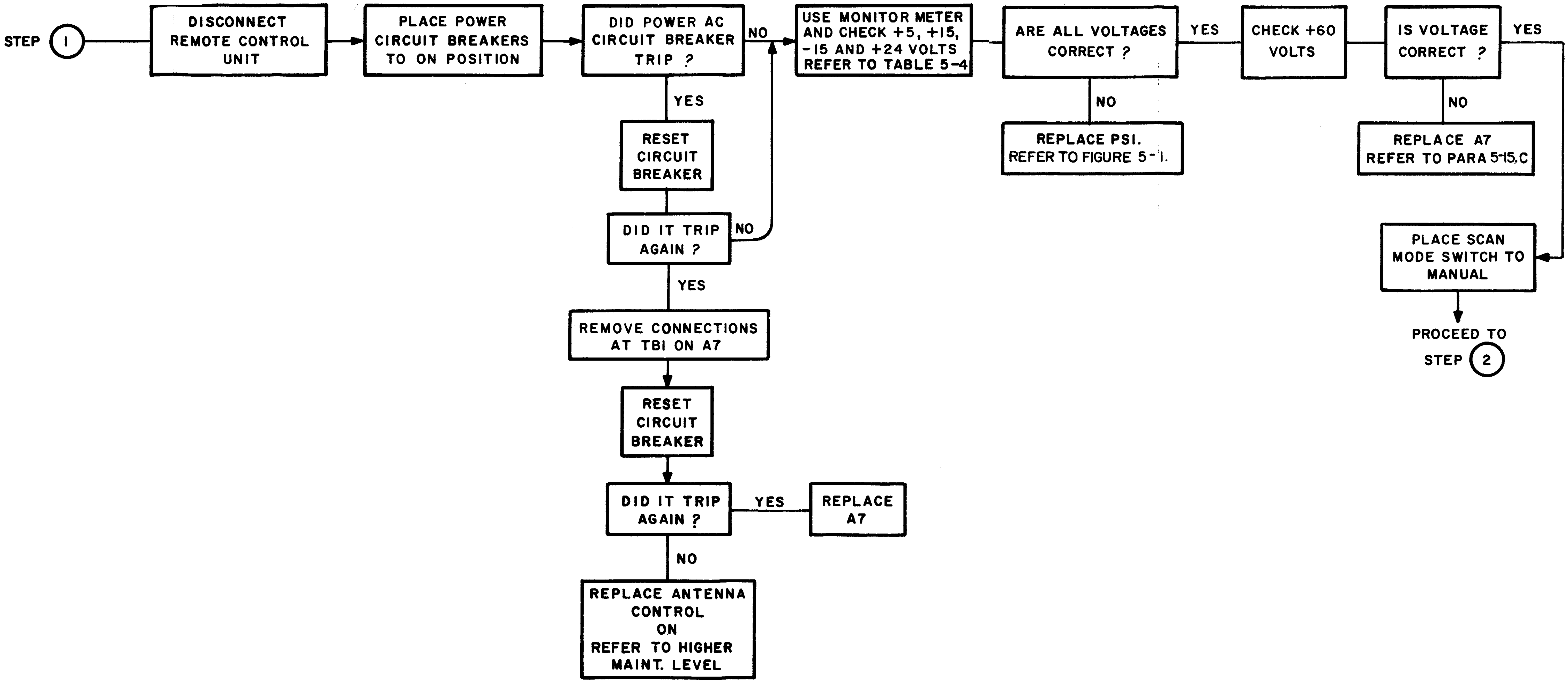
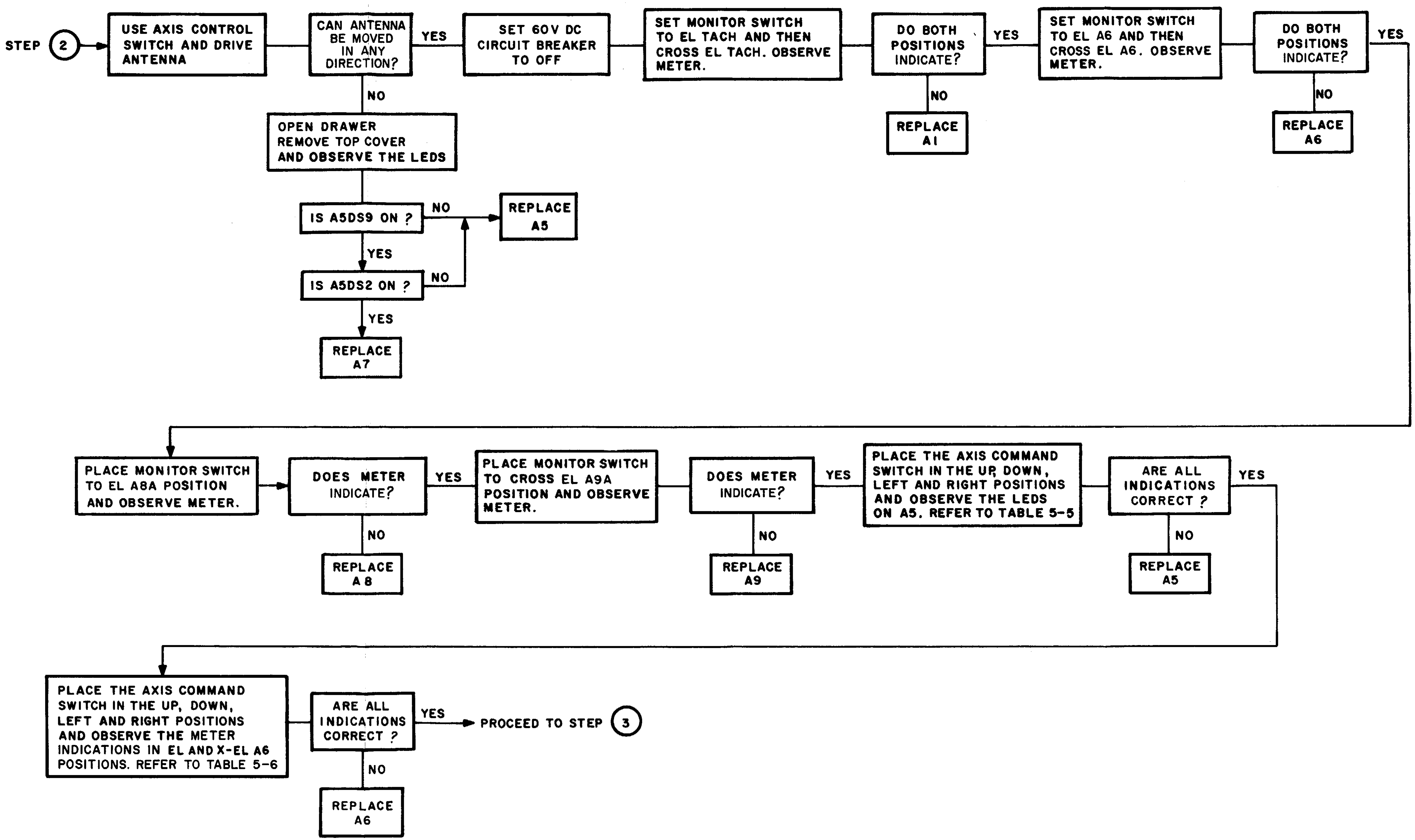


Figure FO-2. CSS System Fault, Troubleshooting Chart (Sheet 23 of 23).



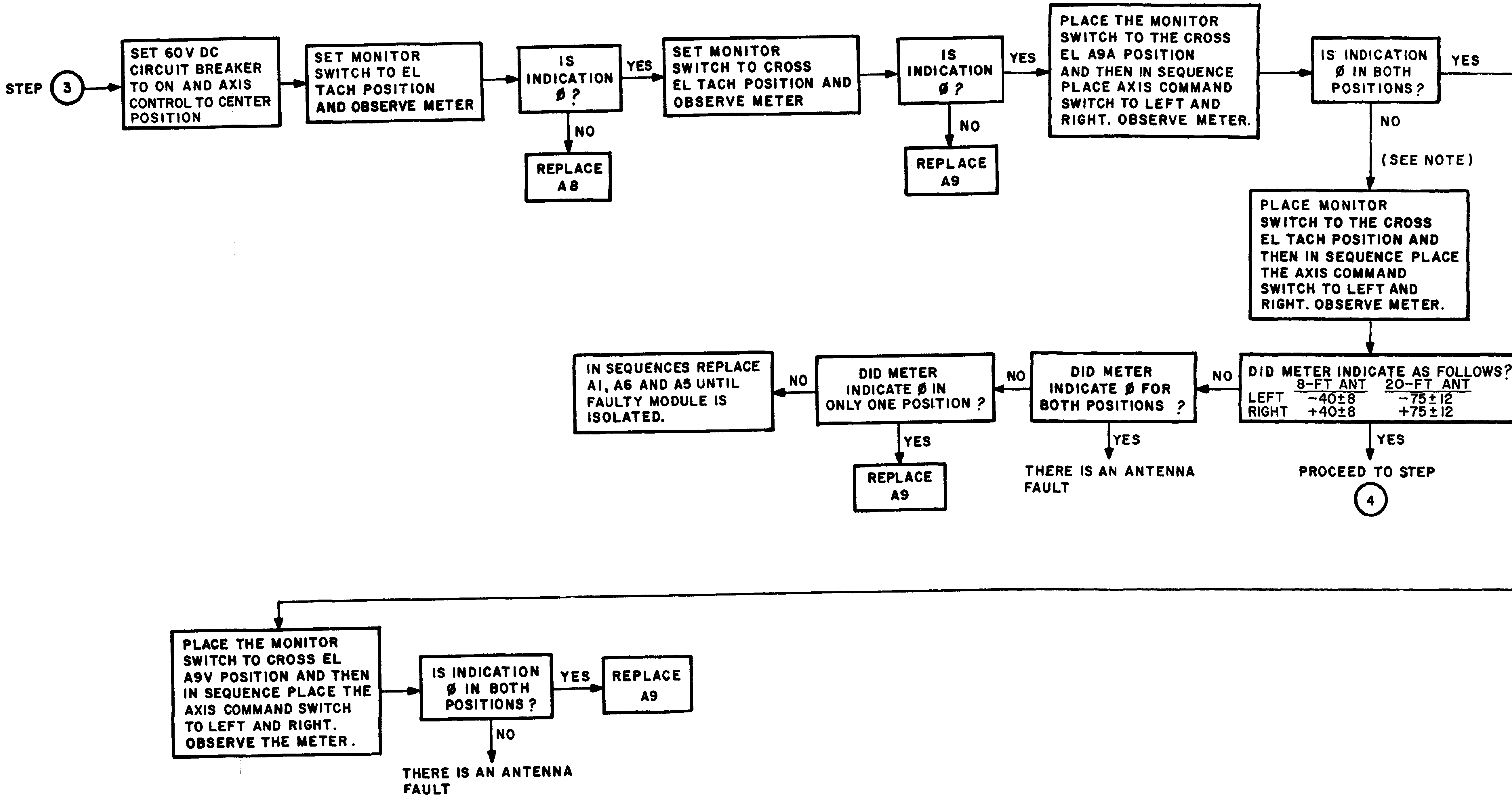
EL6PE138

Figure FO-3. Antenna Control Fault, Troubleshooting Chart (Sheet 1 of 7)



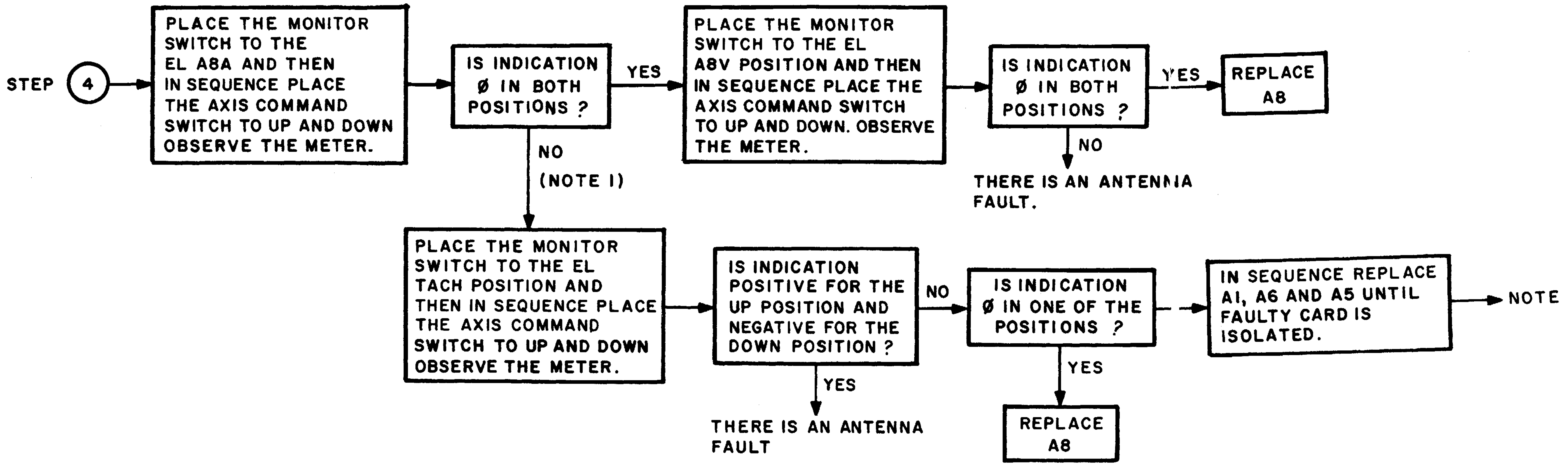
EL6PE139

Figure FO-3. Antenna Control Fault, Troubleshooting Chart (Sheet 2 of 7)



EL6PE140

Figure FO-3. Antenna Control Fault, Troubleshooting Chart (Sheet 3 of 7)



EL6PE141

Figure FO-3. Antenna Control Fault, Troubleshooting Chart (Sheet 4 of 7)

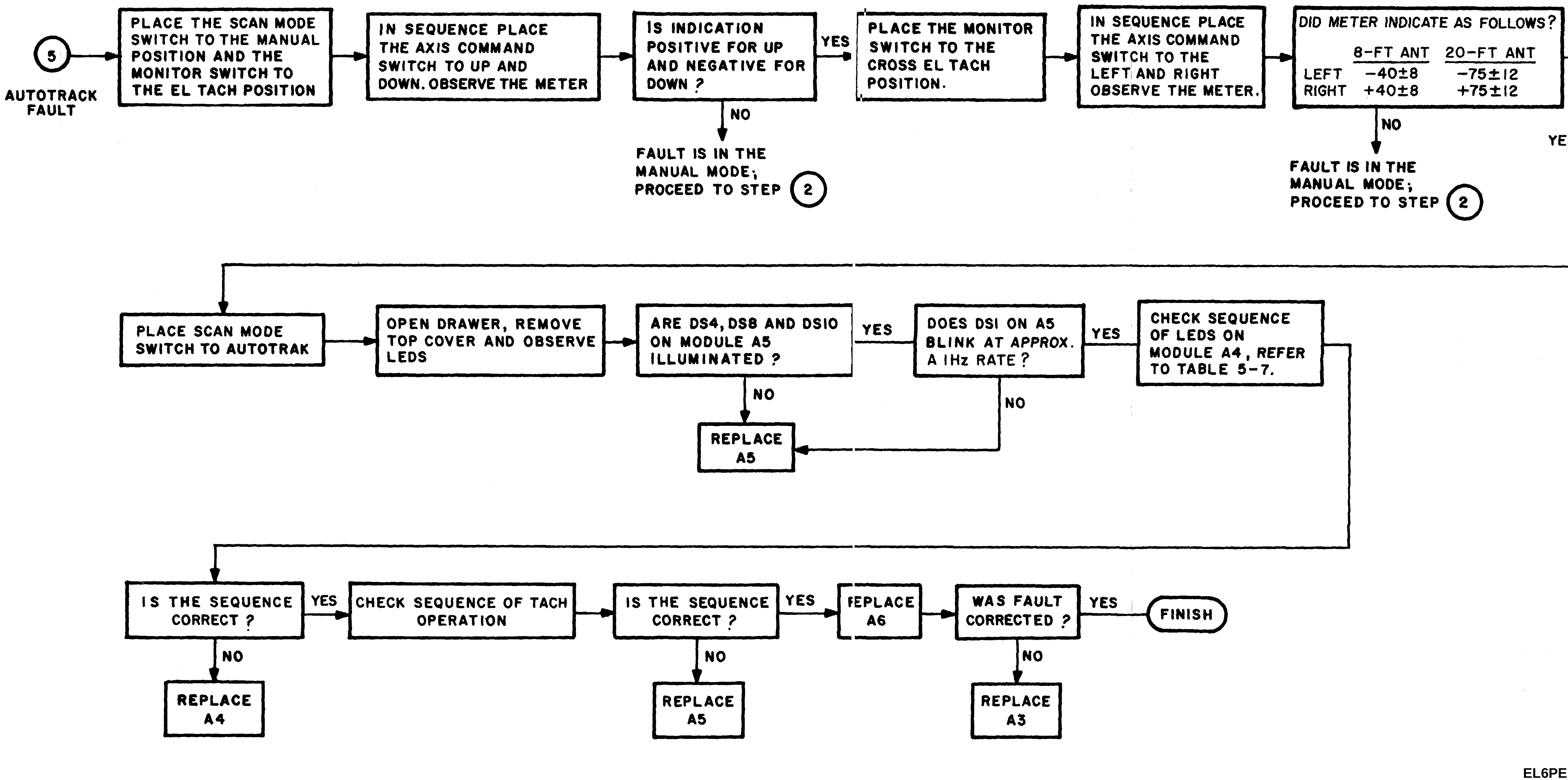
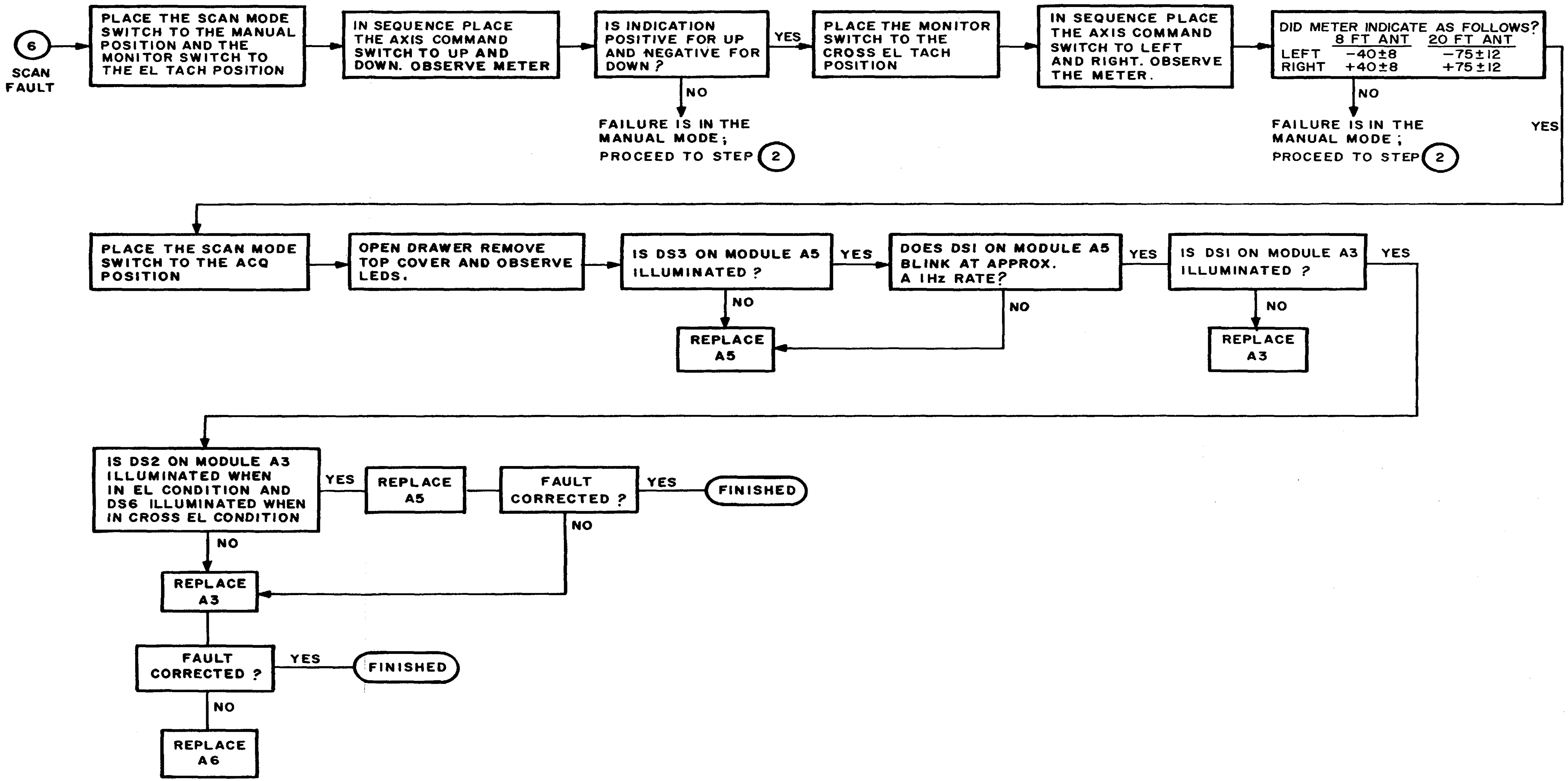


Figure FO-3. Antenna Control Fault, Troubleshooting Chart (Sheet 5 of 7)



EL6PE143

Figure FO-3. Antenna Control Fault, Troubleshooting Chart (Sheet 6 of 7)

