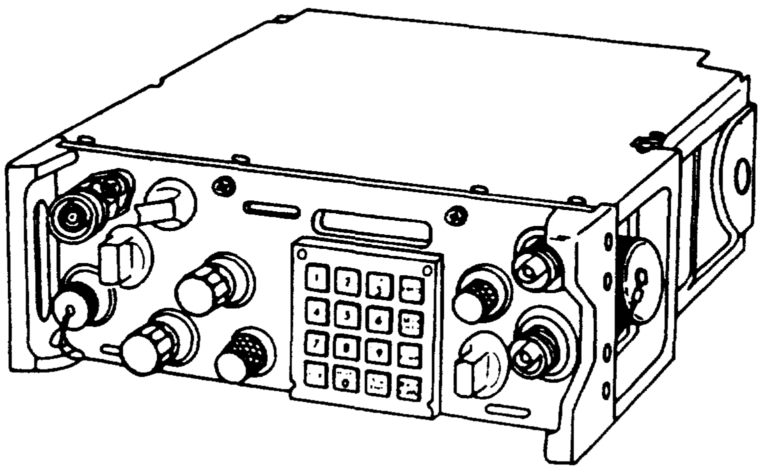
TM 11-5820-890-30

TECHNICAL MANUAL

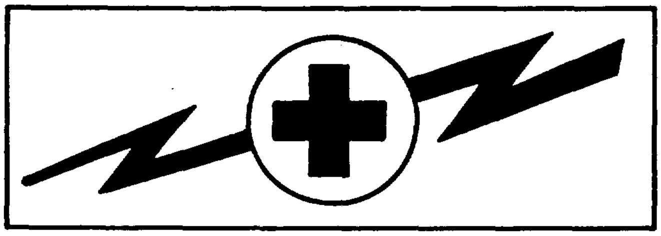
INTERMEDIATE (DIRECT SUPPORT) MAINTENANCE



RECEIVER-TRANSMITTER, RADIO
RT-1439/VRC (NSN 5820-01-195-0827);
AMPLIFIER-ADAPTER, VEHICULAR
AM-7239/VRC (NSN 5895-01-188-8819);
AMPLIFIER, RADIO FREQUENCY
AM-7238/VRC (NSN 5895-01-195-4844):
CONTROL-MONITOR C-11291/VRC
(NSN 5820-01-151-9914);
MOUNTING BASE, ELECTRICAL EQUIPMENT
MT-6352/VRC (NSN 5975-01-188-8873);
BATTERY BOX CY-8346/PRC
(NSN 6135-01-188-8859);
MOUNTING BASE, ELECTRICAL EQUIPMENT
MT-6353/VRC (NSN 5975-01-235-1962):
MAINTENANCE GROUP
OA-9263/GRC (NSN 6625-01-230-2352)
MOUNTING BASE, ELECTRICAL EQUIPMENT
MT-6429/VRC (NSN 5820-01-220-7901)

DEPARTMENT OF THE ARMY

1 MARCH 1988



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

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

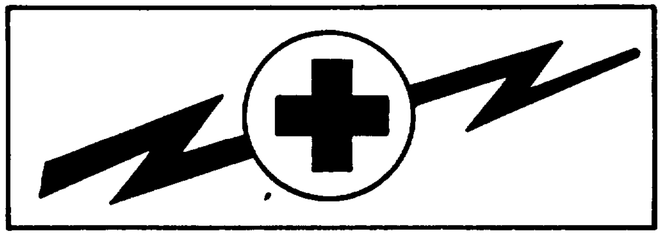
2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A 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

WARNING



HIGH VOLTAGE is present during testing and troubleshooting of Receiver-Transmitter, Radio RT-1439/VRC; Amplifier, Radio Frequency AM-7238/VRC; and Amplifier-Adapter, Vehicular AM-7239/VRC. DEATH ON CONTACT can result so observe the following safety precautions:

If at all possible, work on the equipment only when another person is nearby who is competent in CARDIOPULMONARY RESUSCITATION (CPR) and the five safety steps on page A.

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technicians are aided by operators, they must be warned about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections or 115 volt ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

DO NOT BE MISLED by the terms “low voltage” and “low potential”. Voltages/potentials as low as 50 volts can cause DEATH under certain conditions.

Remove or tape all exposed personal metal objects (e.g., watches, rings, and medallions) before working on C-E equipment.

For Artificial Respiration, refer to FM 21-11.

HARDNESS CRITICAL PROCESS

The RT-1439 series of radio sets have been designed to survive the effects of a nuclear explosion. This includes overpressure and burst, thermal radiation, electromagnetic pulse (EMP), and transient radiation effects on electronics (TREE). These steps that are critical in maintaining the nuclear hardness of the radio. They are marked with $\boxed{\text{HCP}}$.

WARNING

A lithium-sulfur dioxide (Li-SO2) battery used with the Battery Box, CY-8346/PRC contains pressurized sulfur dioxide (S02) gas. The gas is toxic, and the battery MUST NOT be abused in any way which may cause the battery to rupture.

DO NOT heat, short circuit, crush, puncture, mutilate, or disassemble batteries.

DO NOT USE any battery which shows signs of damage, such as bulging, swelling, disfigurement, brown liquid in the plastic wrap, a swollen plastic wrap, etc.

DO NOT test Li-SO2 batteries for capacity.

DO NOT recharge Li-SO2 batteries.

DO NOT use water to extinguish Li-SO2 battery fires if a Shock hazard exists due to high voltage electrical equipment in the immediate vicinity (i.e., greater than 30 volts, alternating current (ac) or direct current (dc).

If the battery compartment becomes hot to the touch, if you hear a hissing sound (i.e., battery venting), or smell irritating sulfur dioxide gas, IMMEDIATELY Turn Off the equipment. Remove the equipment to a well ventilated area or leave the area.

DO NOT use a Halon type fire extinguisher on a lithium battery fire.

In the event of a fire, near a lithium battery(ies), rapid cooling of the battery(ies) is important. Use a carbon dioxide (CO2) extinguisher. Control of the equipment fire, and cooling, may prevent the battery from venting and potentially exposing lithium metal. In the event that lithium metal becomes involved in fire, the use of a graphite based Class D fire extinguisher is recommended, such as Lith-X or MET-L-X.

DO NOT store lithium batteries with other hazardous materials and keep them away from open flame or heat.

C A U T I O N

THIS EQUIPMENT CONTAINS PARTS SENSITIVE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING OR INSERTING PRINTED CIRCUIT BOARDS

GENERAL HANDLING PROCEDURES FOR ESDS ITEMS

USE WRIST GROUND STRAPS OR MANUAL GROUNDING PROCEDURES.
KEEP ESDS ITEMS IN PROTECTIVE COVERING WHEN NOT IN USE.
GROUND ALL ELECTRICAL TOOLS AND TEST EQUIPMENT.
PERIODICALLY CHECK CONTINUITY AND RESISTANCE OF GROUNDING SYSTEM.
USE ONLY METALIZED SOLDER SUCKERS.
HANDLE ESDS ITEMS ONLY IN PROTECTED AREAS.

MANUAL GROUNDING PROCEDURE

MAKE CERTAIN EQUIPMENT IS POWERED DOWN.
TOUCH GROUND PRIOR TO REMOVING ESDS ITEMS.
TOUCH PACKAGE OF REPLACEMENT ESDS ITEM TO GROUND BEFORE OPENING.
TOUCH GROUND PRIOR TO INSERTING REPLACEMENT ESDS ITEMS.