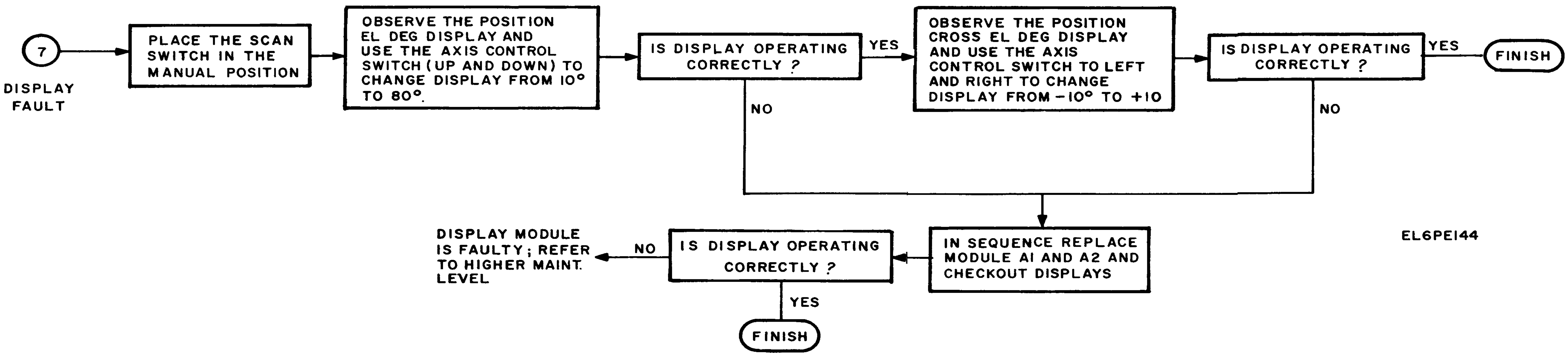
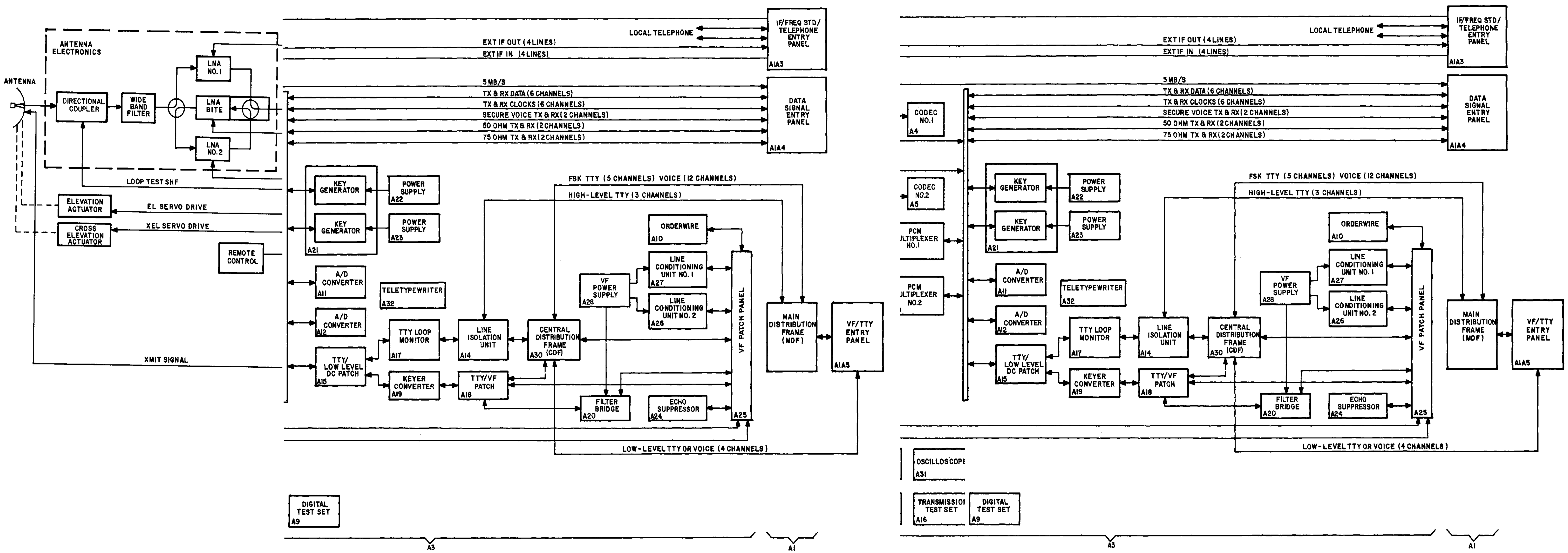
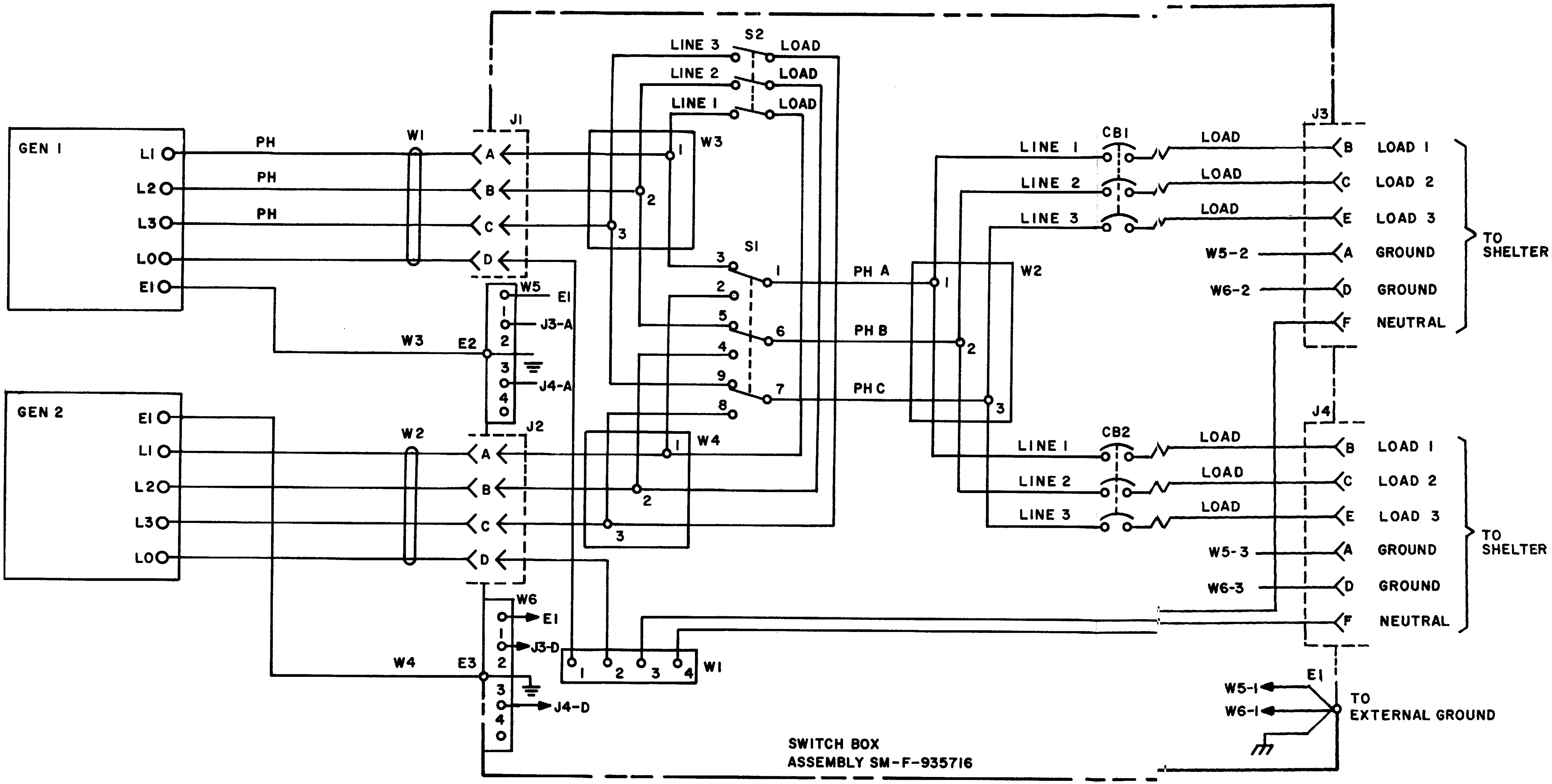


Figure FO-3, Antenna Control Fault, Troubleshooting Chart (Sheet 7 of 7)



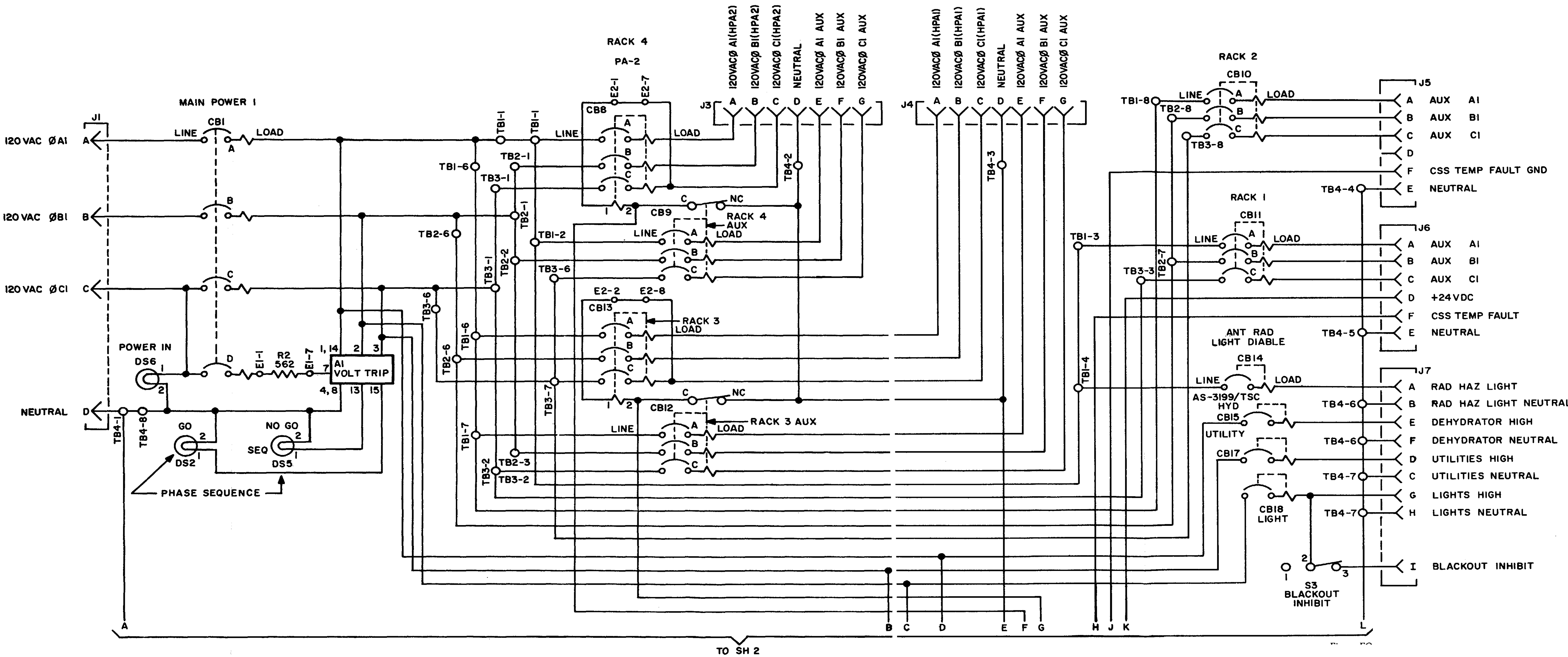
EL6PE145

Figure FO-4. AN/TSC-86, Functional Block Diagram



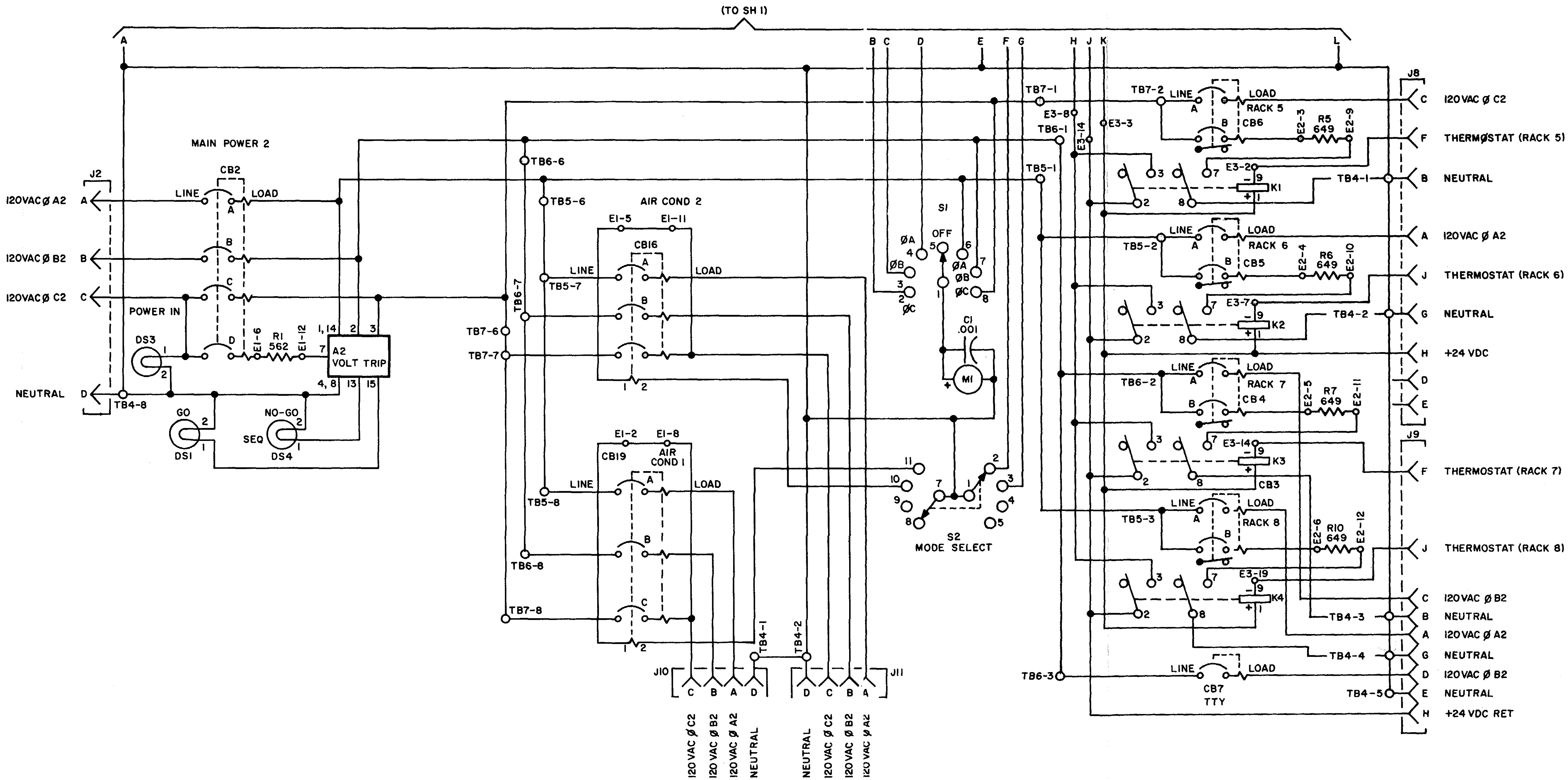
EL6PE146

Figure FO-5. Power Pallet, Schematic Wiring Diagram



ELP6E147

Figure FO-6. Power Distribution Panel, Schematic Wiring Diagram (Sheet 1 of 2)



EL6PE182

Figure FO-6. Power Distribution Panel, Schematic Wiring Diagram (Sheet 2 of 2

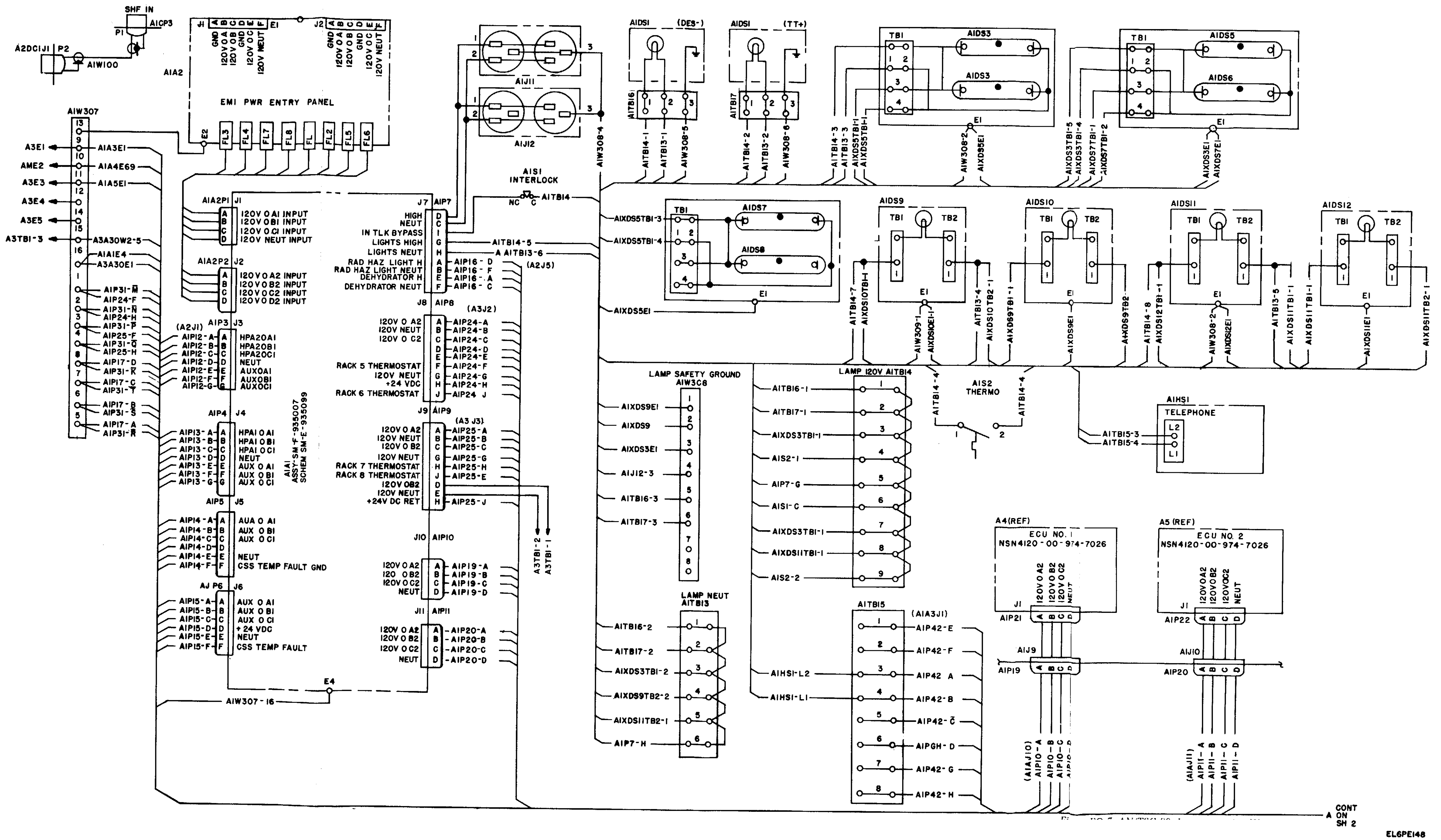


Figure FO-7. AN/TSC-86, Interconnection Wiring Diagram (Sheet 1 of 4)

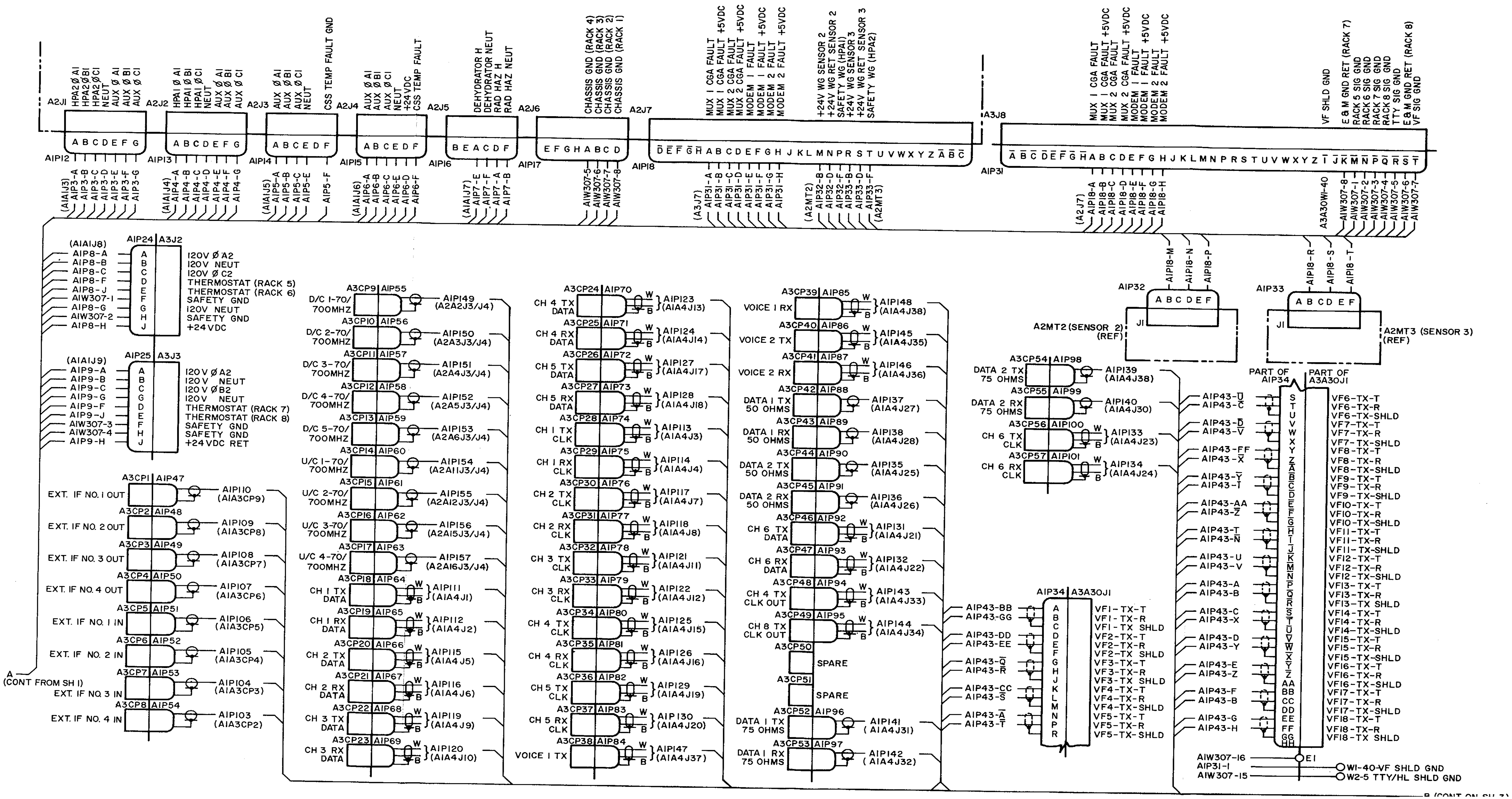
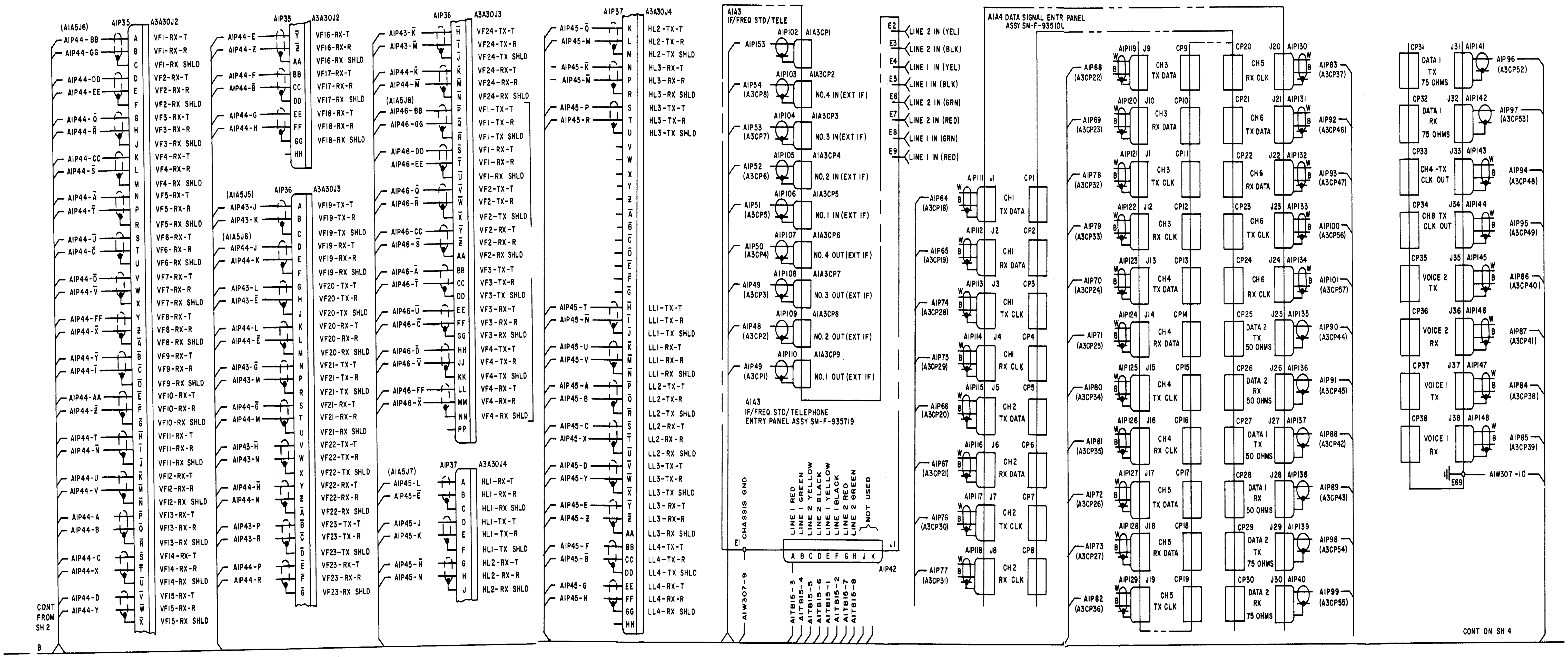


Figure FO-7. AN/TSC-86, Interconnection Wiring Diagram (Sheet 2 of 4)



EL6PE150

Figure FO-7. AN/TSC-86, Interconnection Wiring Diagram (Sheet. 3 of 4

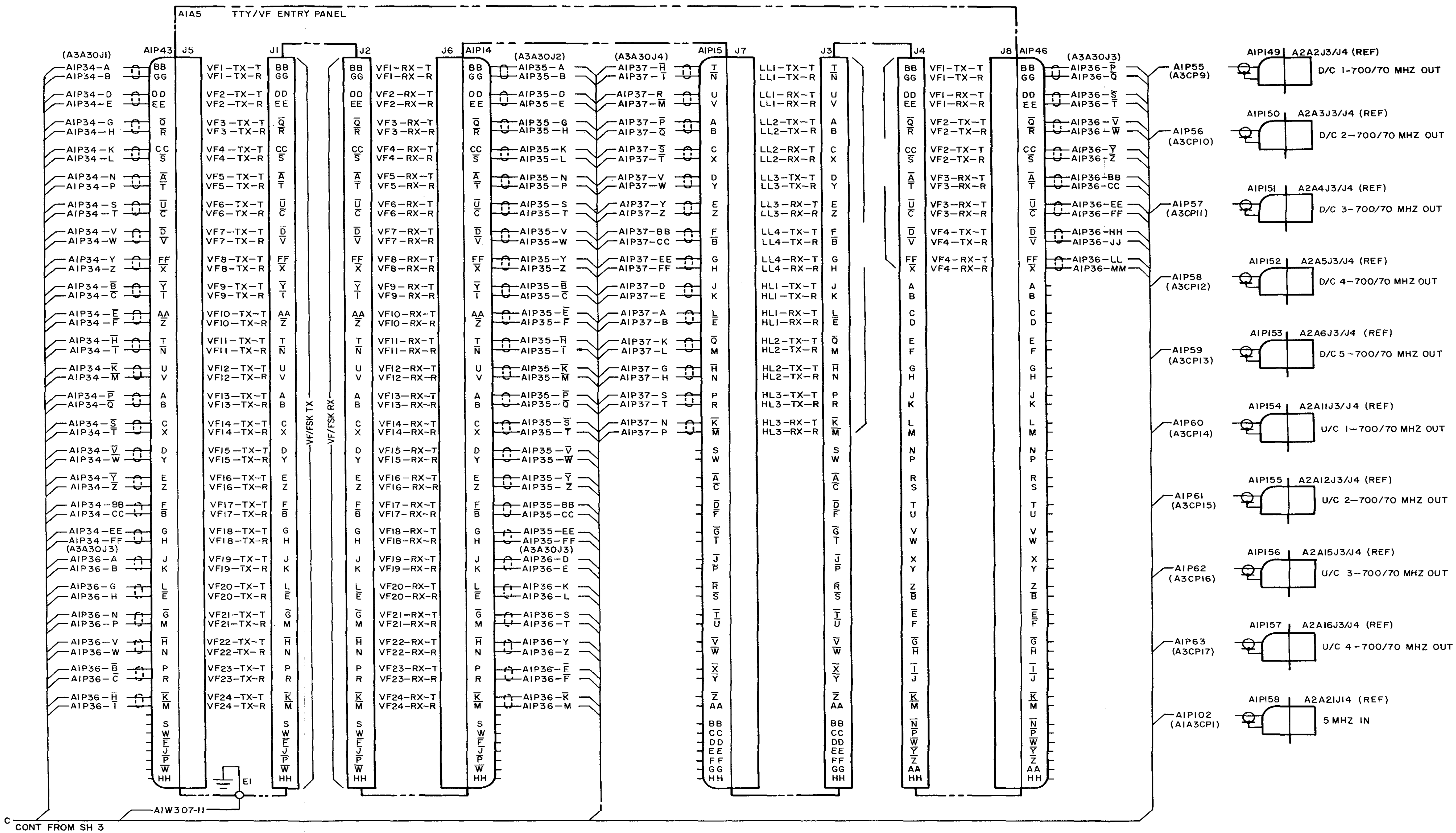
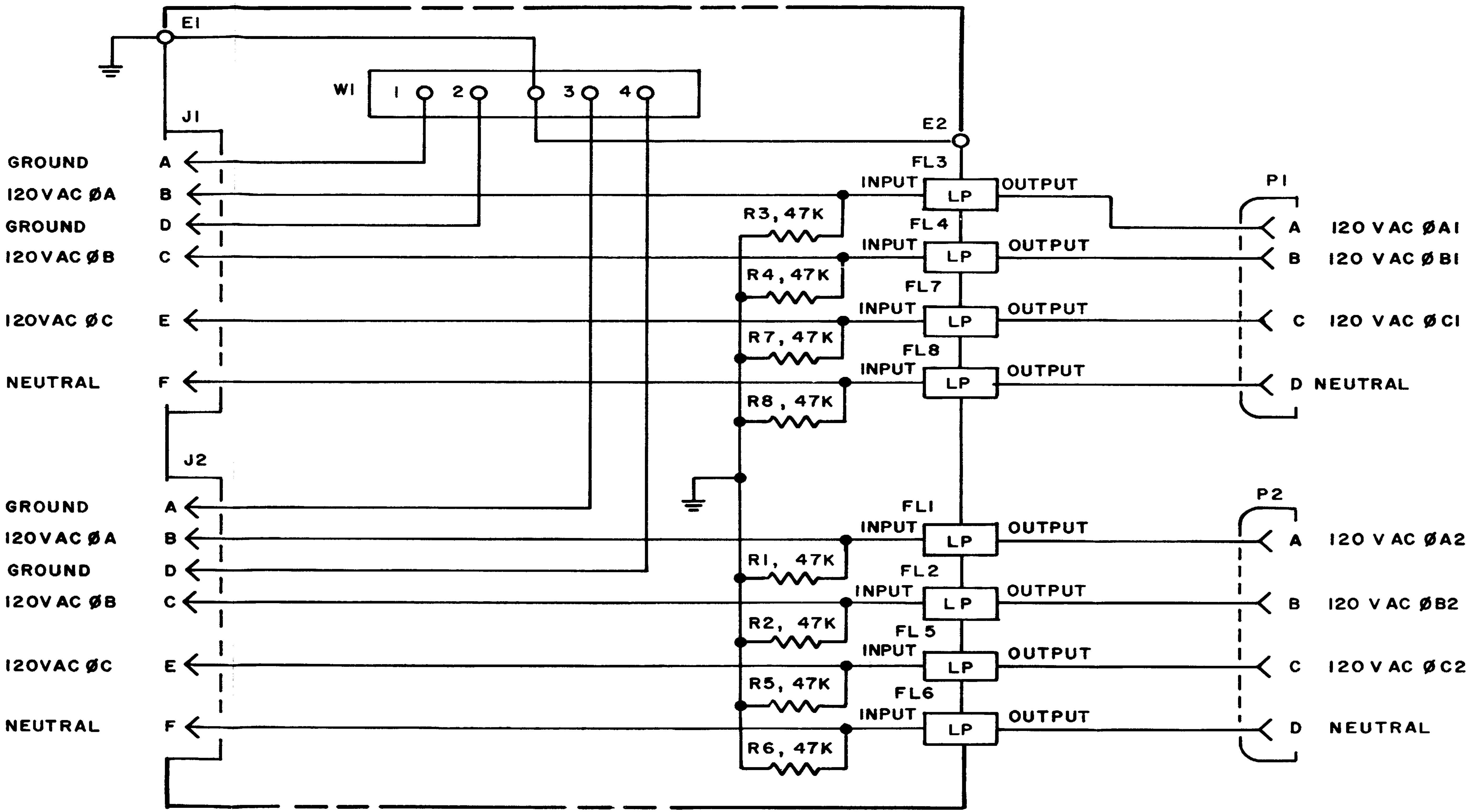
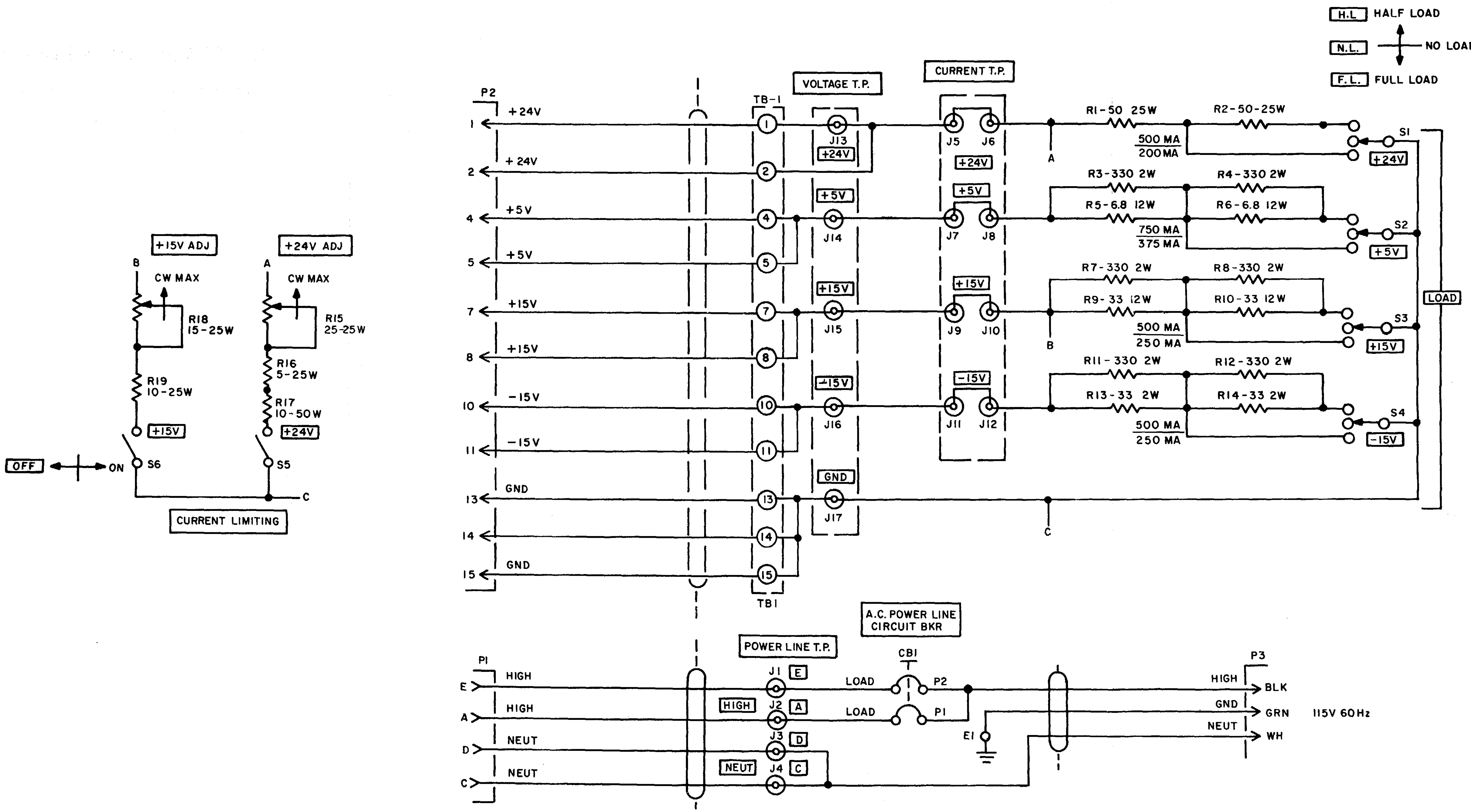


Figure FO-7. AN/TSC-86, Interconnection Wiring Diagram (Sheet 4 of 4)



EL6PE152

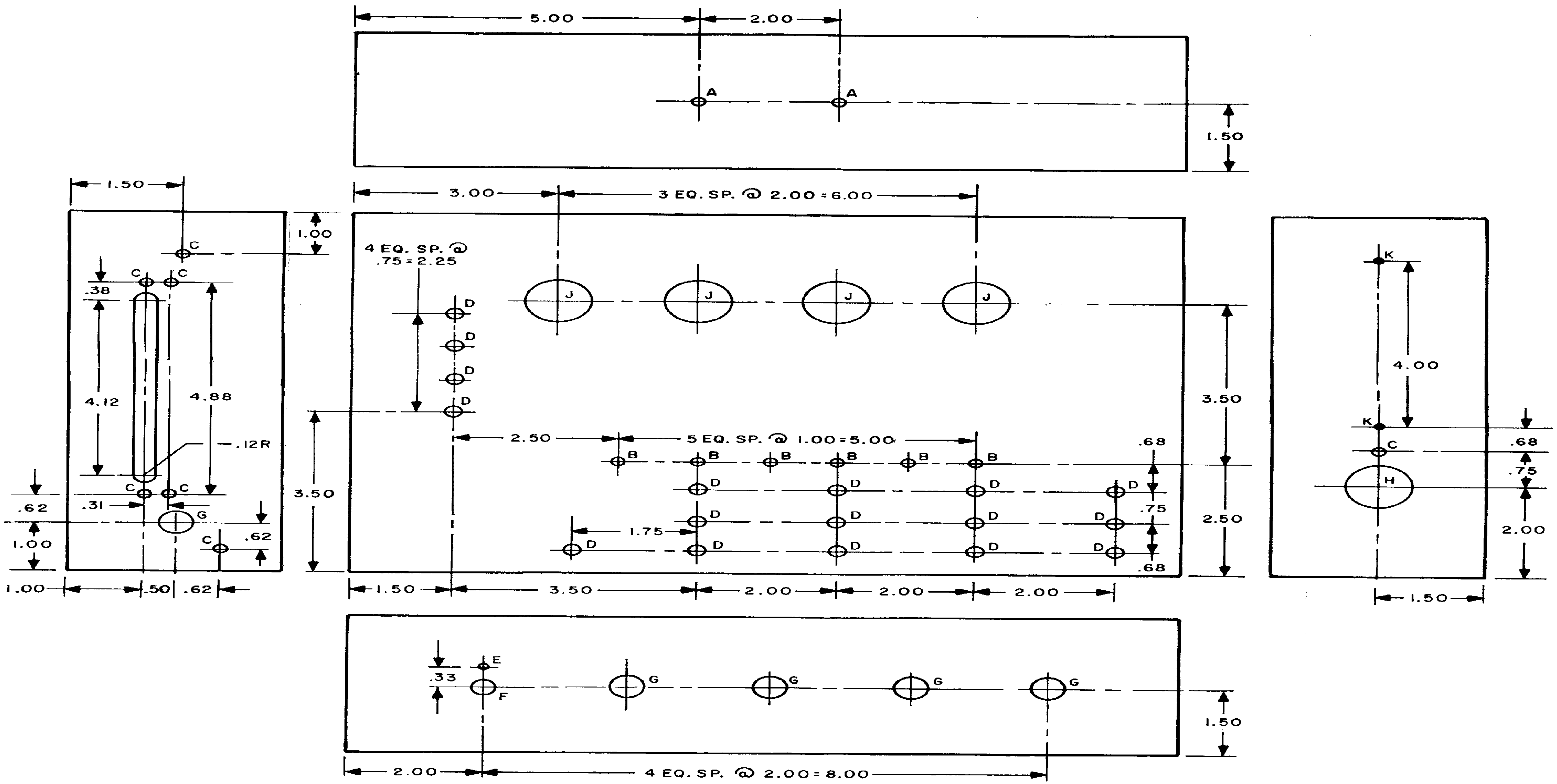
Figure FO-8. EMI Filter, Schematic Wiring Diagram



EL6PE186

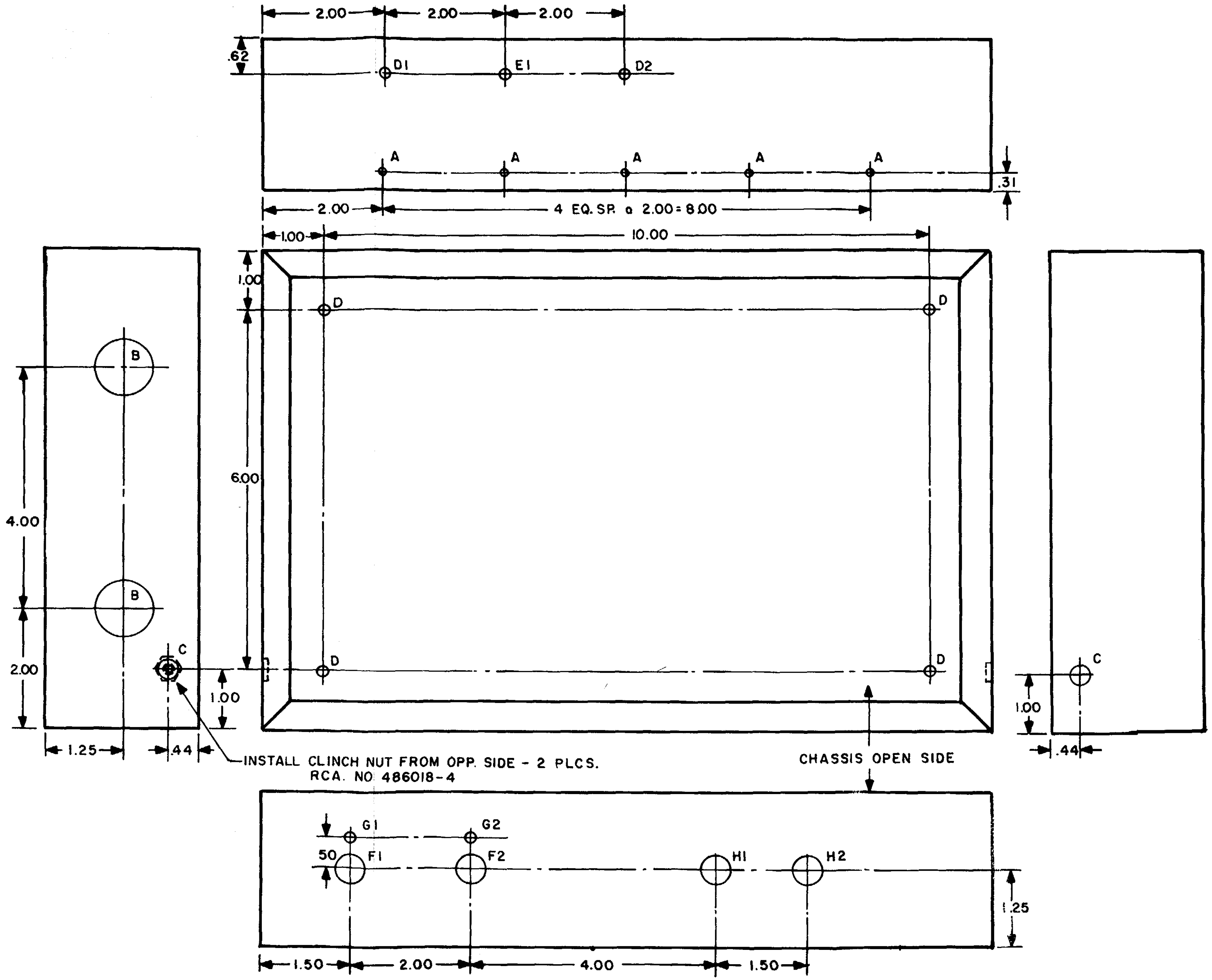
Figure FO-9. Alarm Monitor Power Supply Test Fixture, Schematic Diagram

TOP



HOLE SCHEDULE		
HOLE	SIZE	QTY
A	.201	2
B	.177	6
C	.149	7
D	.257	19
E	.128	1
F	.397	1
G	.50	5
H	.88	1
J	1.00	4
K	.070	2

Figure FO-10. Alarm Monitor Power Supply Test Fixture Top Chassis Layout.



HOLE SCHEDULE		
HOLE	SIZE	QTY
A	.128	5
B	1.00	2
C	.266	2
D	.177	8
E	.201	3
F	.386	3
G	.189	3
H	.468	3

INSTALL CLINCH NUT (hole C)

REF. QTY. ONLY (QTY column)

ALL DIMENSIONS ARE IN INCHES

EL6PE170

Figure FO-11. Alarm Monitor Power Supply Test Fixture, Bottom Chassis Layout.

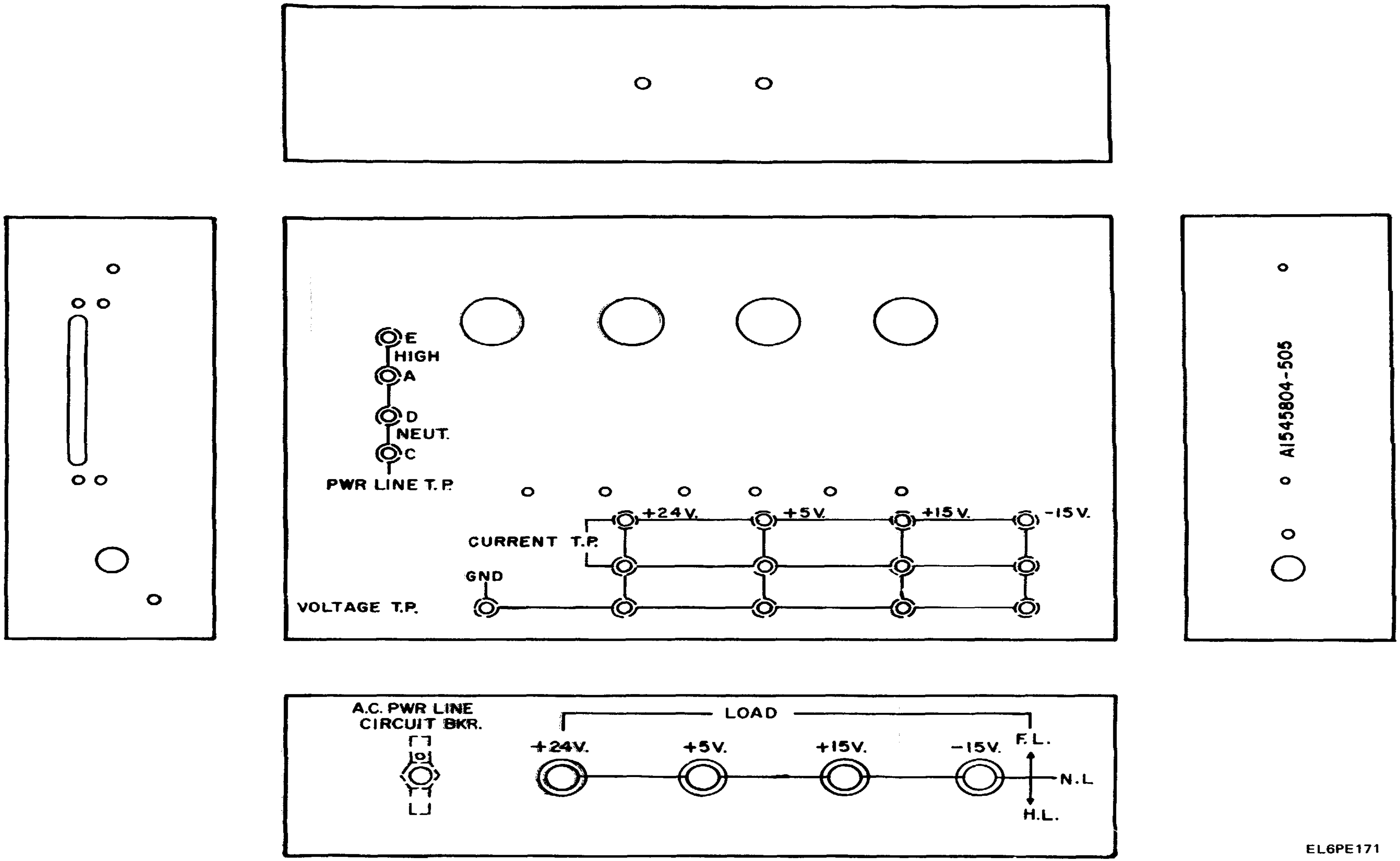


Figure FO-12. Alarm monitor Supply Test Fixture, Top Chassis Marking.