ESD PROTECTIVE PACKAGING AND LABELING

INTIMATE COVERING OF ANTISTATIC MATERIAL WITH AN OUTER WRAP OF EITHER TYPE 1 ALUMINIZED MATERIAL OR CONDUCTIVE PLASTIC FILM

OR

HYBRID LAMINATED BAGS HAVING AN INTERIOR OF ANTISTATIC MATERIAL WITH AN OUTER LAYER OF METALIZED MATERIAL.
LABEL WITH SENSITIVE ELECTRONIC SYMBOL AND CAUTION NOTE, AS ABOVE.

CAUTION

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of the components contain internal gate protection circuits that are partially effective, but sound maintenance practice and the cost of equipment failure in time and money dictate careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

CAUTION

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

STEP 1 Turn off and/or disconnect all power and signal sources and loads used with the unit.

STEP 2 Place the unit on grounded conductive work surfaces.

STEP 3 Ground the repair operator using a conductive wrist strap or other device using a 1 MO series resistor to protect the operator.

STEP 4 Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

STEP 5 All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.

STEP 6 When these devices and assemblies are removed from the unit, they should be placed on the conductive work surface or in conductive containers.

STEP 7 When not being worked on wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.

STEP 8 Do not handle these devices unnecessarily or remove from their packages until actually used or tested.

Technical Manual

No. 11-5820-890-30

Headquarters
Department of the Army
Washington, DC, 1 March 1988

Intermediate (Direct Support) Maintenance Manual

Receiver-Transmitter, Radio RT-1439/VRC (NSN 5820-01-195-0827)
Amplifier-Adapter, Vehicular AM-7239/VRC (NSN 5895-01-188-8819);
Amplifier, Radio Frequency AM-7238/VRC (NSN 5895-01-195-4844);
Control-Monitor C-11291/VRC (NSN 5820-01-151-9914);
Mounting Base, Electrical Equipment MT-6352/VRC (NSN 5975-01-188-8873);
Battery Box CY-8346/PRC (NSN 6135-01-188-8859);
Mounting Base, Electrical Equipment MT-6353/VRC (NSN 5975-01-235-1962);
Maintenance Group OA-9263/GRC (NSN 6625-01-230-2352);
Mounting Base, Electrical Equipment MT-6429/VRC (NSN 5820-01-220-7901).

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 directly to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5000.

A reply will be furnished to you.

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS(Continued)

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES

HOW TO USE THIS MANUAL

This manual is divided into ten chapters. Chapter 1 is an introduction to the equipment. Chapters 2 through 10 are on the units maintained by the Intermediate (Direct Support) (I(DS)) Maintenance. Each chapter begins with an index to the sections. Most of the sections also begin with indexes.

How to Find Something Fast. Check the index on the front cover. The sections you will use most often are boxed on the front cover. The boxes line up with edge marks on the pages. If you need something that is not listed there, use the index in the back of this monual.

Operating Procedures and Unit Maintenance Instructions. Procedures for operating the equipment are not included in this manual. You should read the Operator's Manual TM 11-5820-890-10-1 and be familiar with the procedure in it prior to performing I(DS) maintenance. Also, the information in the Unit Maintenance Manual TM 11-5820-890-20-1 and -2 is not repeated in this manual.

Read all preliminary information found at the beginning of each procedure. It has important information and safety instructions you must follow before beginning work.

Warning pages are at the beginning of this manual. You should learn the warnings before doing maintenance on the equipment. Always follow appropriate safety procedures and precautions.

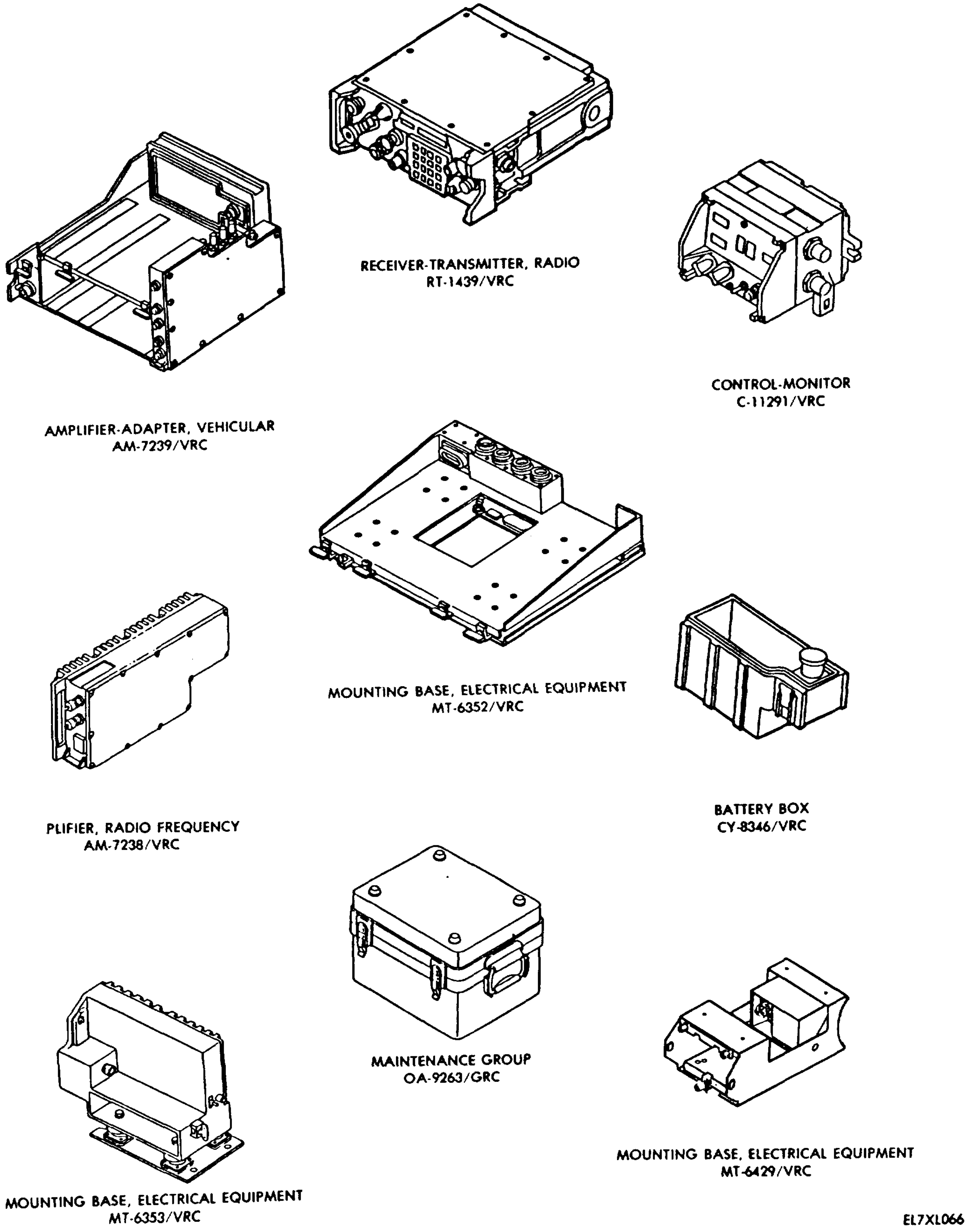


Figure 1-1. RT-1439 Series Radio Components.

CHAPTER 1

INTRODUCTION

OVERVIEW

This chapter provides general information about the communication-electronics (C-E) items of equipment that make up the RT-1439 series of radio sets.

The principles of operation and specific maintenance instructions for the components are included in the maintenance chapter.

Section I. GENERAL INFORMATION

1-1. SCOPE.

Type of Manual: This manual covers the intermediate (direct support) level of maintenance for the RT-1439 series of radio sets.

Model Numbers and Equipment Names: The following equipment is covered:

Receiver-Transmitter, Radio RT-1439/VRC
Amplifier-Adapter, Vehicular AM-7239/VRC
Amplifier, Radio Frequency AM-7238/VRC
Control-Monitor C-11291/VRC
Mounting Base, Electrical Equipment MT-6352/VRC
Battery Box CY-8346/PRC
Mounting Bose, Electrical Equipment MT-6353/VRC
Maintenance Group OA-9263/GRC
Mounting Base, Electrical Equipment MT-6429/VRC

They ore shown in figure 1-1.

Purpose of Radio Sets: The purpose of the RT-1439 series of radio sets is to provide short-range, two-way radio communication in the 30 to 87.975 MHz range, using frequency-modulated (FM) transmission and reception.

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 25-30 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 DA Pam 738-750 as contained in Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed by AR 735-11-2/DLAR 4140-55/NAVMATINST 4355-73B/AFR 400-54/MCO 4430.3F.

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 4610.3C/AFR 75-18/MC0 P4610.19D/DLAR 4500.15.

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your RT-1439 radio set component needs improvement, let us know. Send us on 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: Commonder, US Army Communications-Electronics Command and Fort Monmouth. ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey, 07703-5000. We'll send you a reply.

1-5. ADMINISTRATIVE STORAGE.

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to insure operational readiness. Disasembly and repacking of equipment for shipment or limited storage are covered in paragraphs 2-50, 3-25, 4-22, 5-24, 6-10,7-9, 8-23, 9-24, and 10-10.

1-6. NOMENCLATURE CROSS-REFERENCE LIST.

This list contains common names used throughout this monual in place of official nomenclature.

Common Name	Official Nomenclature
Battery box	Battery Box CY-8346/PRC
COMSEC Mount	Mounting Base, Electrical Equipment MT-6429/VRC
Control-monitor	Control-Monitor C-11291/VRC
Counter	Frequency Counter TD-1225(V)1/U
DMM	Digital Multimeter AN/USM-486
ECCM fill device	Fill Device, Electronic Counter-Countermeasures MX-10579/VRC
Function generator	Function Generator SG-1171/U
Handset	Handset H-250/U
Holding battery	Battery, Holding BA-1372/U
Interconnecting device	Interconnecting Device J-4404/GRC
Maintenance group	Maintenance Group OA-9263/GRC
Mounting adopter	Amplifier-Adapter, Vehicular AM-7239/VRC
Mounting base	Mounting Base, Electrical Equipment MT-6352/VRC
PA mount	Mounting Base, Electrical Equipment MT6353/VRC

1-6. NOMENCLATURE CROSS-REFERENCE LIST. Continued

Common Name	Official Nomenclature
Power amplifier	Amplifier, Radio Frequency AM-7238/VRC
Rt	Receiver-Transmitter, Radio RT-1439IVRC
Scope	Oscilloscope AN/USM-488
Signal generator	Signal Generator SG-1112
Test adapter	Adapter, Test pn A3013826-1
Test power supply	Power Supply HP 6434B
Test radio	Radio Set AN/VRC-87 (part of maintenance group)

Section II. EQUIPMENT DESCRIPTION AND DATA

1-7. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

Refer to Operator's Manual TM 11-5820-890-10-l and Unit Maintenance Manuals TM 11-5820-890-20-1 and 11-5820-890-20-2 for general information on the characteristics, capabilities, and features of this equipment.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

Refer to sections I and IV of the maintenance chapters for the location and description of major internal components.

1-9. EQUIPMENT DATA.

RECEIVER-TRANSMITTER. RADIO RT-1439/VRC

Audio input impedance	150 ohms
Audio input level	0.7 to 2.1 mV rms
Audio frequency response	300 to 2000 Hz
Audio distortion (max)	7 percent
Audio output power	50 mW
Sidetone level	3 to 9 dB below received audio level
Squelch tone	150 Hz (147 to 153 Hz)

1-9. EQUIPMENT DATA. Continued

Receive sensitivity	
Audio, SC	-116 dBm
Audio, FH	-115 dBm
16 kb/s, SC	-116 dBm
16 kb/s, FH	-115 dBm
75 b/s to 4.8 kb/s, SC	-116 to -112 dBm
75 b/s to 4.8 kb/s, FH	-115 to -111 dBm
AD1, SC	-112 dBm
AD1, FH	-110 dBm
AD2, SC	-117 dBm
AD2, FH	-116 dBm
Rf frequency accuracy	±3 PPM
Holding battery current drain (max)	
Clock on	1.2 mA
Clock off	0.5 mA
Worm-up time (max at 20° to 30°C)	
Operational (±50 PPM)	10 seconds
Specification (±3 PPM)	1 minute
AMPLIFIER-ADAPTER, VEHICULAR AM-7239/VRC	
Audio output power	0.2 W (intercom) into 150 ohms 1.0 W (speaker) into 600 ohms
Audio distortion (max)	3 percent
Frequency response	300 to 3000 Hz
AMPLIFIER, RADIO FREQUENCY AM-7238/VRC	
Rf gain	11 dB
Power output with 4 W input	50 W (45 to 48.4 dBm)
Signal loss in receive or low power transmit (max)	0.75 dB

1-10. SAFETY, CARE, AND HANDLING.

Safety hazards are present when testing and troubleshooting the equipment. Review the WARNINGS and CAUTIONS in the front of this manual and in each maintenance chapter. WARNINGS provide information on safety hazards that can cause personal injury. The high voltage present during some of the tests can cause death. CAUTIONS provide information on safety hazards that can cause equipment damage. Most of the modules have integrated circuits that can be damaged by static electricity.

CHAPTER 2

RECEIVER-TRANSMITTER, RADIO RT-1439/VRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

2-1. INTRODUCTION.

The rt can be divided into five parts or functional sections. They are:

Control Section

RF Section

Audio/Data Section

Power Supply

RT Chassis

Figure 2-1 illustrates the basic interconnections of the rt sections. Figure 2-2 shows the partitioning of the rt.

The control section contains the microprocessors, programming, and interface circuits that:

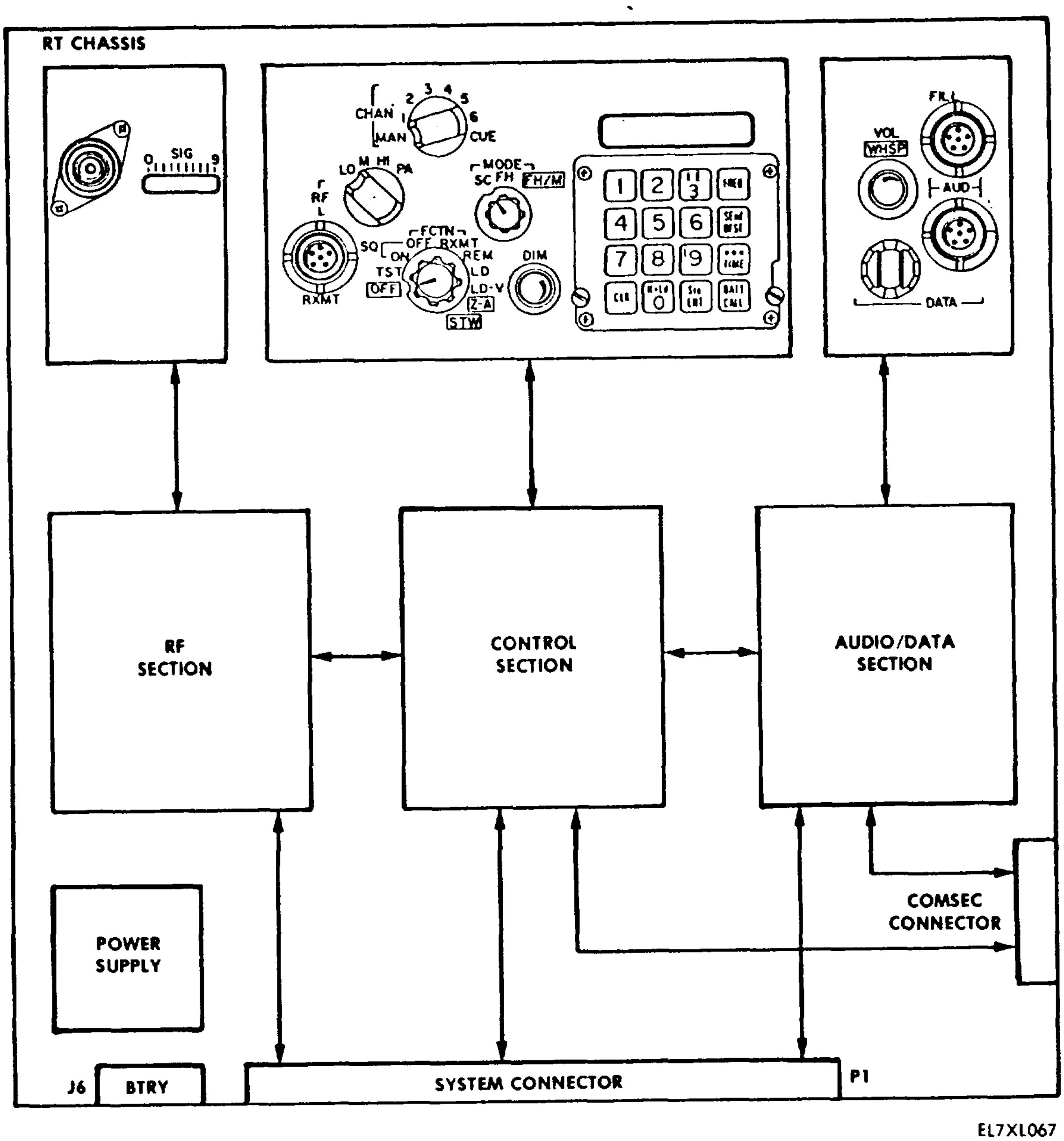


Figure 2-1. RT Functional Sections Block Diagram,

2-1. INTRODUCTION. Continued

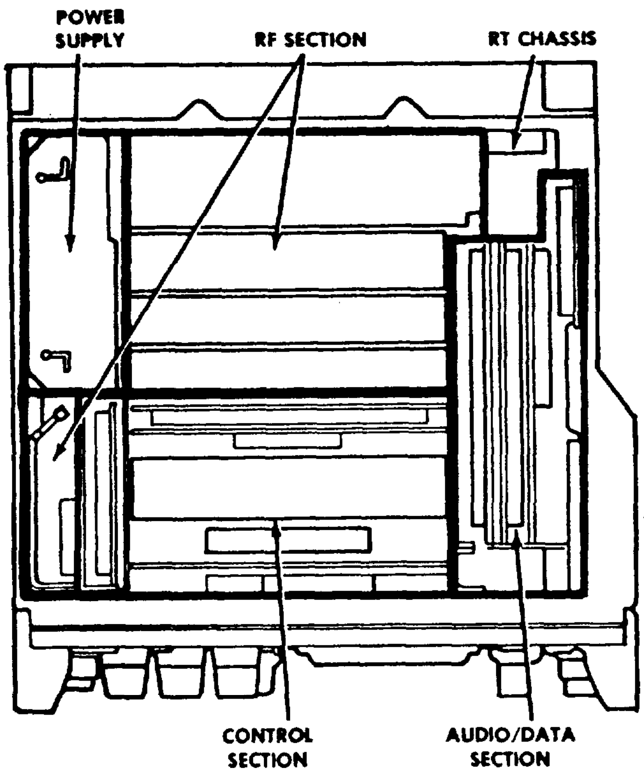


Figure 2-2. RT Partitioning of Functional Sections

Scan the front panel for operator instructions.

Provide feedback to the operator through the keyboard display.

Control frequency selection during FH operation.

Control signal routing between modules.

Provide the remote control interface.

The control section is described in paragraph 2-2.

The rf section is digitally tuned by the control section. When receiving, it demodulates the rf signal. The recovered audio or data signal is routed to its destination through the control section. When transmitting, it modulates the rf carrier with the audio or data signal. The rf section is described in paragrapn 2-3.

The audio/data section provides:

The interface circuitry for audio and data input/output (I/O).

Audio/data signal level control.

Enhanced data handling capability.

COMSEC interface.

2-1. INTRODUCTION. Continued

The audio/data section is described in paragraph 2-4.

The power supply converts the dc input voltage into the voltages required by the other modules in the rt. It is described in paragraph 2-5.

The rt chassis includes:

The front panel with its switches, controls, connectors and displays.

The module interconnections.

Frame for physical support of the modules.

System, battery and COMSEC connectors.

It is described in paragraph 2-6.

A description of the types of signals present in the rt is included in paragraph 2-7.

Paragraphs 2-8 through 2-21 provide functional description of the rt in different modes of operation.

2-2. CONTROL SECTION.

The control section consists of five modules. They are:

Electronics Components Assembly - Control 1A4 (control module).

Control, Counter-Countermeasures, Electronic 1A5 (ECCM module).

Circuit Card Assembly, Remote I/O 1A2 (remote I/O module).

Circuit Card Assembly, Two-Wire Interface 1A6. (two wire interface).

Circuit Card Assembly, Switching 1A7 (switching module).

The module locations are shown in figure 2-3.

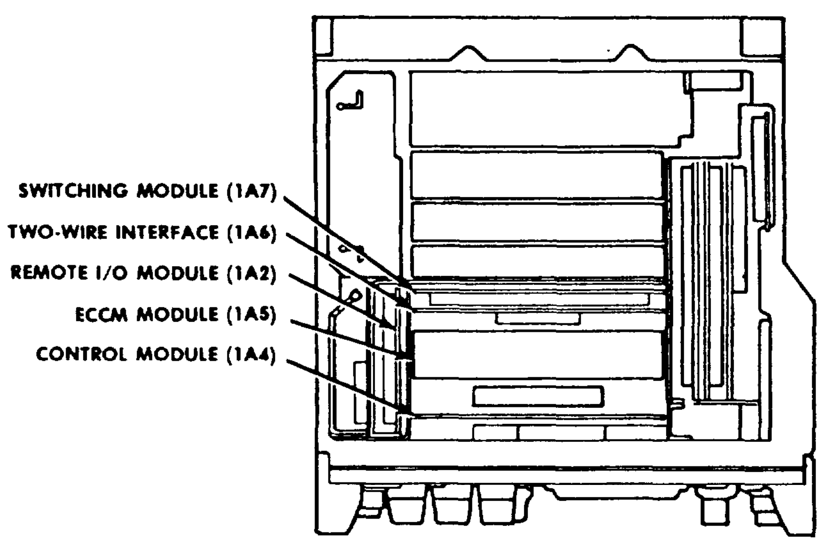


Figure 2-3. Control Section Module Locations

2-2. CONTROL SECTION. Continued

The control module contains a microprocessor and the programming used in single channel operation. Buffers, registers, and interface circuits are included to permit the microprocessor to communicate with the other rt modules. It checks the FCTN, MODE, RF, and CHAN switches and the keyboard for operator action. If the operator action's are valid, the other modules and the front panel display are informed of any directed changes. Control signals are described in paragraph 2-14.