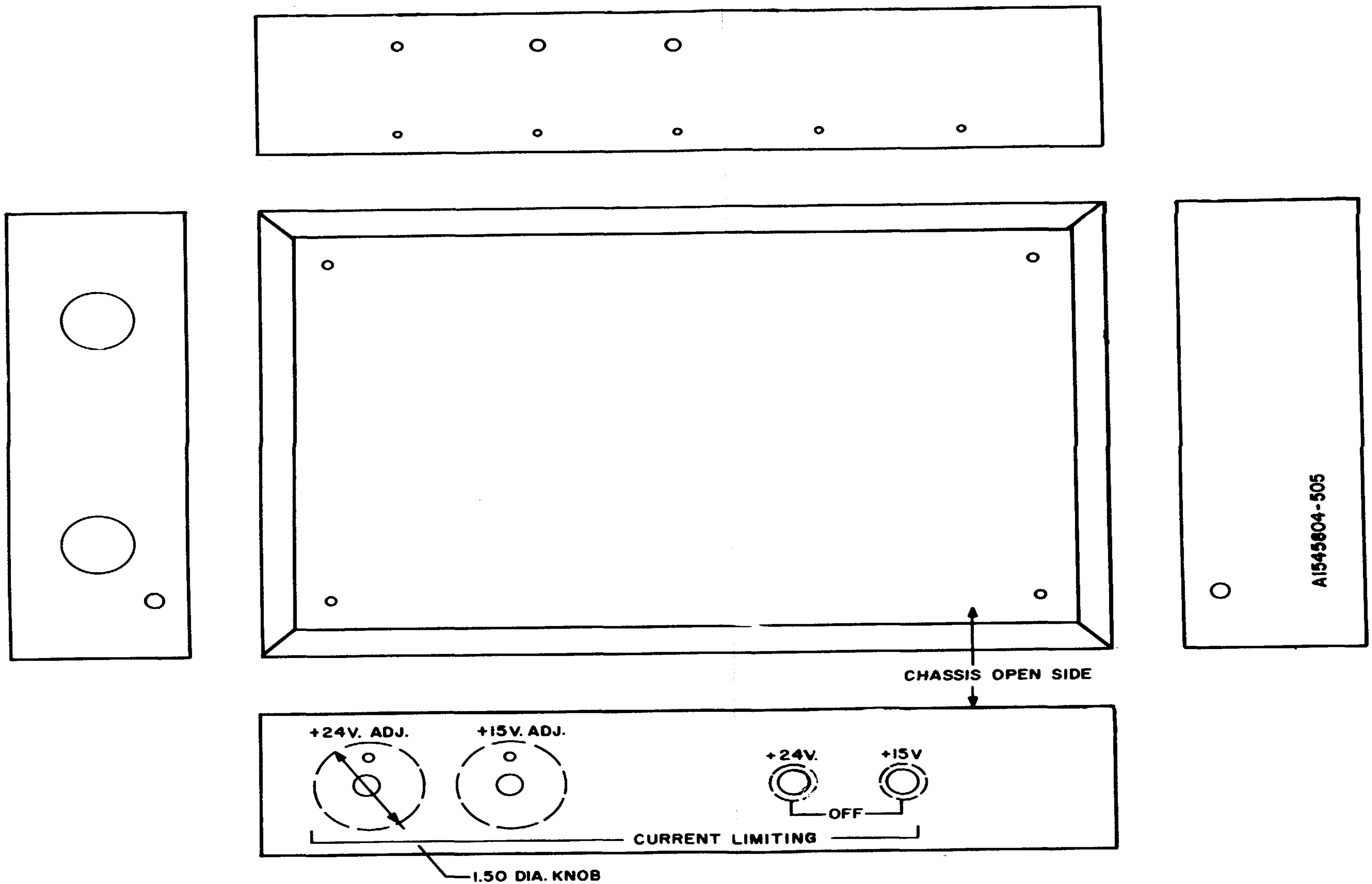


Figure FO-13. Alarm Monitor power Supply Test Fixture, Bottom Chassis Markings.

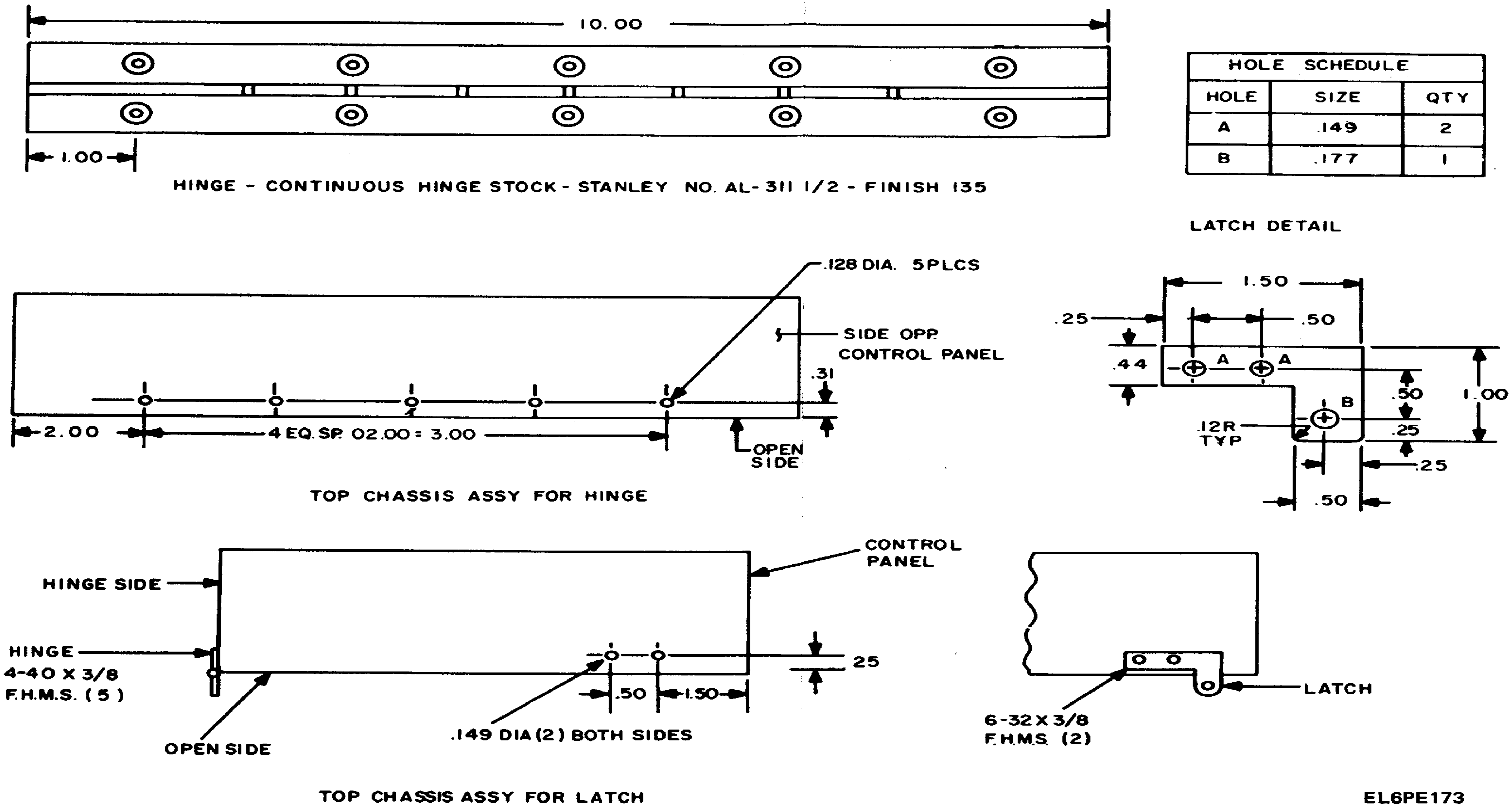


Figure FO-14. Alarm Monitor Power Supply Test Fixture, Hinge Assembly.

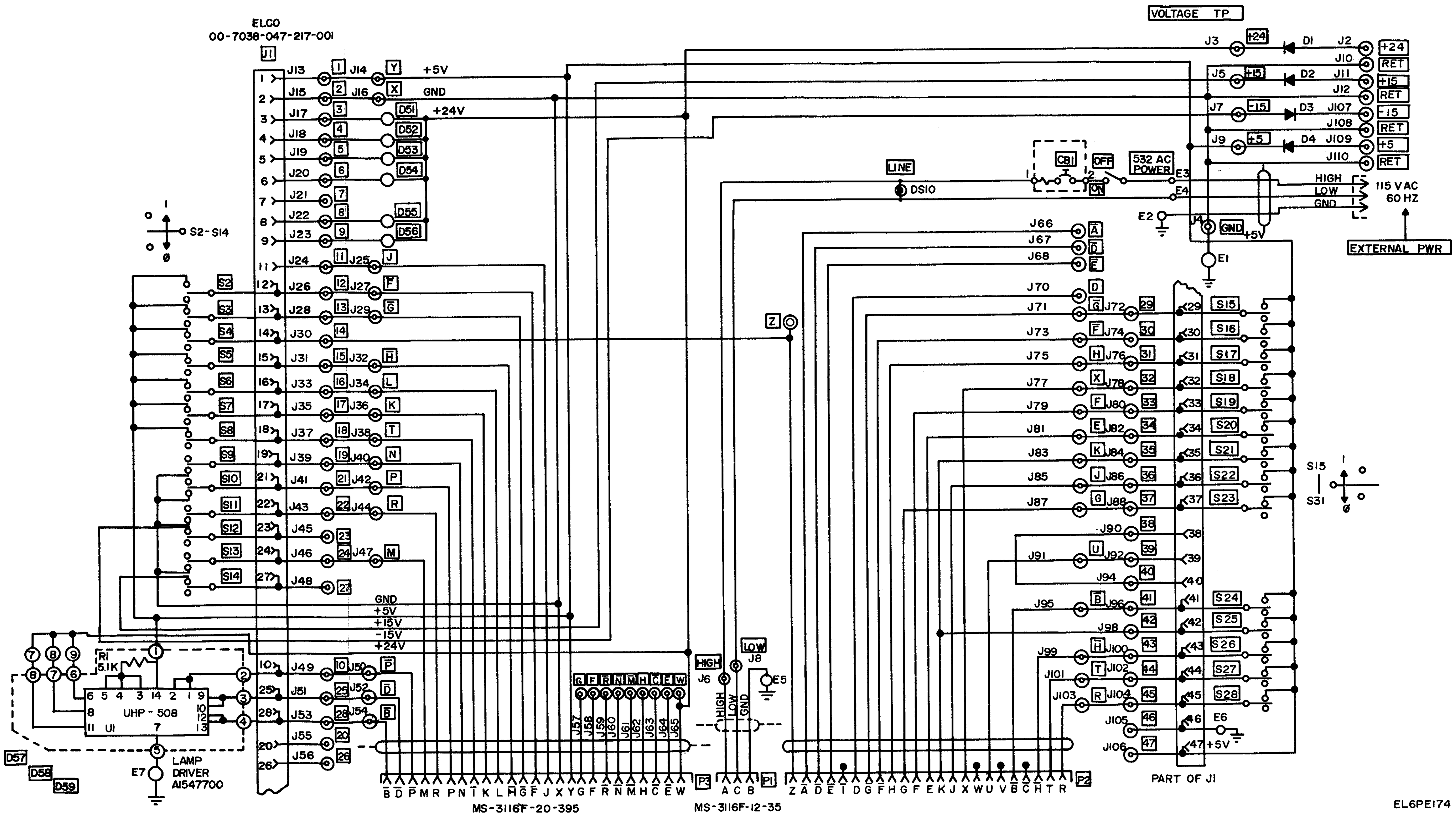
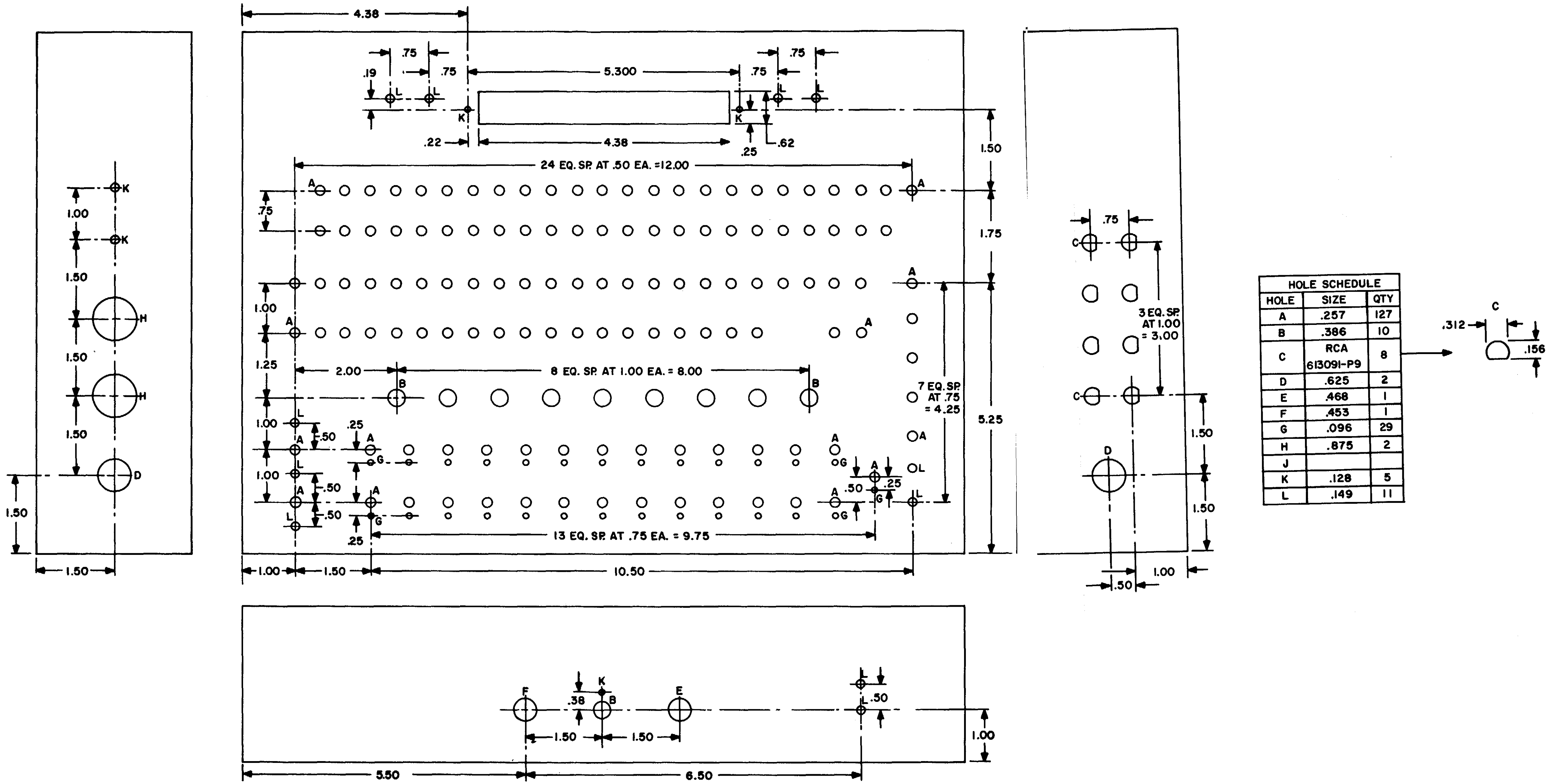


Figure FO-15. Alarm Monitor Fault/Safety Gate Test Fixture, Schematic Diagram



HOLE SCHEDULE		
HOLE	SIZE	QTY
A	.257	127
B	.386	10
C	RCA 613091-P9	8
D	.625	2
E	.468	1
F	.453	1
G	.096	29
H	.875	2
J		
K	.128	5
L	.149	11

Figure FO-16. Alarm Monitor Fault/Safety Gate Test Fixture, Chassis Layout

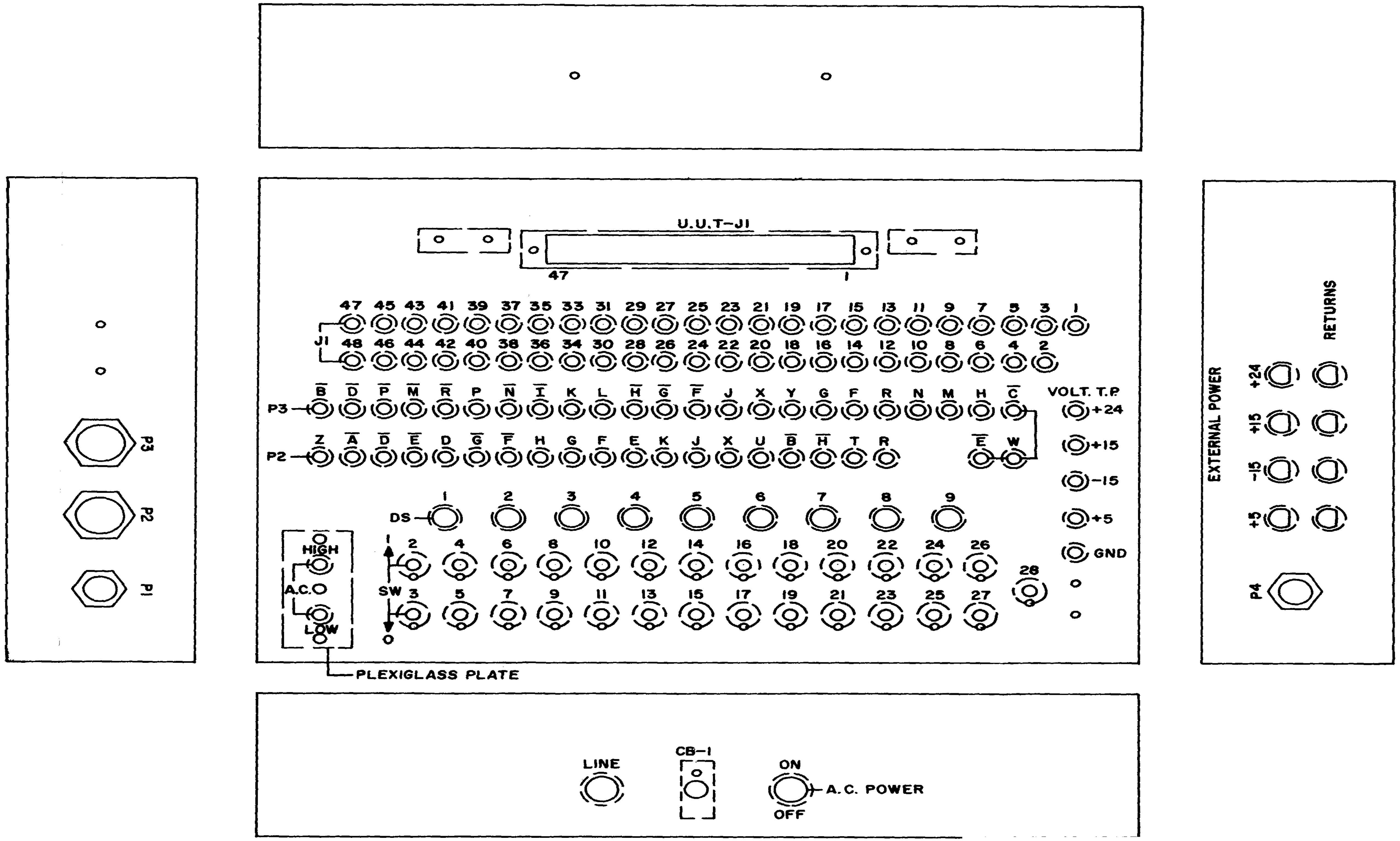


Figure FO-17. Alarm Monitor Fault/Safety Gate Test Fixture Chassis Markings

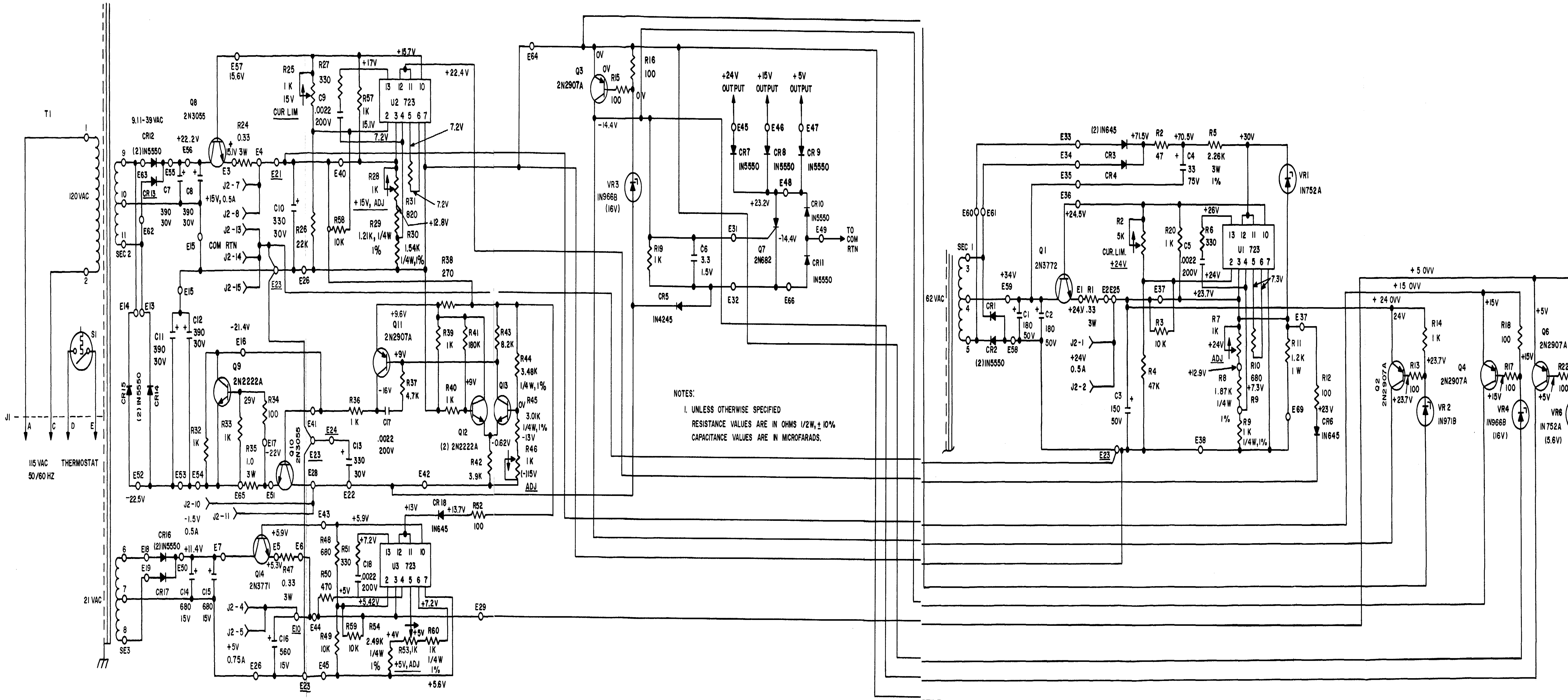


Figure FO-18. Alarm Monitor Power Supply, Schematic Diagram.

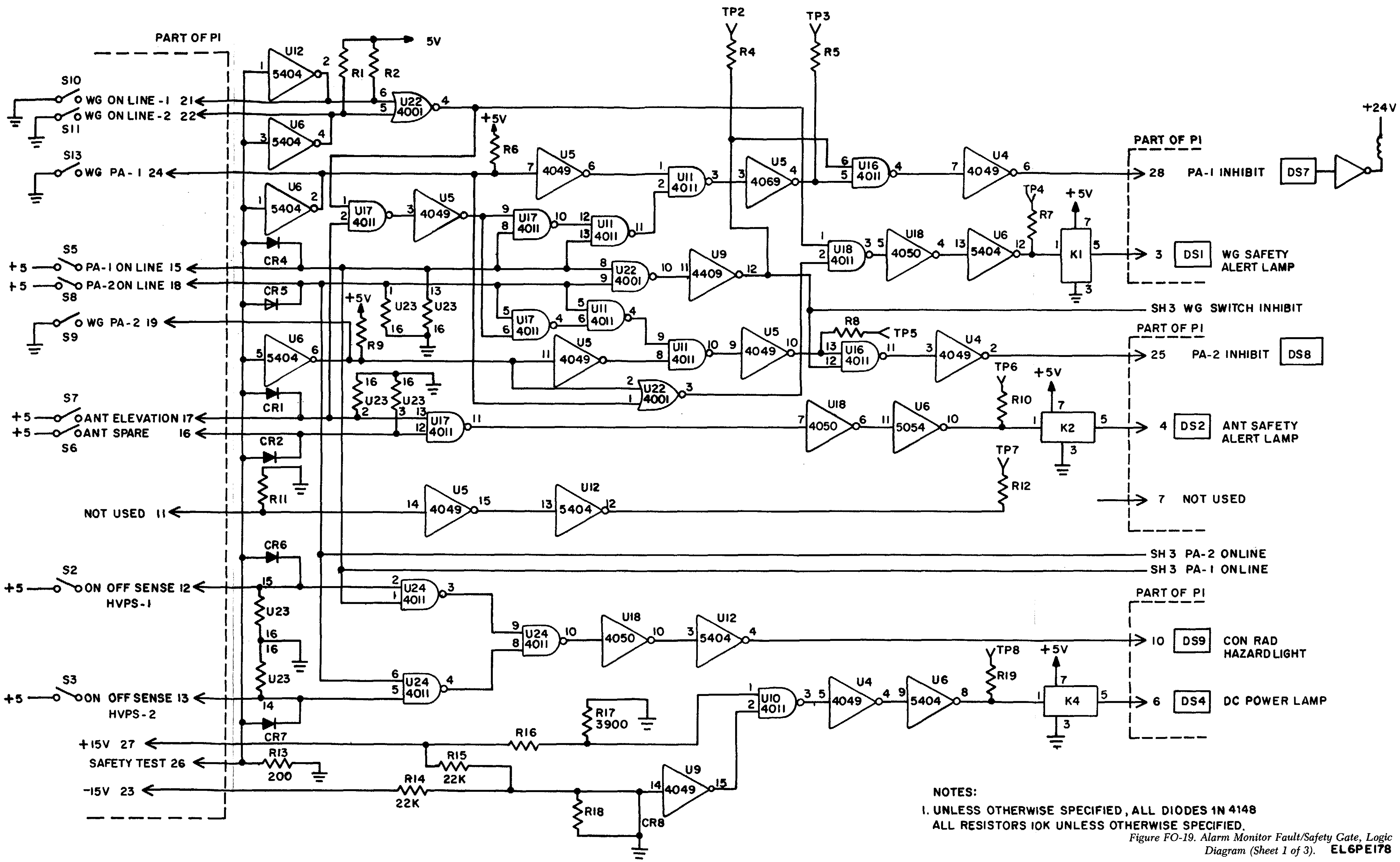


Figure FO-19. Alarm Monitor Fault/Safety Gate, Logic Diagram (Sheet 1 of 3).