The ECCM module also contains a microprocessor and the programming used in frequency hopping operation. The ECCM module has two connectors. One connects to the control module and the other to the rt chassis. When the MODE switch is set to FH or FH/M, the microprocessor in the control module executes instructions in the ECCM module. It uses the hopset and lockout sets to build o look-up table of frequencies. The TRANSEC variable, time-of-day, and net ID number are used to select a frequency from that table. When transmitting, the ECCM module converts the analog signal into a digital data signal. The ECCM module microprocessor interleaves the data signal onto the frequency hops. When receiving, the process is reversed. Frequency hopping operation is described in detail in paragraph 2-15.

The remote I/O module and two-wire interface provide the remote operating capability. The two-wire interface sends and receives information to and from the remote control unit over a two-wire link. Control information is encoded using frequency shift keying (FSK). It converts instructions received into a digital data stream for the remote I/O module. A microprocessor in the remote I/O module interprets the instructions and exchanges data with the control module. During remote operation, the control module executes instructions from the remote I/O module instead of the front panel. Remote operation is described in detail in paragraph 2-19. (Also see Chapter 5 on the control-monitor.)

The switching module functions like a railroad switching yard. Many signals ore routed between modules through the switching module. The path the signals take is determined by control input signals. It also performs the following functions.

Bit synchronization.

Premodulation filtering.

Tone squelch.

Notch filtering.

Module level control.

Generation of clock frequencies using the 3.2 MHz clock signal from the synthesizer.

Input and output control during retransmit operation.

The switching module is involved in most functions of the rt.

2-3. RF SECTION.

The rf section consists of five modules. They are:

Network, Impedance Matching 1A1

IF/Demodulator 1A8

Tuner/Mixer 1A9

Synthesizer, Electrical Frequency 1A10 (synthesizer)

Exciter/Power Amplifier 1A11

The module locations are shown in figure 2-4.

2-3. RF SECTION. Continued

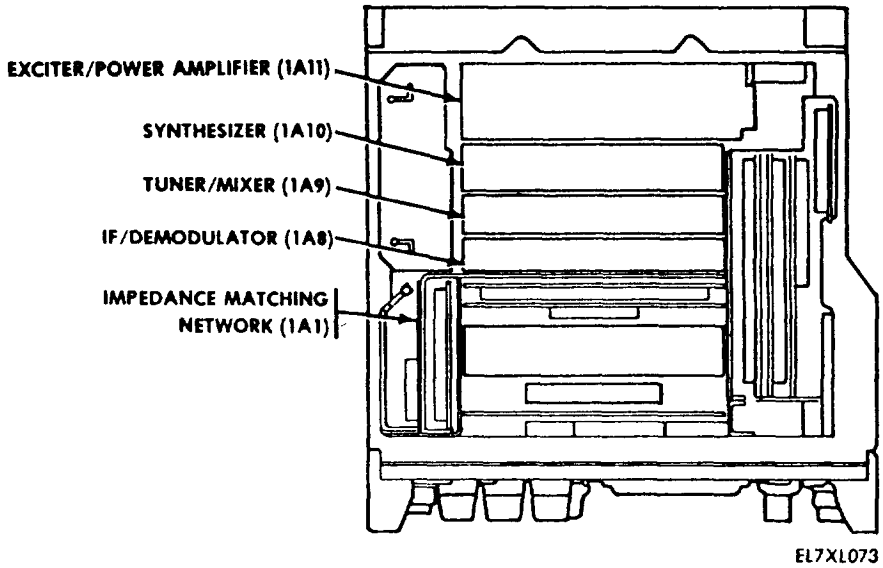


Figure 2-4. RF Section Module Locations

The impedance matching network provides the impedance matching required for the rt to operate with two different antenna types. It provides a 50-ohm impedance when used with a vehicular antenna. To keep the VSWR below 3.5:1 when used with a manpack antenna, one of the module's five matching circuits is used. The module receives frequency data from the control module which is used to select the matching circuit. A detector in the module checks the VSWR when transmitting with a manpack antenna. If it goes above 5:1, sidetone is disabled.

The tuner/mixer and IF/demodulator perform basic receive functions. The tuner/mixer filters and amplifies the received rf signal and mixes it with the local oscillator (LO) signal from the synthesizer. The resulting if signal is sent to the IF/demodulator. It demodulates the if signal to recover the transmitted audio or data signal. The IF/demodulator detects cue signals during FH operation. Receive operation is described in paragroph 2-10.

The exciter/power amplifier performs the basic transmit functions. It modulates the rf carrier with the audio or data signal. It then amplifies it to the required output level. Transmit operation is described in paragraph 2-11.

The synthesizer provides the reference frequencies for the tuner/mixer and the exciter/power amplifier.

2-4. AUDIO/DATA SECTION.

The audio/data section consists of four modules. They are:

Circuit Card Assembly, Audio Power Supply 1A12 (audio power supply)

Circuit Card Assembly, Audio Control 1A13 (audio control module)

Circuit Card Assembly, Audio/Data I/O 1A14 (audio/data I/O module)

Circuit Cord Assembly, Data Adapter 1A15 (data rate adapter)

The module locations are shown in figure 2-5.

2-4. AUDIO/DATA SECTION. Continued

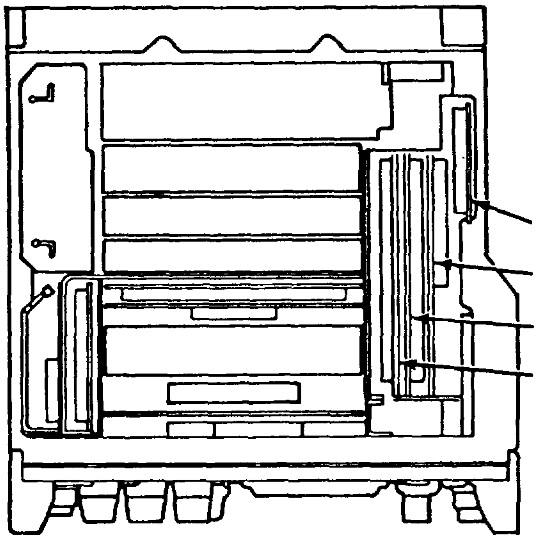


Figure 2-5. Audio/Data Section Module locations

This section includes the COMSEC interface circuitry. All signals passing between the audio/data section and the rest of the rt are filtered or buffered by the audio power supply. These signals inside the audio/data section are called RED signals to ovoid confusion. The audio power supply also odds the 150-Hz squelch tone to the audio/data signal to be transmitted.

The audio control module performs the following functions:

Generation of audio/data section control signals.

Routing of data signals to the data rate adopter.

Plain text/cipher text (PT/CT) signal routing.

Controls the push-to-talk line inside the audio/data section.

The audio/data I/O module controls signal routing within the audio/data section. It also contains the microphone and audio output amplifiers.

The data rate adapter performs the following functions:

Interleaves and deinterleaves low speed data into the 16 kb/s data rate of the rt.

Provides error correction at low speed data rates..

Adds a synchronization preamble to the start of data transmissions to identify the type of data being transmitted.

Inserts and removes transitions in plain text data modes.

Generates low speed data clocks and synchronizes local clocks.

2-5. POWER SUPPLY (1A3).

The power supply is a dc-to-dc solid state power converter. It requires an input voltage of 10.5 to 15 V dc (13 V dc nominal). The maximum current required is 865 mA. Its output voltages ore as follows:

DC Output Voltage (V dc)	Maximum Current (mA)	Maximum Ripple (mV p-p)
6.75 (6.55 to 6.95)	440	10
10.0 (9.7 to 10.3)	180	10
-10.0 (-9.7 to -10.3)	95	10
60.0 (54 to 70)	0.8	25
3.0 (2.85 to 3.15)	890 peak 220 continuous	10

Figure 2-6 shows the location of the power supply. Figure 2-7 is a functional block diagram of the power supply.

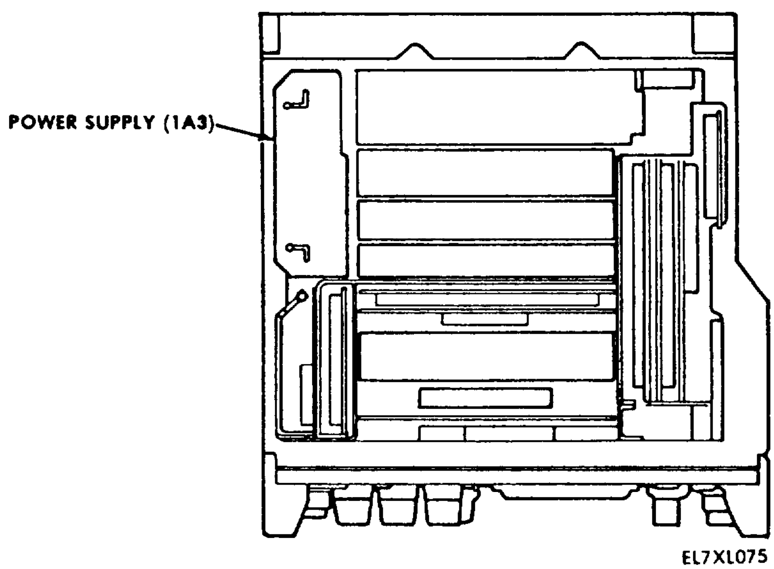


Figure 2-6. Power Supply Location

2-5. POWER SUPPLY (1A3). Continued

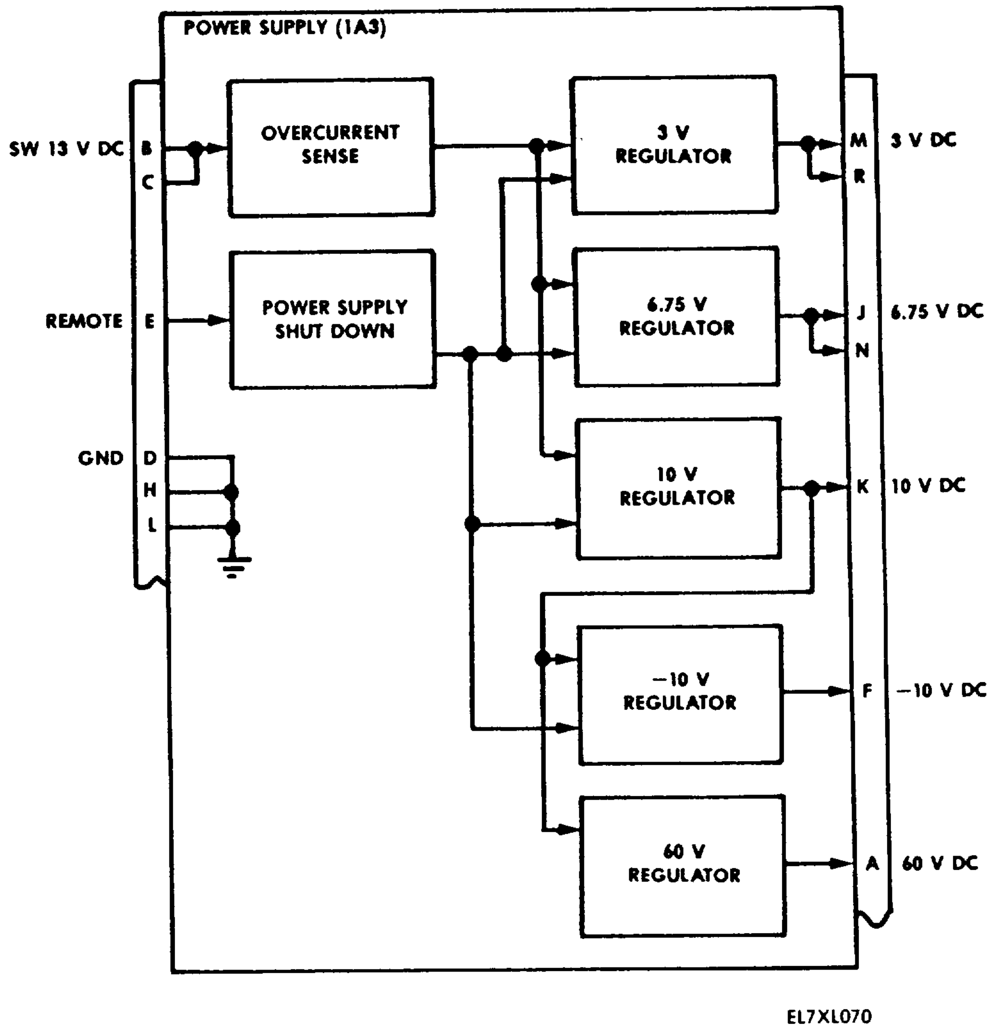


Figure 2-7. Power Supply Functional Block Diagram

The power supply outputs are over-current protected. If an output is shorted to ground, the power supply will shut down.

CAUTION

> The power supply will not be damaged if an output is shorted. However, other modules in the rt may be damaged if this occurs. Exercise caution when troubleshooting the rt.

The power supply will also shut down if 6 V dc is applied to pin E. This is used by the two-wire interface to turn the rt off during remote operation.

The other modules in the rt use the output voltages as listed in Table 2-1.

2-5. POWER SUPPLY (1A3). Continued

Table 2-1. Power Supply Output Destinations

Voltage	Destinations
6.75 v dc	1A1-A, 1A2-R, 1A4-8, 1A5H, 1A6-X, 1A7-77, 1A8-P, 1A9-F, 1A10-J, 1A11-X, 1A12-47, J1-KK, J2-E
10.0 V dc	1A5-B, 1A6-T, 1A7-76, 1A8-Q, 1A9-C, 1A10-F, 1A11-F, 1A12-41
3.0 V dc	1A1-M, 1A9-B, J2-D
60 V dc	1A1-Q, 1A11-R
-10.0 v dc	1A5-D, 1A6-Z, 1A7-72, 1A8-O, 1A9-A, 1A10-H, 1A11-D, 1A12-57, J2-A

2-6. RT CHASSIS (1A16).

The rt chassis includes the front panel, backplane assembly (parent board), and frame. The controls and connectors on the front panel ore used to direct the operation of the rt. The keyboard and SIG displays provide feedback to the operator. The parent board has 15 sockets for the plug-in modules (1A1 through 1A15). It also has three connectors that mate with the front panel connectors. It provides most of the module interconnections. The terminals (E fields) are used as solder points for wires and the flexible circuits that interconnect it to the system and COMSEC connectors. Figure 2-8 identifies the external connectors.

There are two elapsed time meters (ETM1 and ETM2) on the parent board. ETM1 operates off of the 6.75 V dc line. It indicates the total time the rt is on. ETM2 operates from the T/R line. It indicates the number of hours the rt has been transmitting.

CAUTION

Do not attempt to measure ETM resistance. The ETM's use very small voltages and currents and can be damaged by the DMM probe voltage.