Figure FO-19. Alarm Monitor Fault/Safety Gate, Logic Diagram (Sheet 1of 3).

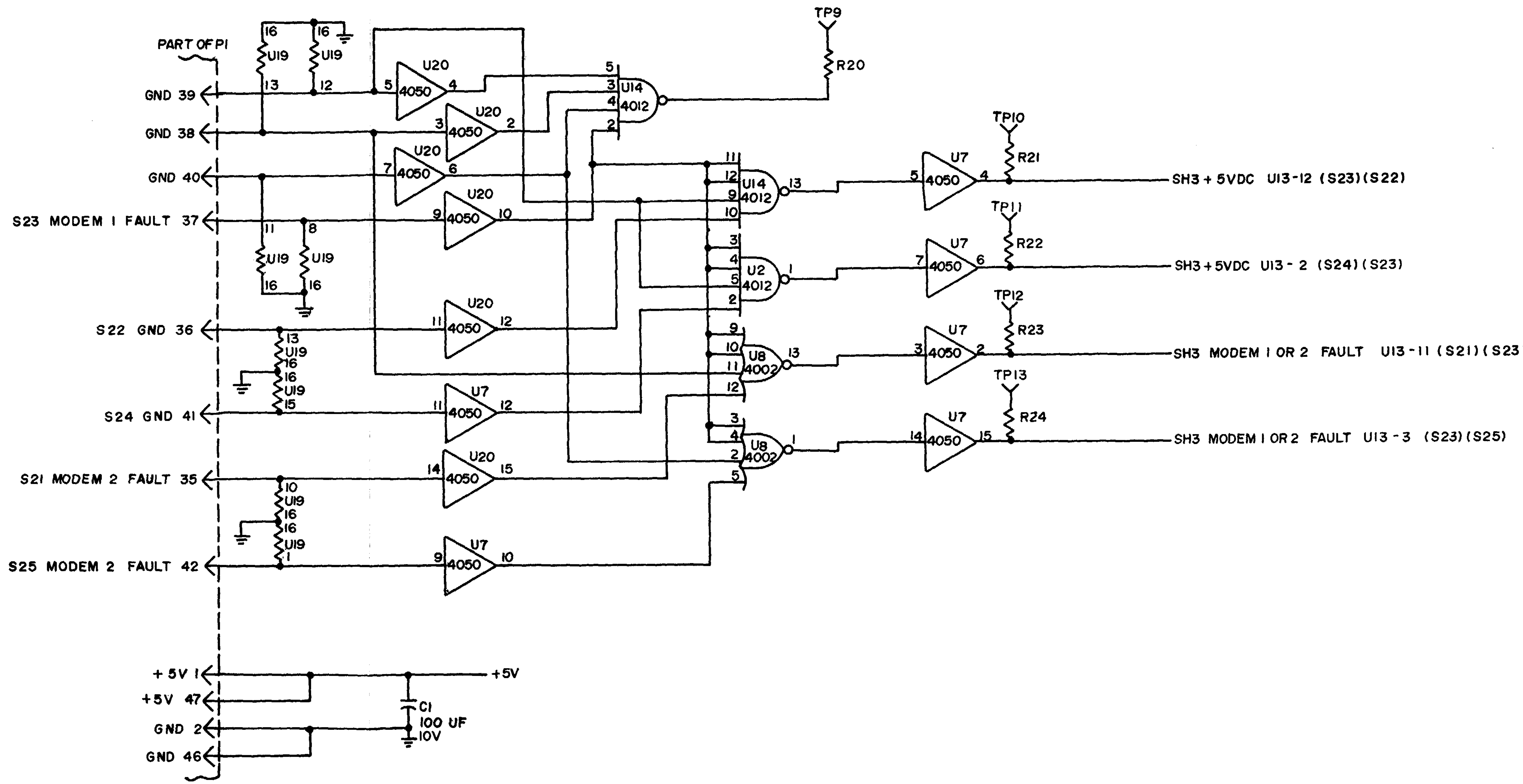


Figure FO-19. Alarm Monitor Fault/Safety Gate, Logic Diagram (Sheet 2 of 3).

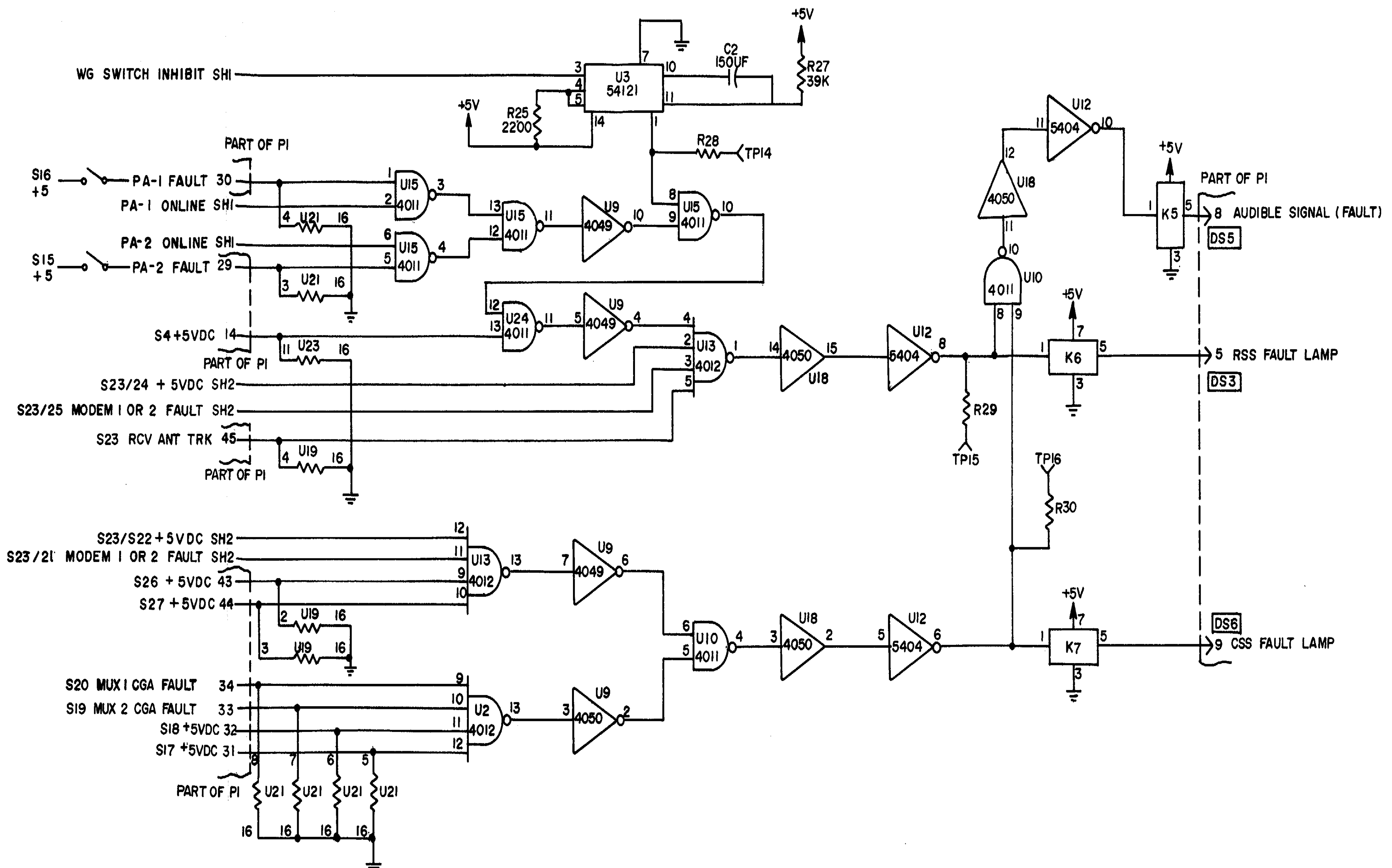


Figure FO-19. Alarm Monitor Fault/Safety Gate, Logic Diagram (Sheet 3 of 3)

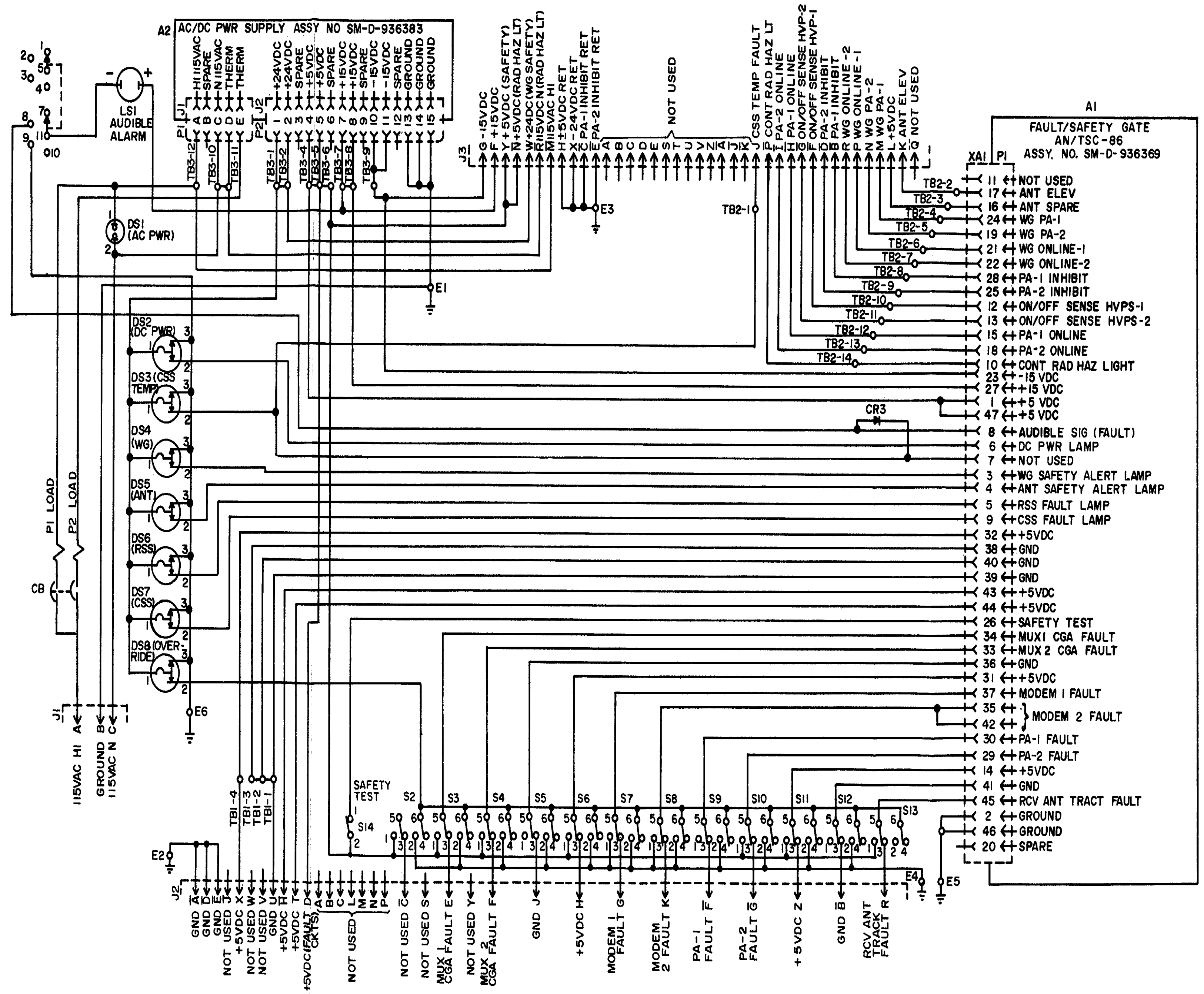


Figure FO-20. Alarm Monitor, Schematic Wiring Diagram

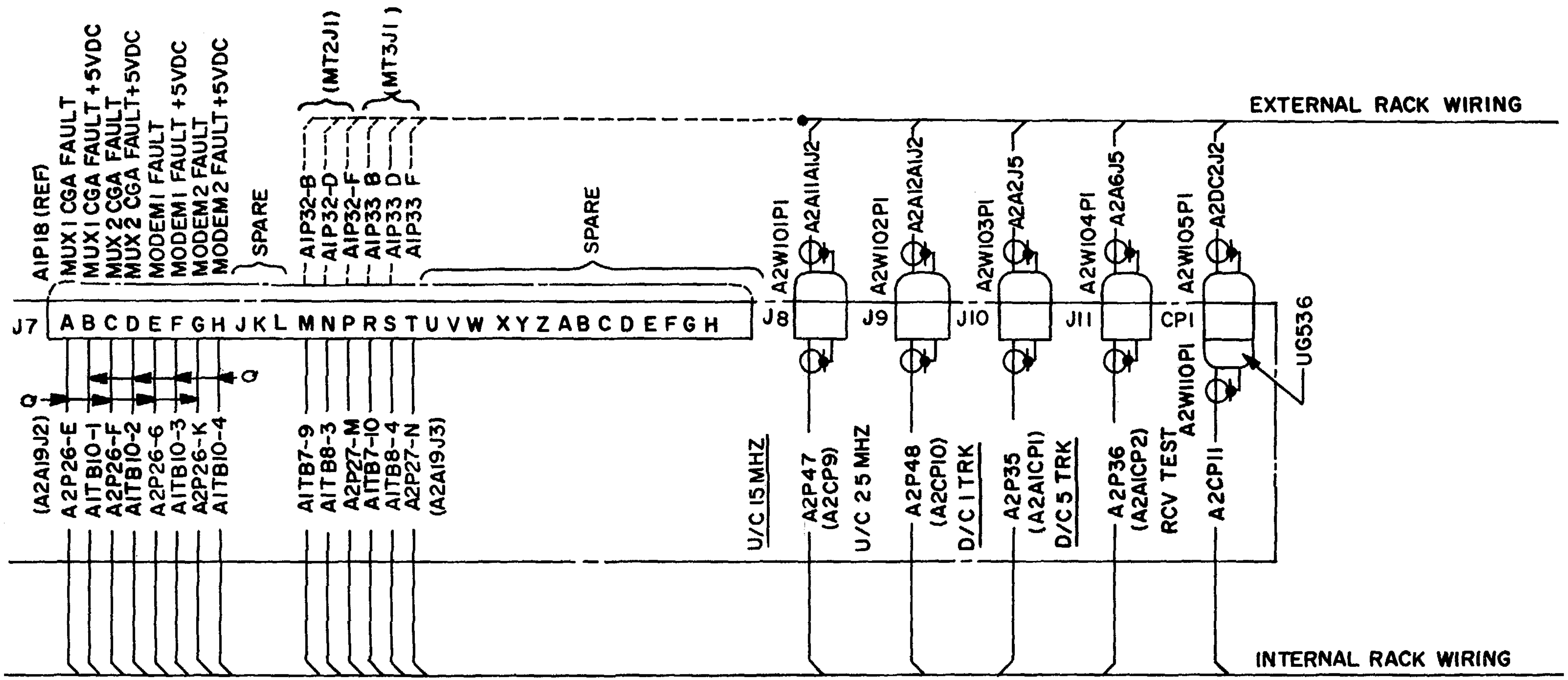
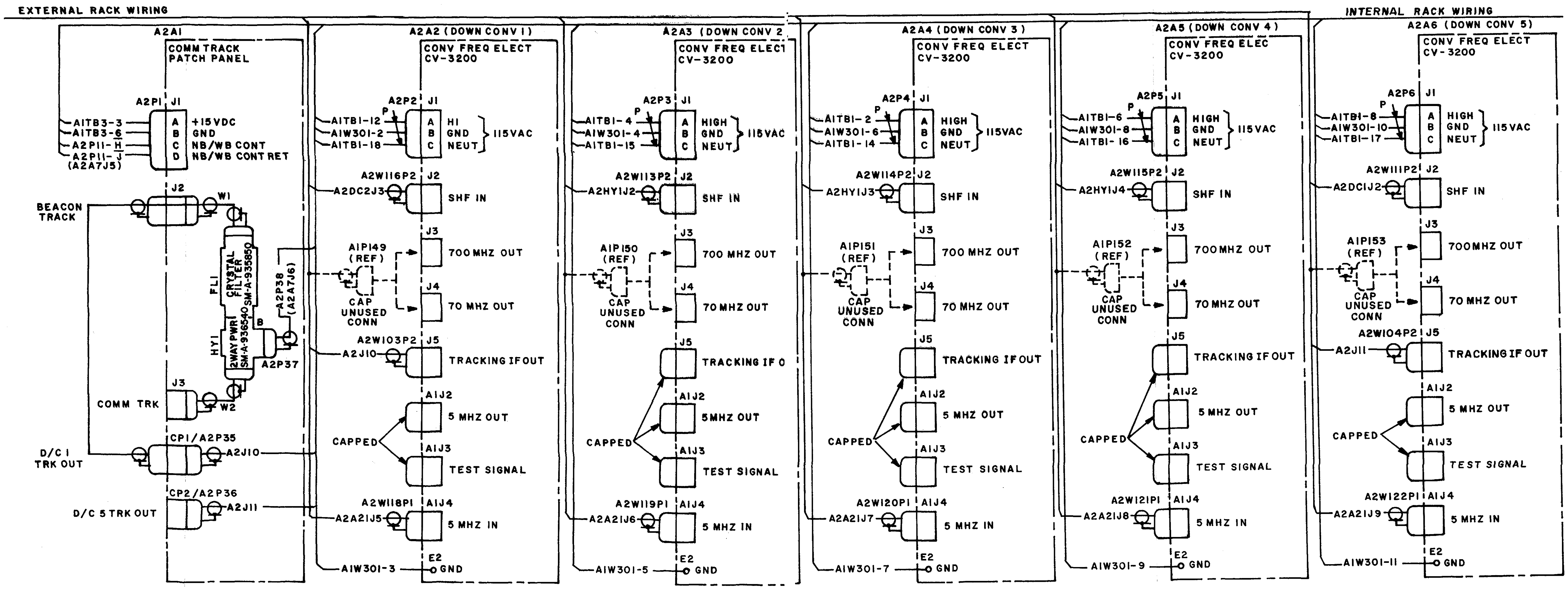
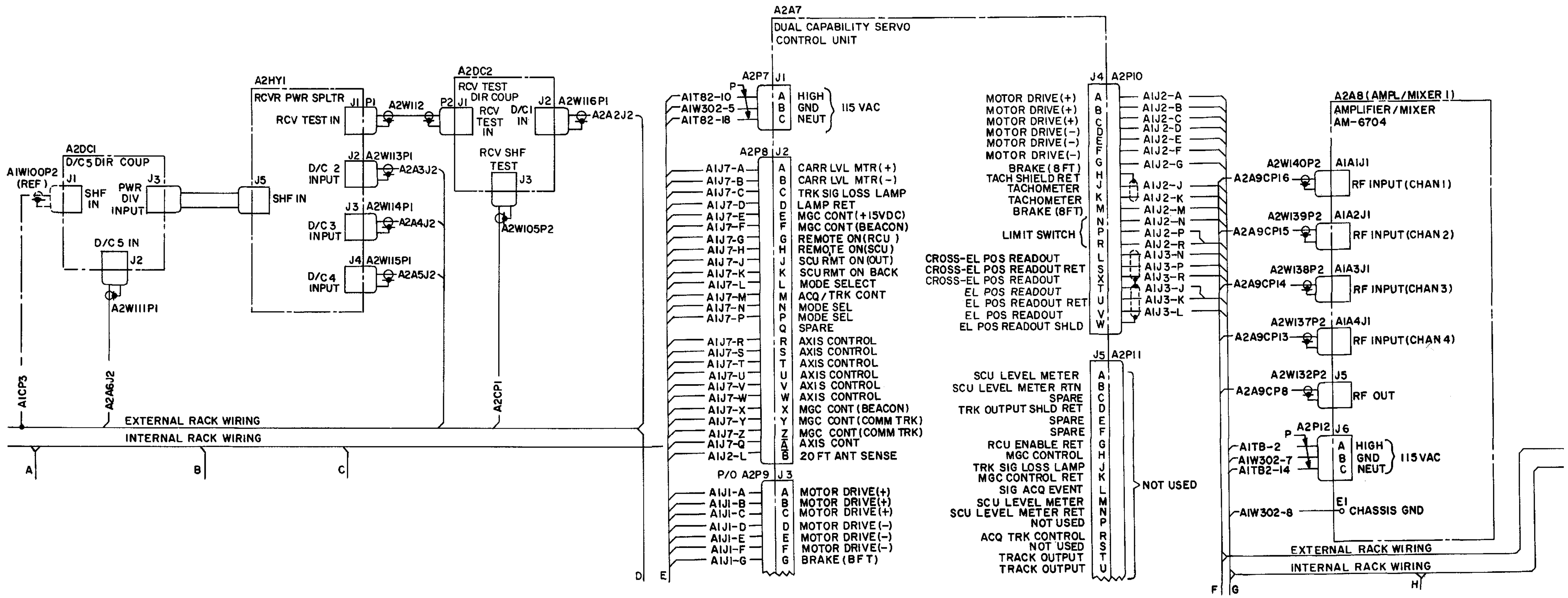


Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 1 of 12).



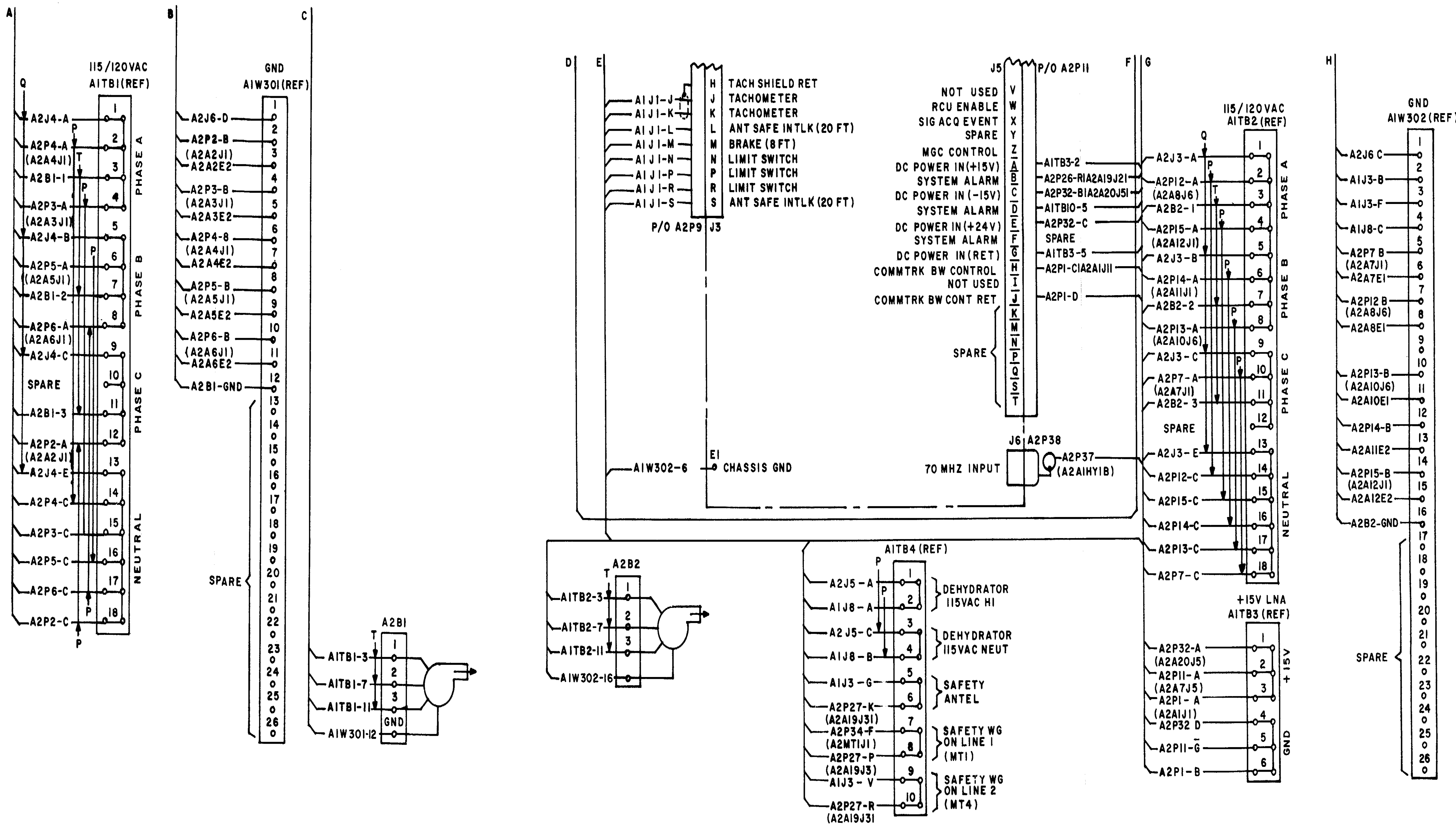
EL6PE184

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 2 of 12).



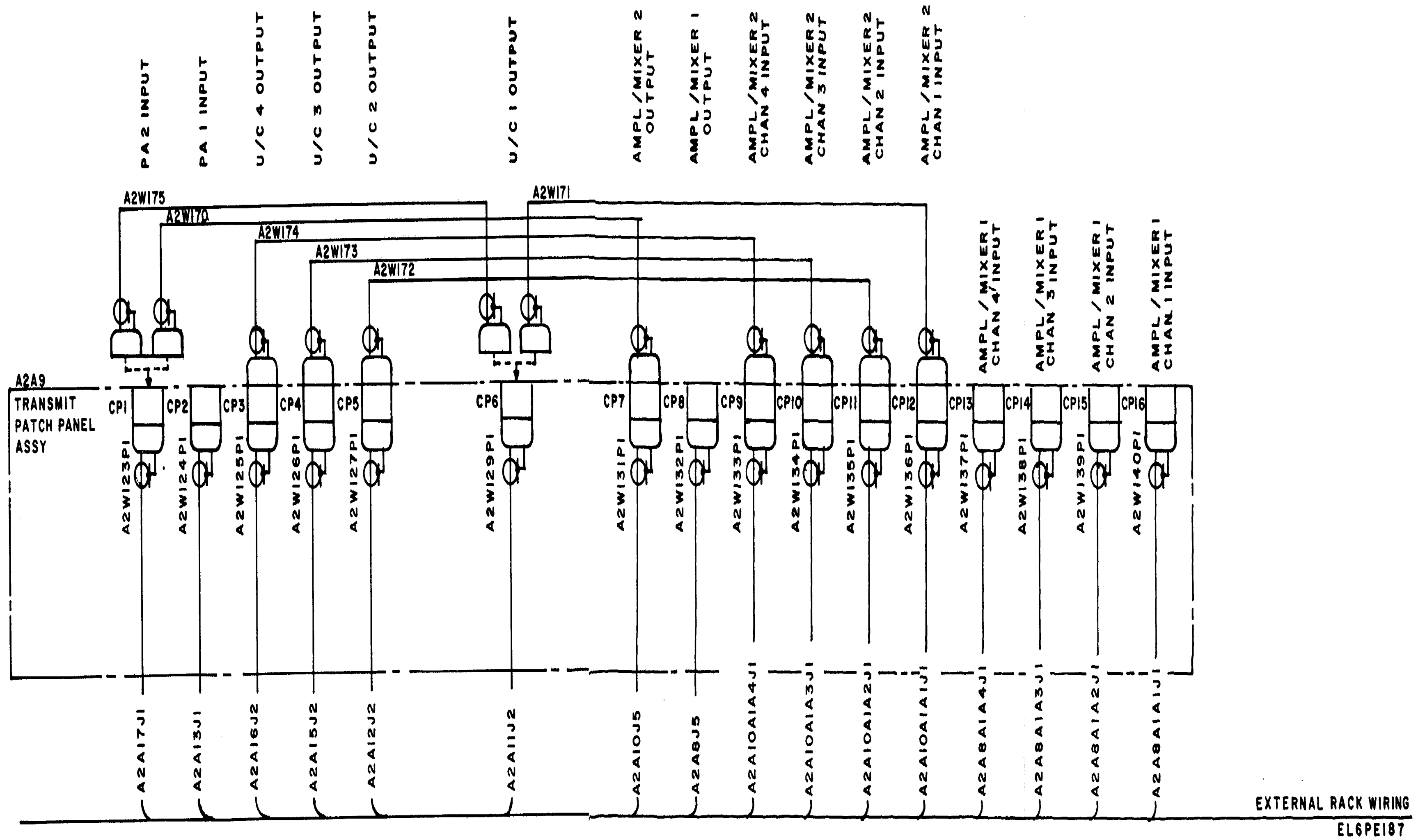
EL6PE185

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 3 of 12).



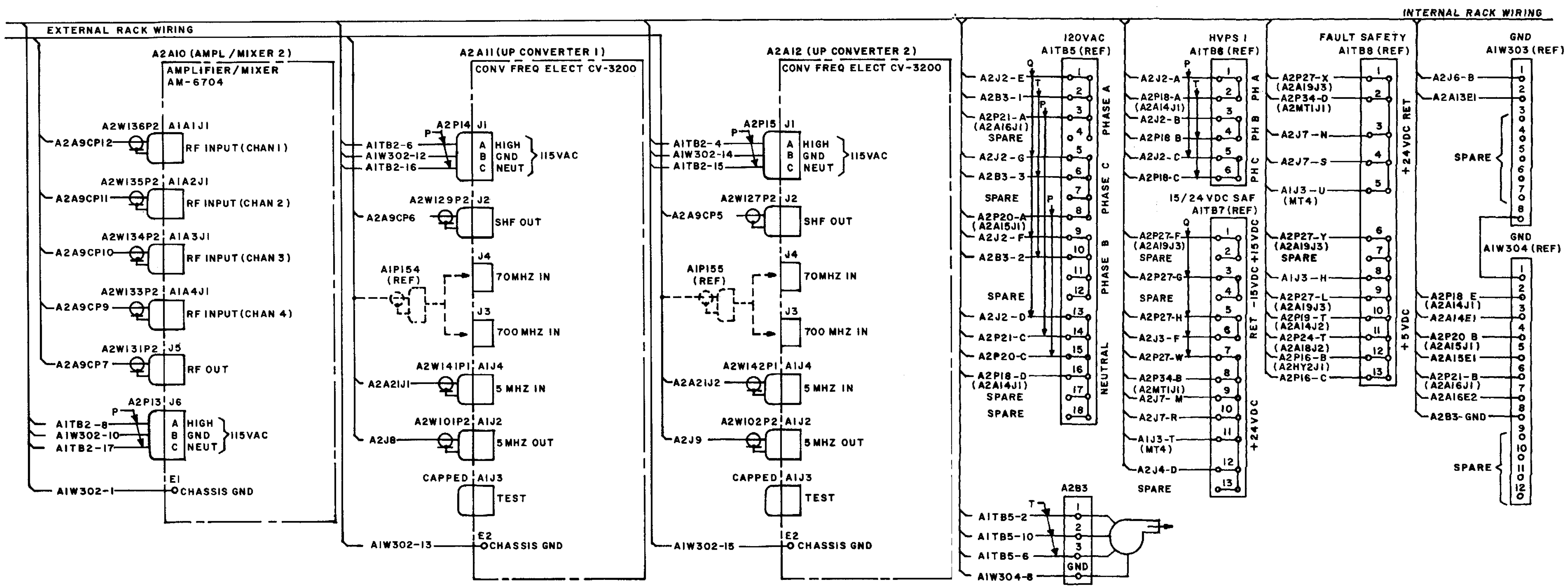
EL6PE186

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 4 of 12).



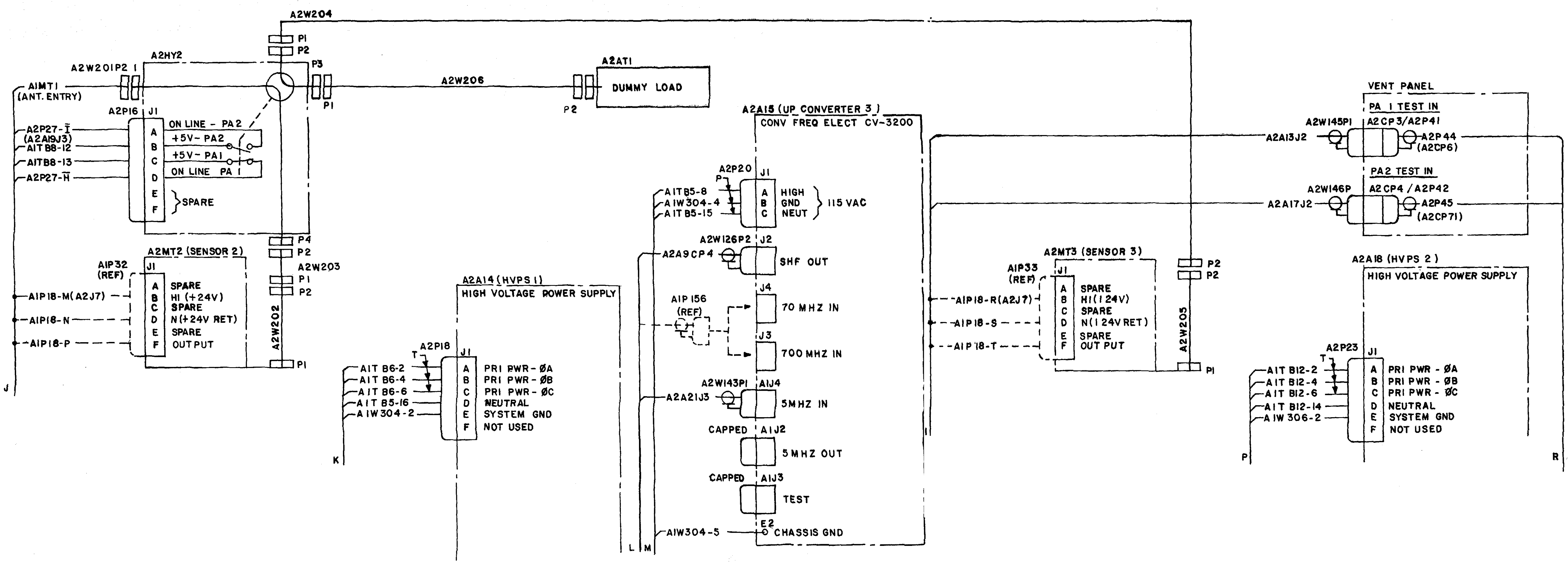
EL6PE187

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 5 of 12).



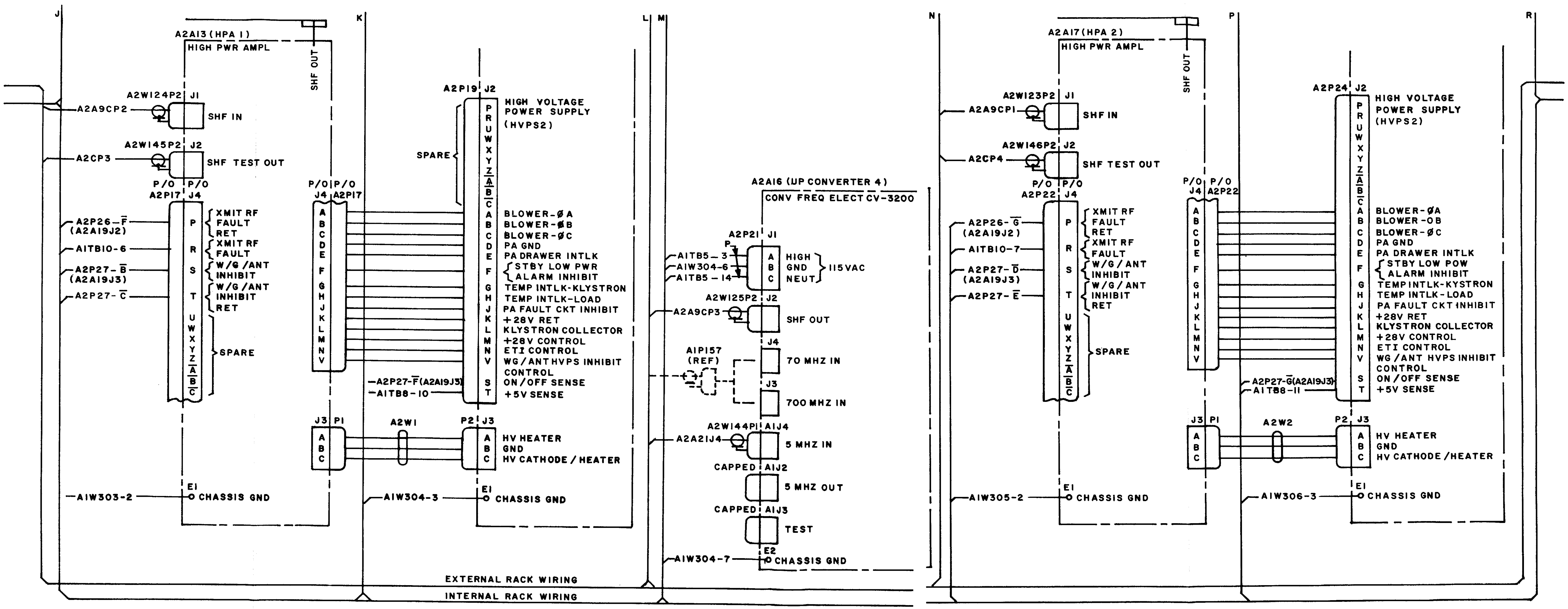
EL6PE188

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 6 of 12).



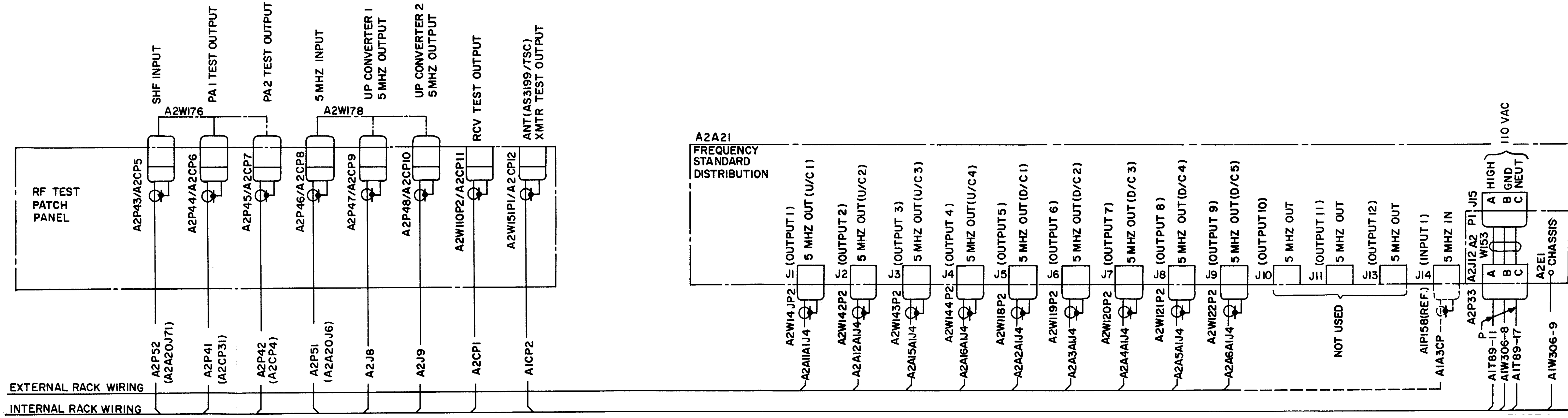
EL6PE189

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 7 of 12).



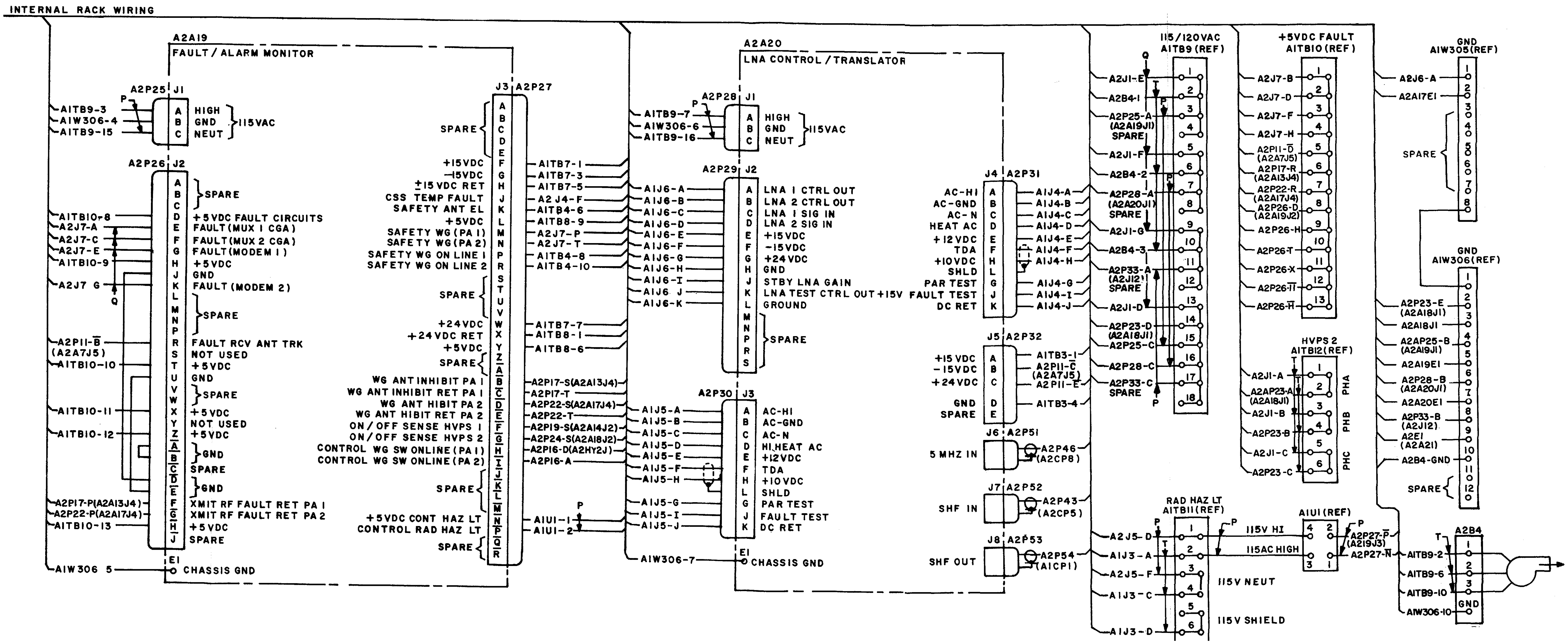
EL6PE190

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 8 of 12)



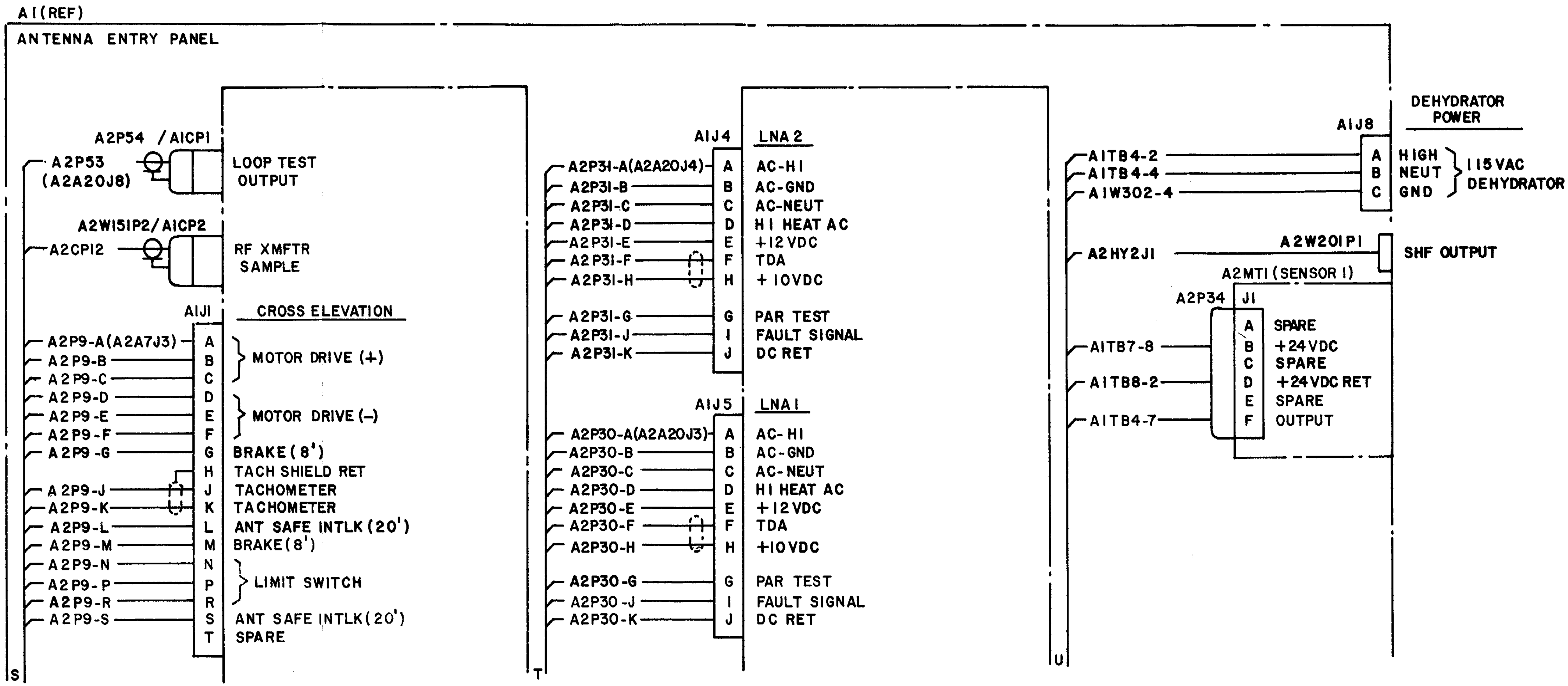
EL6PE191

FO-21. Radio Subsystem, Interconnection Diagram
(Sheet 9 of 12)



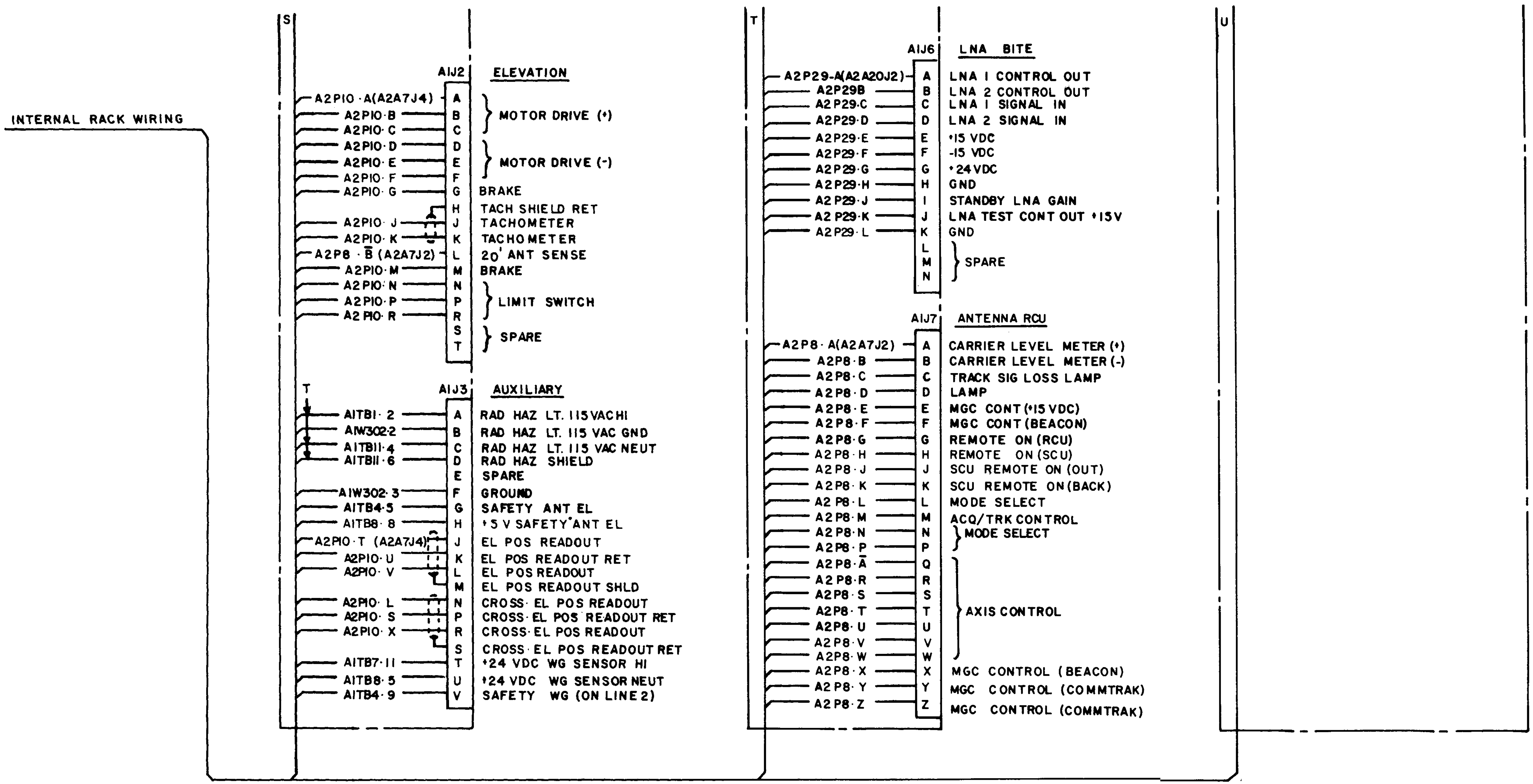
EL6PE192

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 10 of 12).