The frame provides physical supports for the modules. The covers must be properly installed and the screws torqued to provide the required environmental protection.

Two interlock switches are present on the rt chassis. They protect the TRANSEC variable. They are connected to the ECCM module at pin e through E73. If an rt cover is removed, the switches ground E73. This will cause the ECCM module to zeroize the TRANSEC variable. When troubleshooting an rt with its cover removed, the interlock switch levers must be fully extended to use the FH mode.

2-7. BASIC RT SIGNAL TYPES.

There are five basic signal types used in the rt:

Analog
Digital
Control
Power
RF

Analog signals include the audio and analog data signals. They can vary greatly in signal level, shape, and frequency.

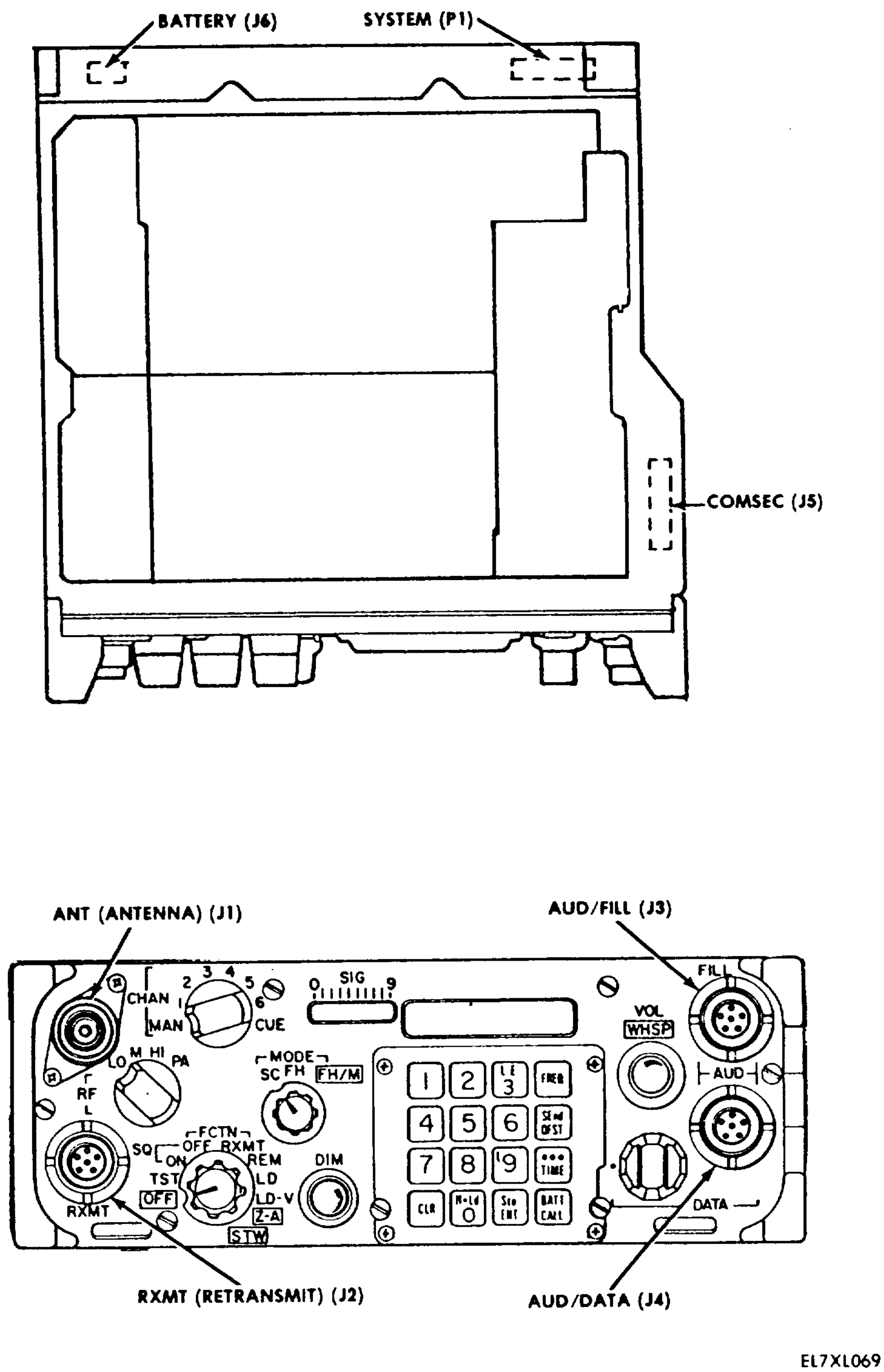


Figure 2-8. RT Chassis External Connectors

2-7. BASIC RT SIGNAL TYPES. Continued

Digital signals include the timing clocks and digital data signals. The clocks are used to synchronize the serial digital data streams between modules. Within the rt they are typically at logic 0 and logic 1 levels. Logic 0 is -0.5 to 0.5 V dc. logic 1 is 6.25 to 7.25 V dc. Clock frequencies vary. Rt I/O digital signals use the ±5 V logic levels as required by MIL-STD-188-114. logic 0 is 5 V dc. logic 1 is -5 V dc. The ECCM fill device uses 0 V for logic 1 and -6.75 V for logic 0.

Control signals include the status and control lines. They will be set to logic 1 to indicate or direct a particular condition. In some cases, a signal name includes a "-N" to indicate that the logic is reversed. For example, a logic 1 on the PTT-N line indicates the absence of a PTT; logic 0 indicates a PTT.

Power signals are at constant V dc levels. Most are provided by the power supply as described in para 2-5. The audio power supply provides the voltages used by the audio/data section.

Rf and if signals are also present in the rt. Coaxial cables ore used to pass these signals between modules. Frequencies range from 12.5 (if) to 100.5 MHz.

2-8. RECEIVE RF SIGNAL PATH.

The rf signal received by the rt is processed by four module to provide the demodulated audio or data signal. These modules are:

Impedance matching network (1A1)
Exciter/power amplifier (1A11)
Tuner/mixer (1A9)
IF/demodulator (1A8)

See FO-1 for the block diagram of this signal path.

The rf signal enters the rt at the ANT connector (J1) and passes through the impedance matching network. The impedance matching network has six bands. One is a 50-ohm network that is used when a BNC is connected to the rt. When a manpack antenna is connected to the rt, one of five impedance matching networks is used depending on the frequency selected.

A logic 1 level is placed on the rf input path by the impedance matching network. If a manpack antenna is connected to the ANT connector, the switch shown in figure 2-9 stays closed. The logic 1 level is pulled to ground by the inductor. The impedance matching network detects the change in logic level and selects the appropriate matching network. If a BNC is connected to the ANT connector, the center part of the connector is pushed in and opens the switch. The rf signal is fed through the capacitor. The dc level stays at logic 1. The impedance matching network selects the 50-ohm matching network.