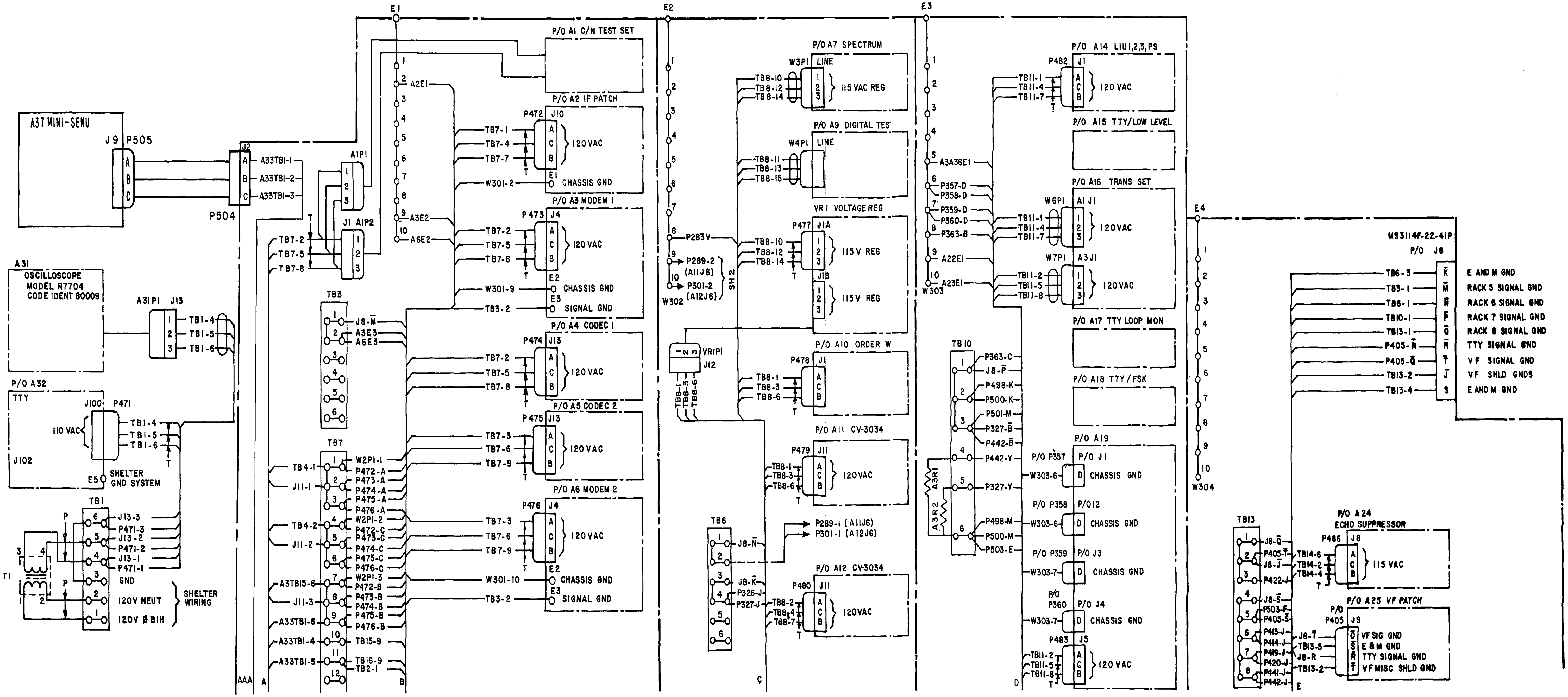
EL6PE193

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 11 of 12).



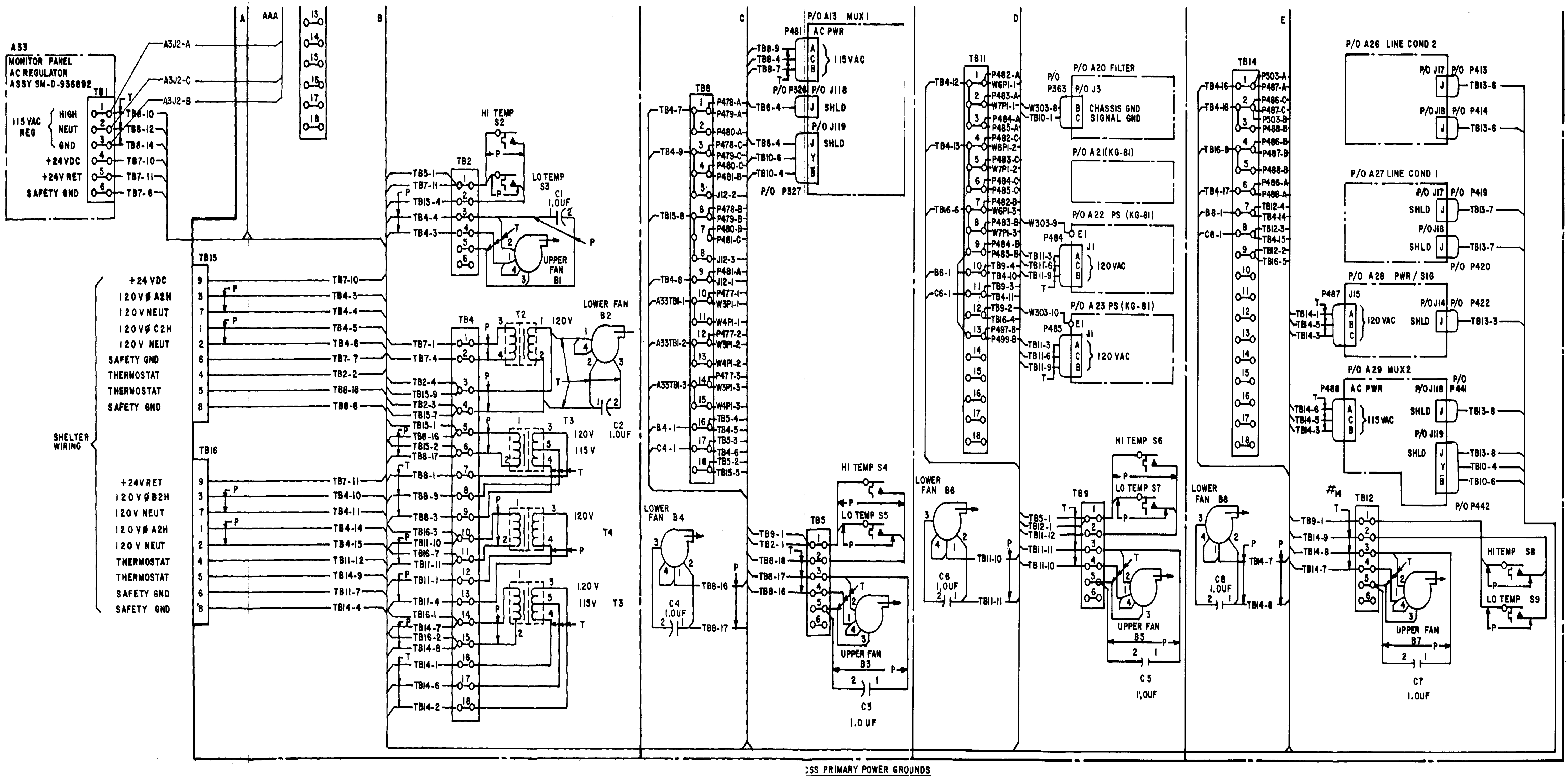
EL6PE194

Figure FO-21. Radio Subsystem, Interconnection Diagram (Sheet 12 of 12).



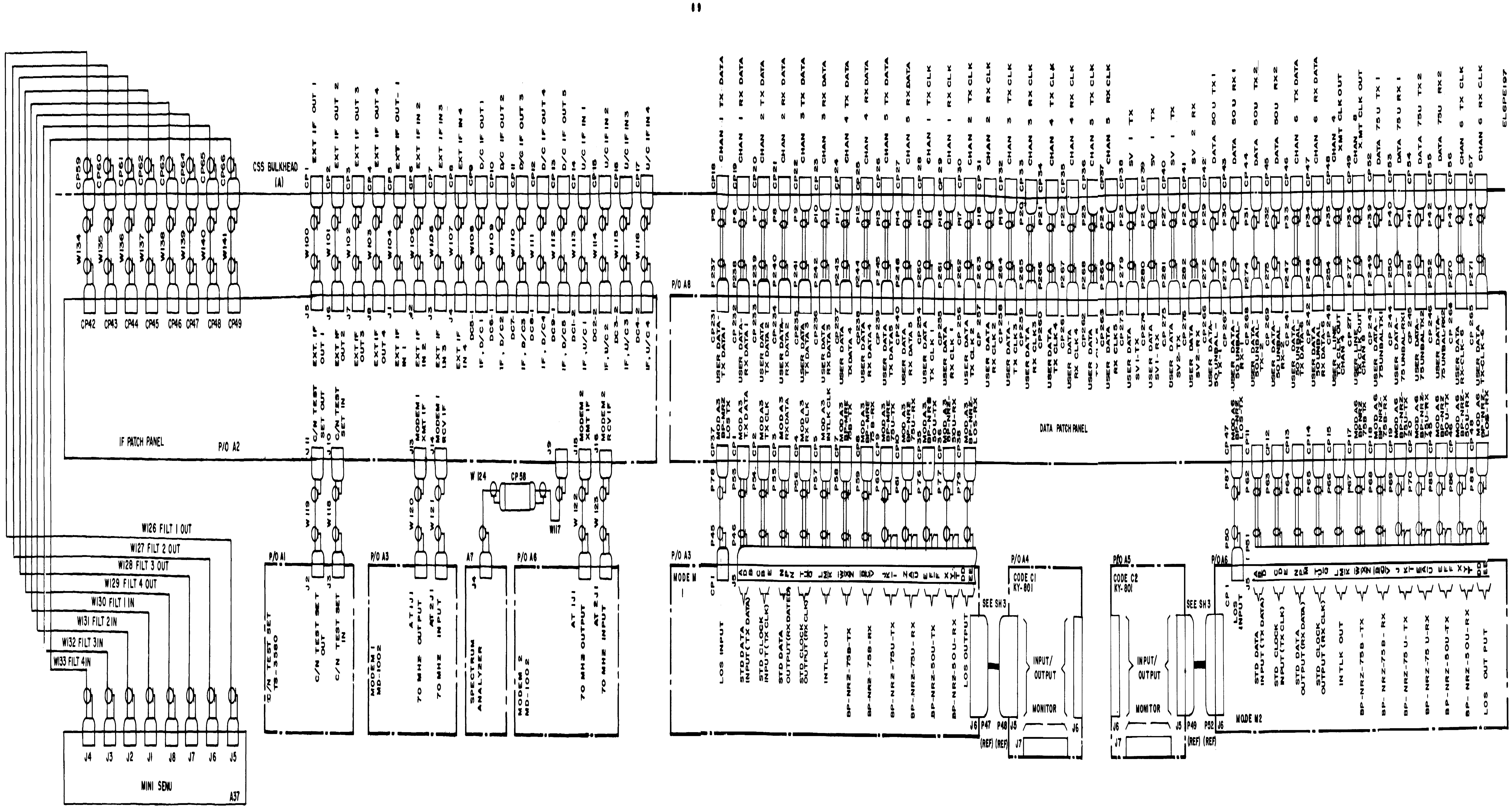
EL6PE195

Figure FO-22. Radio Subsystem, Interconnection Diagram (Sheet 1 of 14).



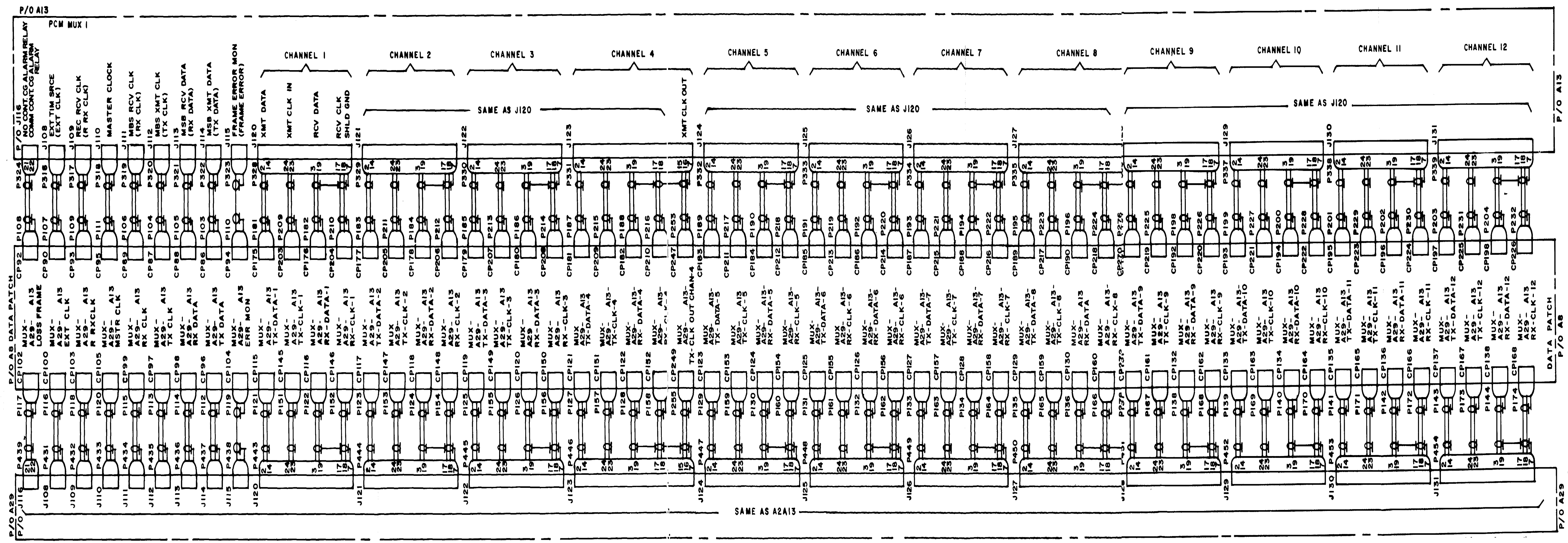
EL6PE196

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 2 of 14).



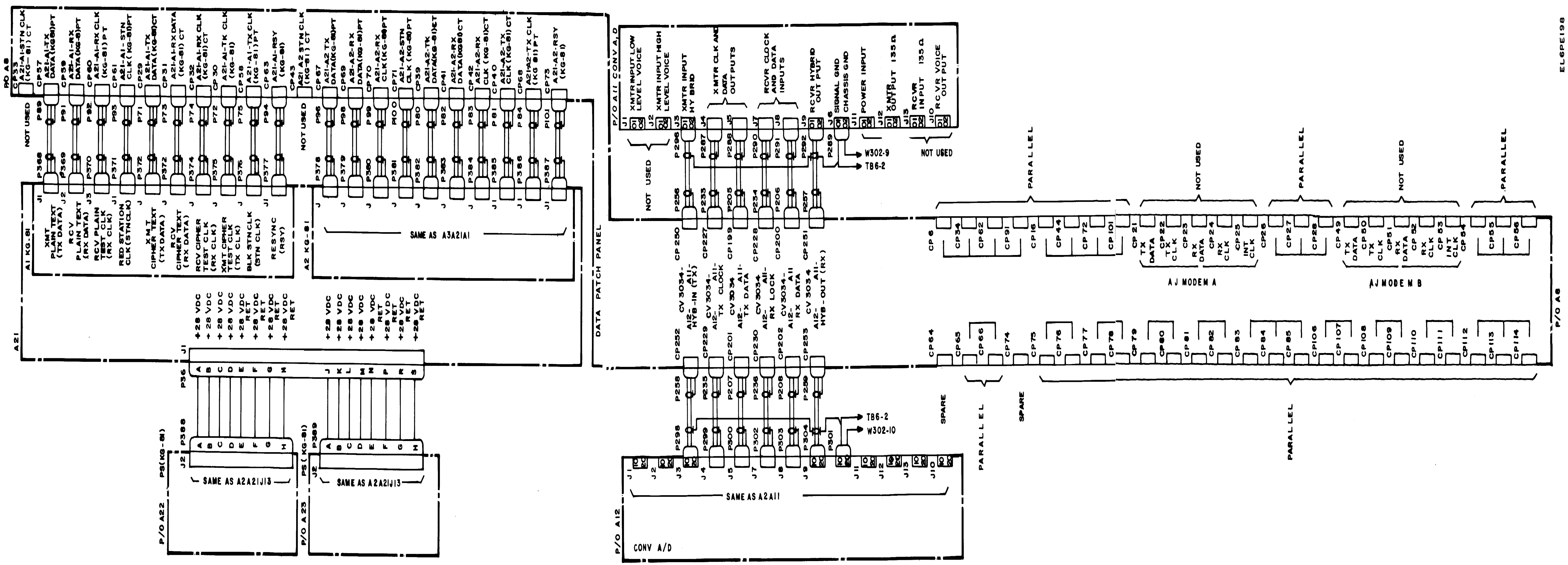
EL6PE197

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 3 of 14).



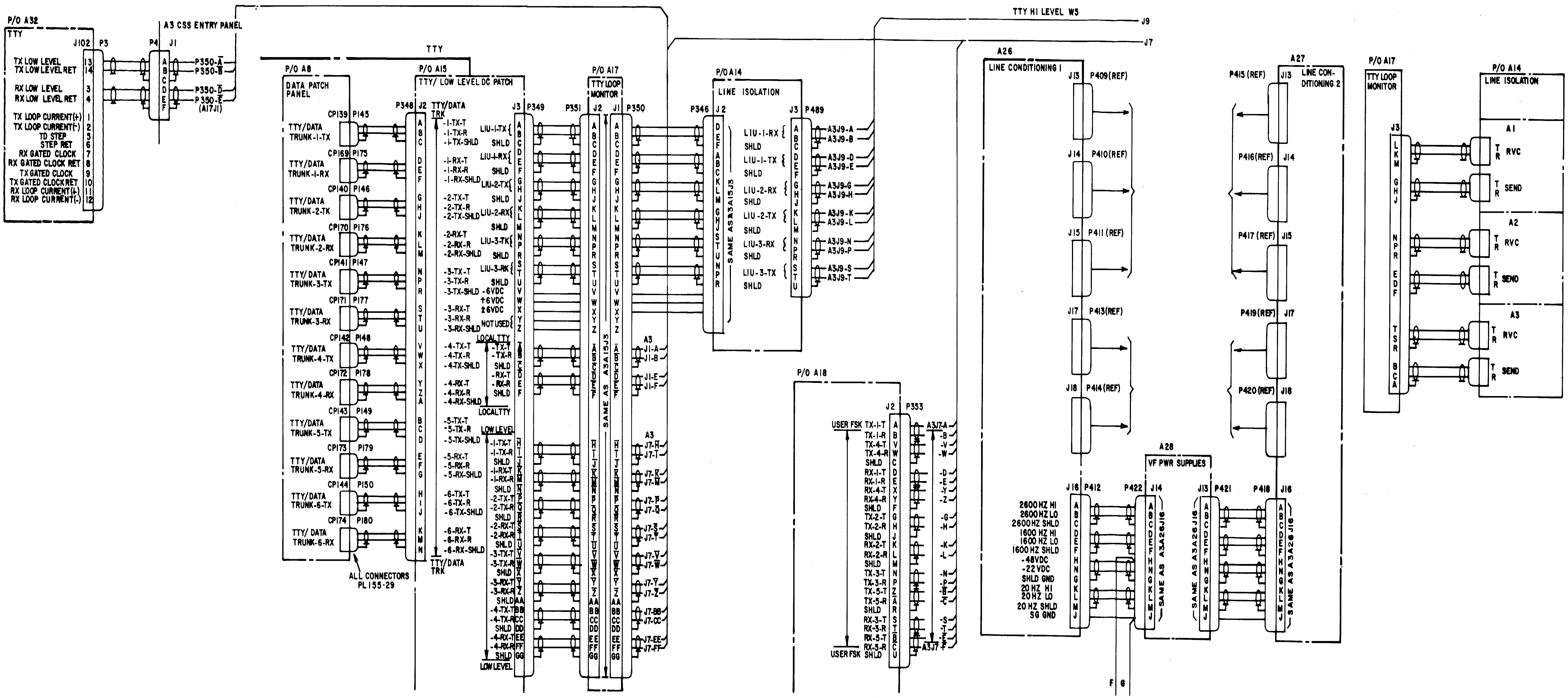
EL6PE209

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 4 of 14).



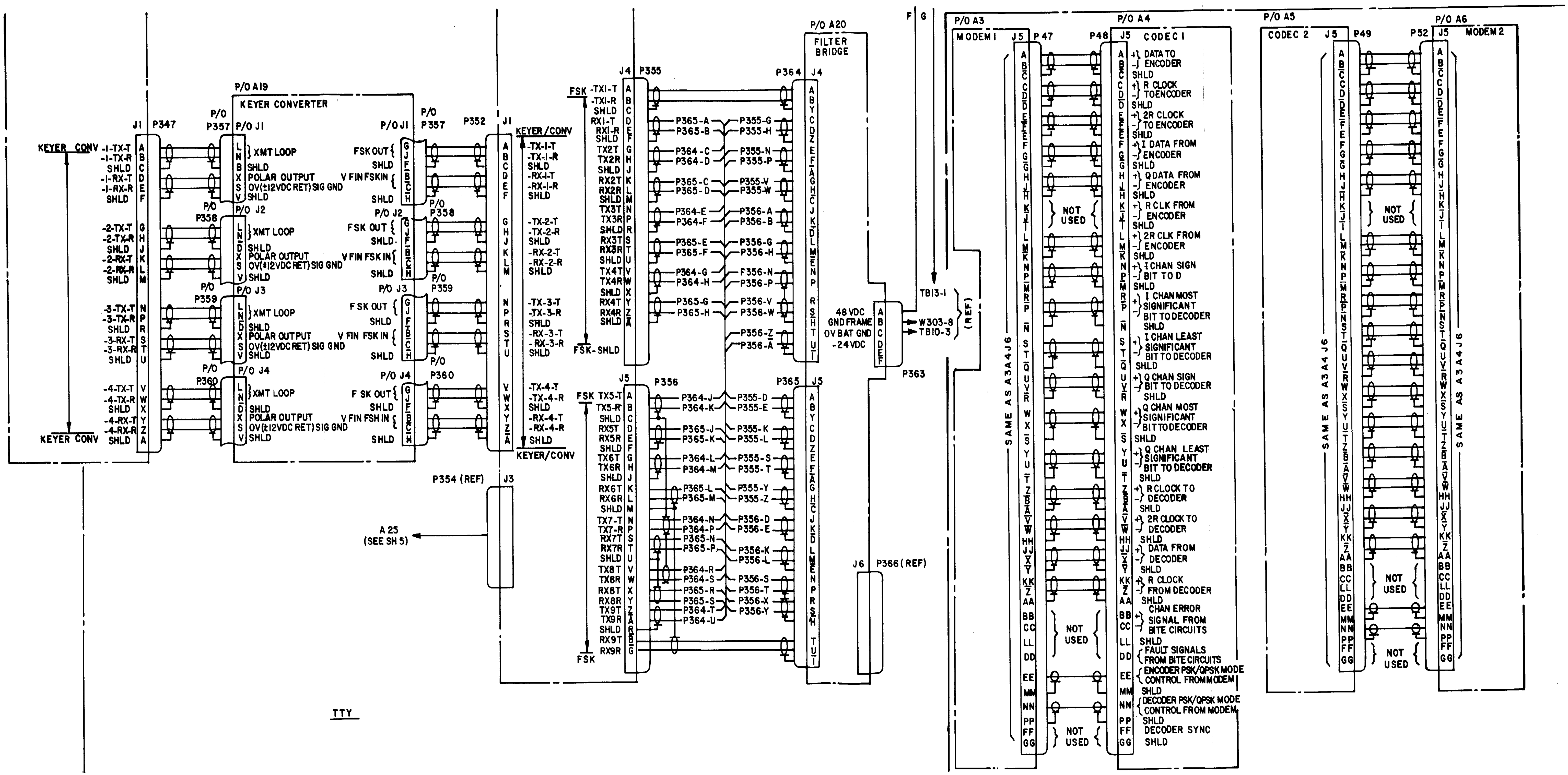
EL6PE200

Figure FO-21. Communication Subsystem, Interconnection Diagram (Sheet 5 of 14).



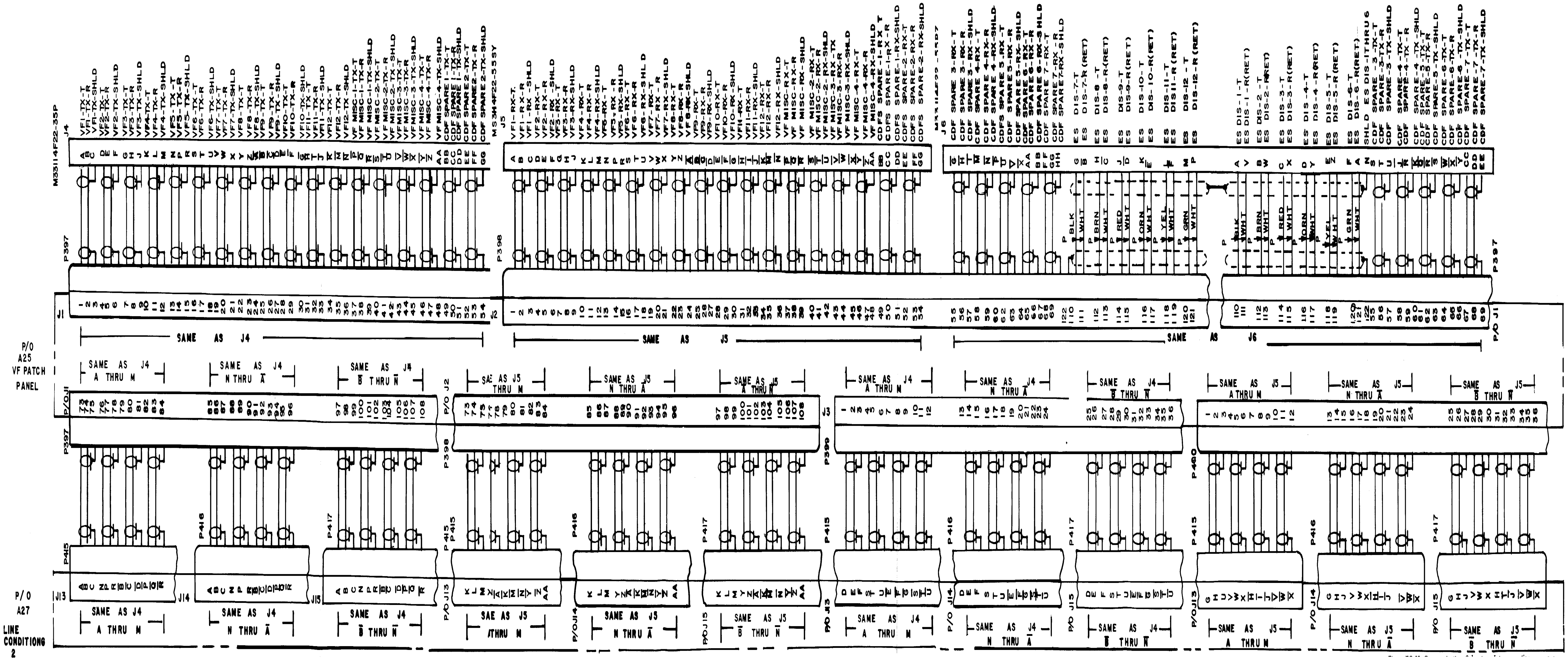
EL6PE199

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 6 of 14).



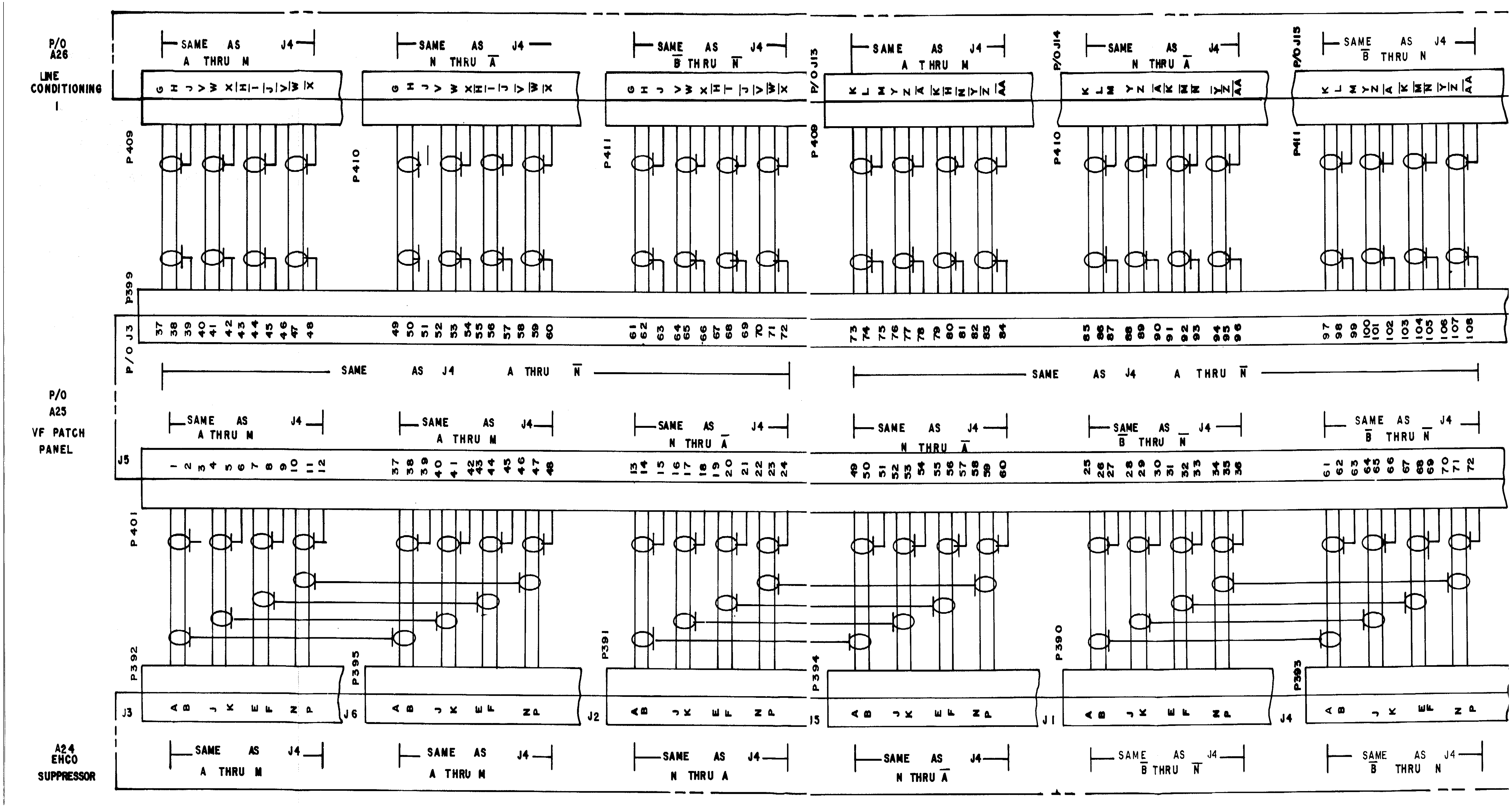
EL6PE200

Figure FO-22. Communications Subsystem. Interconnection Diagram (Sheet 7 of 14)



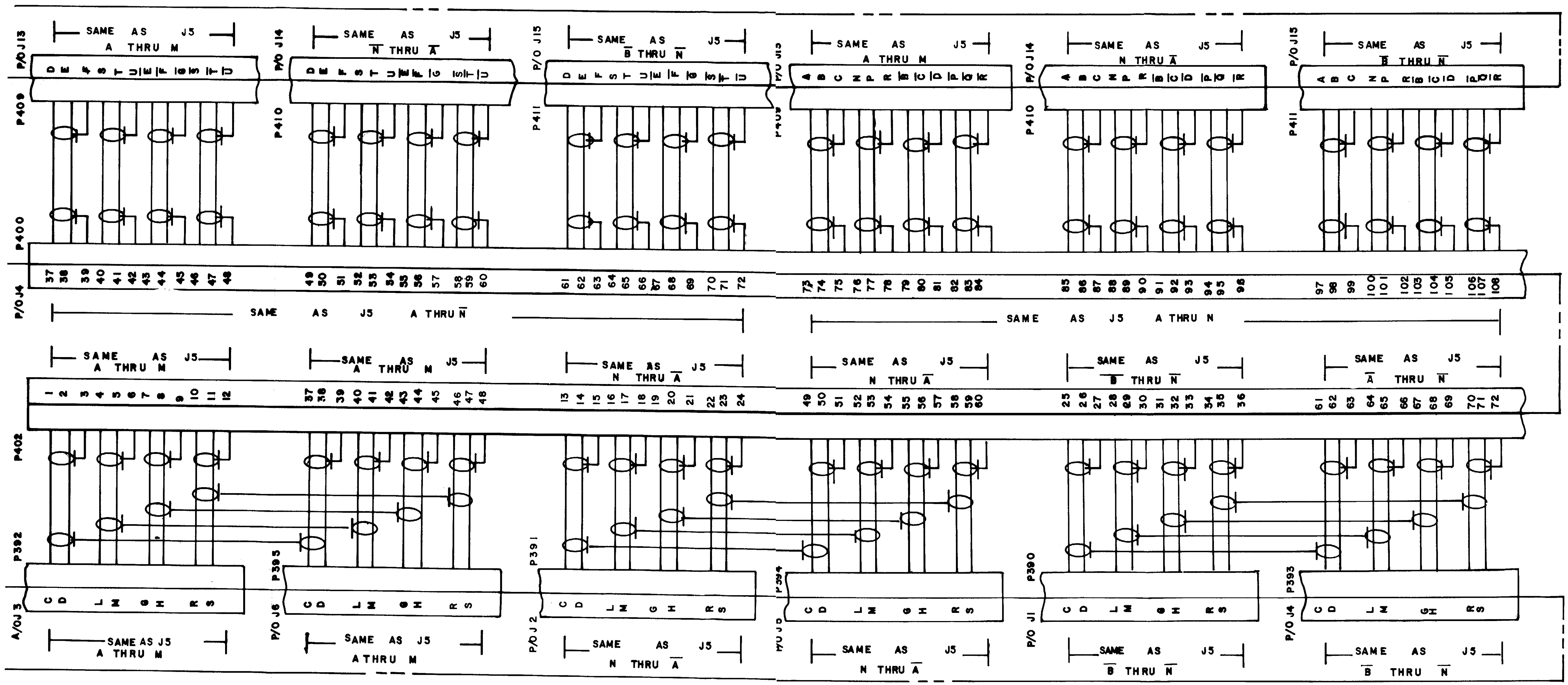
EL6PE201

Figure FO-22. Communication Subsystem, Interconnection Diagram
(Sheet 8 of 14).



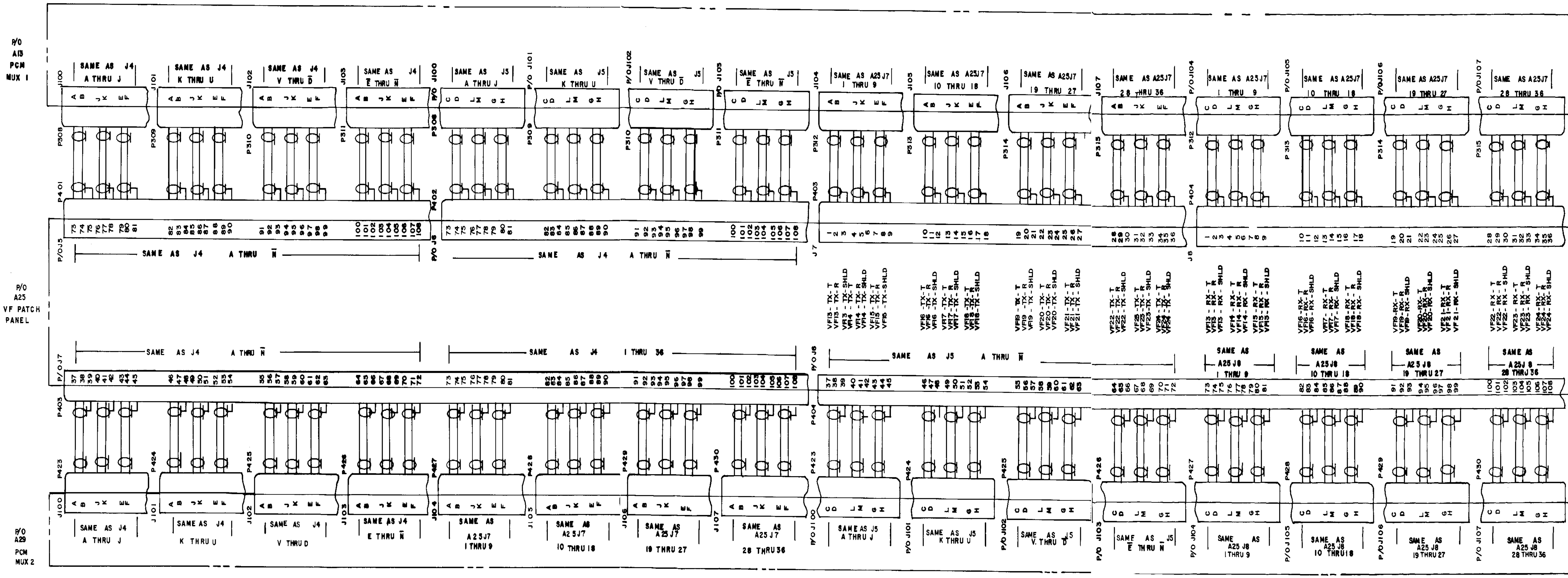
EL6PE208

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 9 of 14).



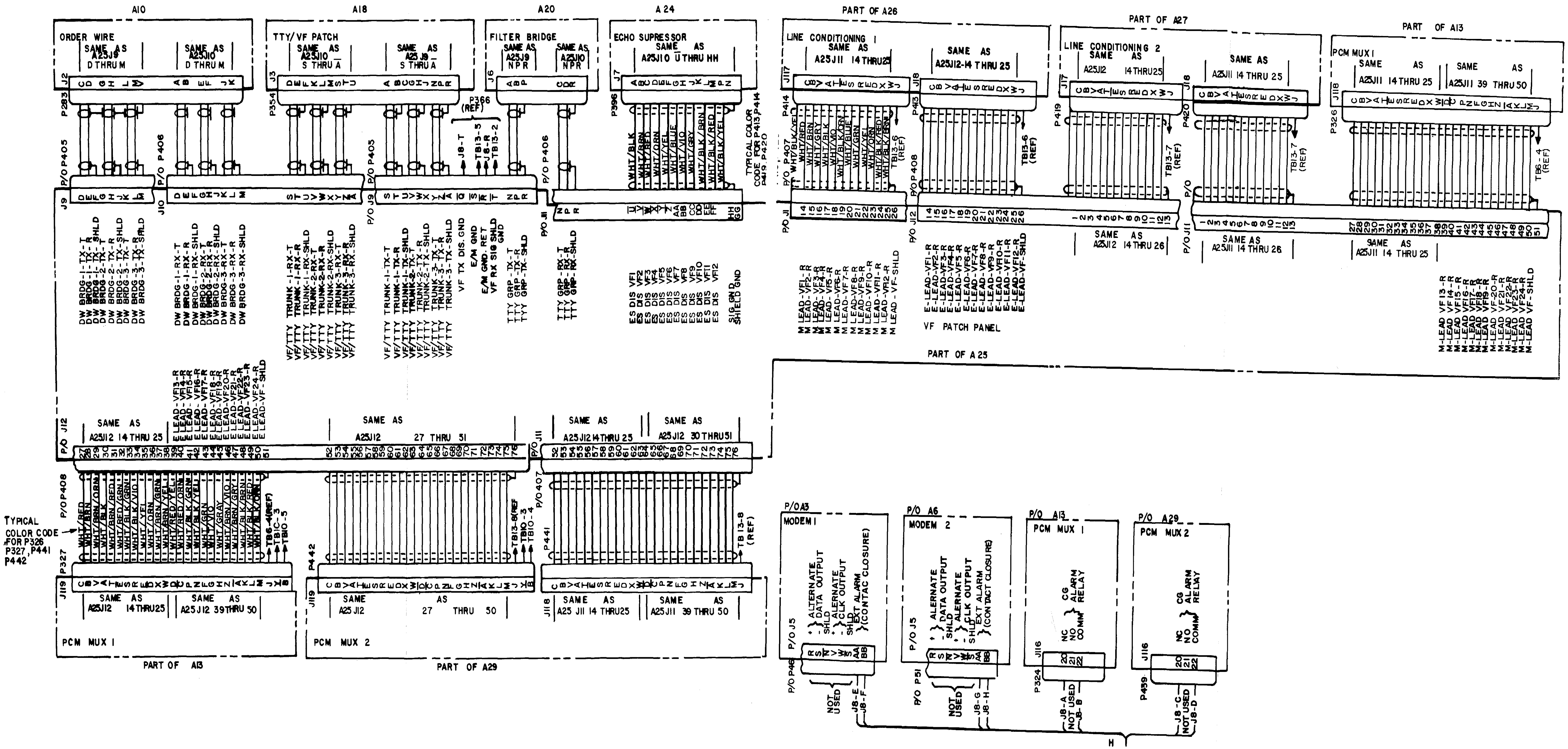
EL6PE207

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 10 of 14).



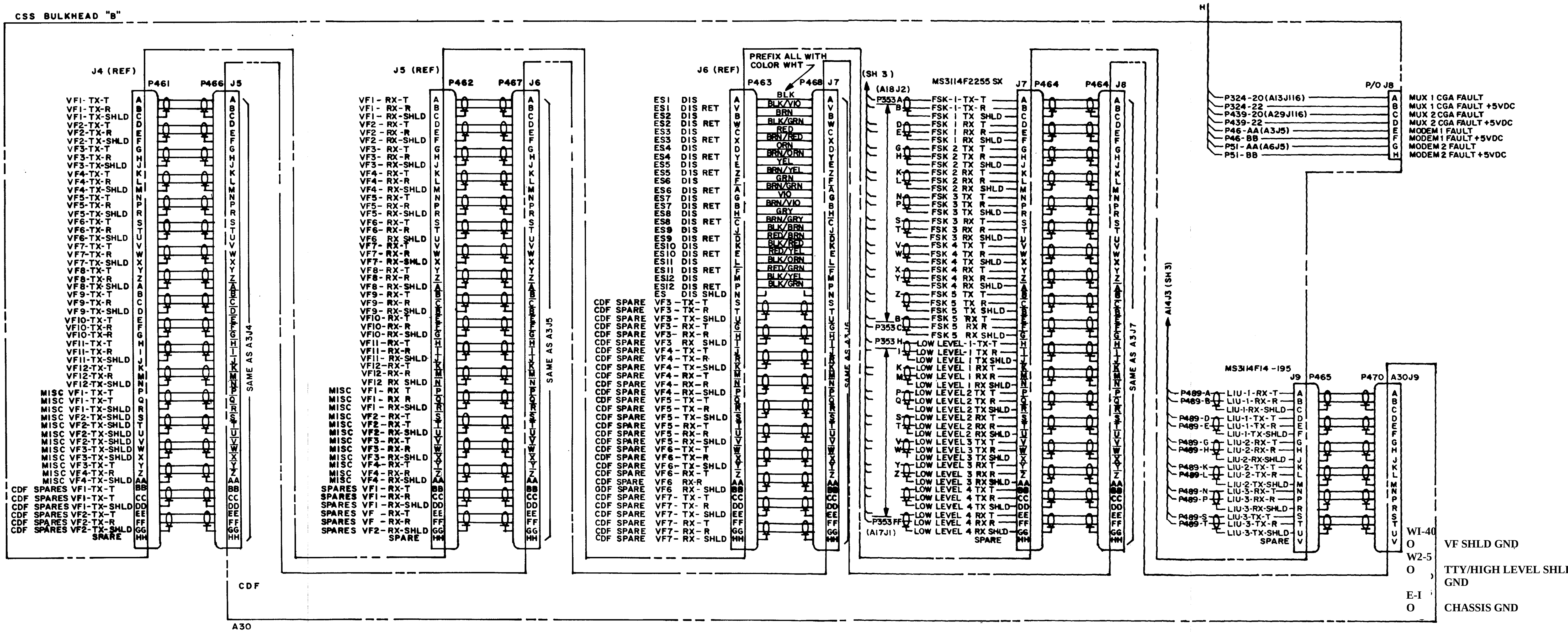
EL6PE202

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 11 of 14).



EL6PE203

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 12 of 14).



EL6PE204

Figure FO-22. Communication Subsystem, Interconnection Diagram (Sheet 13 of 14).

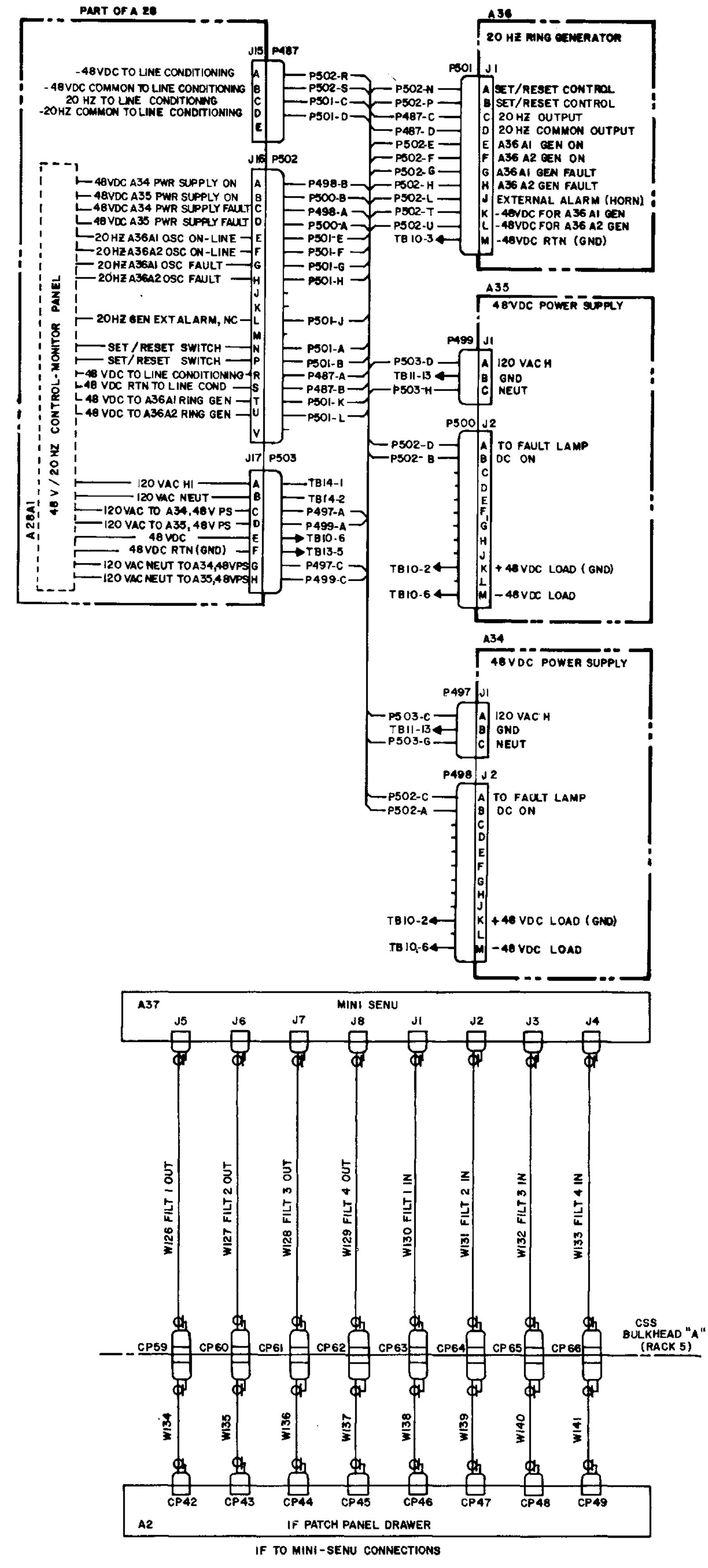


Figure FO-22. Communications Subsystem, Interconnection Diagram (Sheet 14 of 14).

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