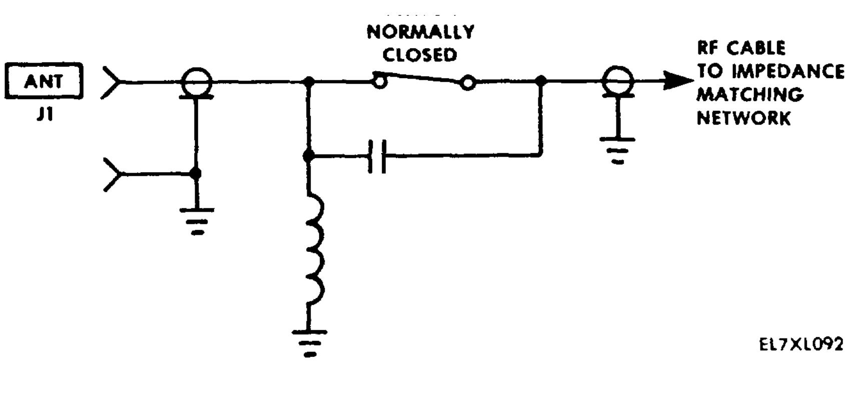


Figure 2-9. Antenna Connector Schematic

2-8. RECEIVE RF SIGNAL PATH. Continued

Keying and frequency selection are controlled by the control module. During receive, the T/R line is held at logic 0. The operating frequency is distributed using the SERIAL DATA line. TUNE GATE-N and TUNE CLK are used to decode the SERIAL DATA.

The rf signal from the impedance matching network goes to the exciter/power amplifier. After passing through a low-pass filter, it is routed to the tuner/mixer. The tuner/mixer filters and amplifies the rf signal and then mixes it with the local oscillator (LO) signal from the synthesizer. The LO is 12.5 MHz higher than the operating frequency. The tuner/mixer and synthesizer are digitally tuned using the SERIAL DATA line. The 12.5 MHz if signal is routed to the IF/demodulator. The IF/demodulator demodulates the if signal to recover the baseband audio or data signal (FM DEMOD).

The SIG display is driven by the SIG STR RCV signal from the IF/demodulator. The SIG display should respond as follows:

RF Level at ANT Connector (dBm)	SIG Display
-116 to -97	0
-108 to -87	1
- 98 to -77	2
- 88 to -67	3
- 67 to -20	4 through 7 in sequence

The signal path is unchanged for FH operation. A SYNC CODE signal is recovered from the received signal and used to synchronize the receiver with the transmitter. DATA SW-N, HOP TIME, and WB SEL are control lines from the ECCM module used during FH operation. DATA SW-N is held at logic 1 during FH operation. HOP TIME goes to logic 1 while the frequency is being changed. WB SEL (widebond select) goes to logic 0 when the rt looks for a CUE signal. If a CUE signal is detected, the IF/demodulator sets the CUE PRESENT line to logic 1.

2-9. TRANSMIT RF SIGNAL PATH.

The transmit mode is initiated by a PTT input from outside the rt. The RADIO PTT-N line is set to logic 0 when the rt is keyed. If the request is valid (frequency loaded and front panel switches set correctly), the control module responds by setting the T/R line to logic 1. See FO-2.

The exciter/power amplifier, synthesizer, and the impedance matching network are digitally tuned by the SERIAL DATA signal from the control module. TUNE GATE-N and TUNE CLK are used to decode the SERIAL DATA.

The exciter/power amplifier modulates the carrier with the FM MOD signal from the switching module. The RF REFERENCE signal provided by the synthesizer is 7 MHz higher than the carrier frequency. A 3.2 MHz reference frequency is also provided by the synthesizer.

The exciter/power amplifier generates the FM signal using two phase-locked loops (PLL). In the first, the FM MOD signal controls a 3.9 MHz voltage controlled crystal oscillator (VCXO). This produces an FM 3.9 MHz signal. Mixing it with the 3.2 MHz reference frequency generates a 7 MHz FM output. The phase detector samples the 7 MHz output and the feedback regulates the VCXO frequency. The second PLL operates the same. It mixes the 7 MHz output with the RF REFERENCE signal to generate the modulated rf signal. The modulated rf signal is amplified and filtered and then sent to the impedance matching network.

The rf output level is selected by the RF switch on the front panel. The control module reads the RF switch position then sets the RF PWR A and RF PWR B lines as follows:

RF Switch	RF PWR A	RF PWR B
LO	1	1
M	1	0
HI	0	1
PA	0	1

2-9. TRANSMIT RF SIGNAL PATH. Continued

A HI PWR XMT line is set to logic 1 when the RF switch is set to PA. This signal is routed to the system connector (P1) and is used to enable the power amplifier.

The impedance matching network routes the rf signal to the ANT connector. A 50-ohm network is used when a BNC is connected to the rt. When a manpack antenna is connected to the rt, one of five impedance matching networks is used depending on the frequency selected.

A VSWR detector in the impedance matching network checks the output versus reflected power. If the VSWR goes above 5:1, the SIDETONE DISABLE line is set to logic 1. The SIDETONE DISABLE line can also be set to logic 1 by the exciter/power amplifier if the temperature of the module exceeds 105°C. The rf power output level will be reduced 10 to 15 dB if an over temperature condition occurs.

During FH operation, the control module sets the FH MODE line to logic 1.

2-10. RECEIVE AUDIO SIGNAL PATH.

The received audio signal enters the audio/data section as the FM DEMOD signal output by the IF/demodulator. Its path to the audio connectors is shown in FO-3.

The switching module detects the presence of the 150-Hz squelch tone. If present, the BIT SYNC/TONE SQUELCH line is set to logic 1. The switching module routes the FM DEMOD signal through the processing circuitry. For single channel (SC), plain text (PT) operation, the signal continues as RCV PT AUDIO. It is routed through the audio power supply and the audio control module. The audio/data I/O module sums the audio signal (RCV AUDIO/SIDETONE) with the 600-Hz alarm tone, if present, and amplifies it. It is routed through a high-pass filter, low-pass filter, and the VOL control. It is amplified using a voltage-to-current converter and routed to the AUD/FILL and AUD/DATA connectors at pin B.

In the FH and PT mode, the FM DEMOD signal is o digital data stream. It is routed to the ECCM module as BIT SYNC DATA to be de-interleaved. (See para 2-11.) The signal is sent through a digital-to-analog converter to recover the original audio signal. The audio signal is returned to the switching module as RCV FH PT AUDIO and continues along the RCV PT AUDIO path.

In the cipher text (CT) mode, the FM DEMOD signal is again a digital data stream. It is routed to the COMSEC connector (J5) as RCV CT. The COMSEC device decrypts the signal and recovers the audio signal. The recovered audio (RCV CT AUDIO DECODED) is routed to the audio control and back into the audio receive path.

In the FH and CT mode, the ECCM module de-interleaves the data stream. The data stream (FH DATA) is routed to the COMSEC device where the audio signal is recovered.

2-11. TRANSMIT AUDIO SIGNAL PATH.

The transmit audio signal proceeds through the same modules as the receive audio signal only in reverse order. See FO-4. The audio transmit (AT) signal is input at J3 or J4 pin D. A PTT is required for the transmit mode.

The AT signals from J3 and J4 are summed by the audio/data I/O module. The audio signal is routed to an automatic gain control (AGC) amplifier. If the WHSP switch is on, the gain of the agc amplifier is increased. The XMT AUDIO signal is routed through the audio control module to the audio power supply. The audio power supply combines the XMT AUDIO signal with the 150-Hz squelch tone. From there it is routed through the switching module to the exciter/power amplifier.

A PTT at J3 is routed through the audio/data I/O module to the audio control module. A PTT at J4 is routed directly to the audio control module. Both are combined to generate the AUDIO MDL PTT-N. It is buffered by the audio power supply and sent to the control module and the switching module.

2-11. TRANSMIT AUDIO SIGNAL PATH. Continued

When operating in the FH mode, the XMT AUDIO signal is routed from the audio power supply to the ECCM module prior to the addition of the 150-Hz squelch tone. The ECCM module converts the XMT AUDIO signal into a digital data stream (FH DATA). The FH DATA signal go to the switching module where it is amplified and routed to the exciter/power amplifier module.

When operating in cipher text, the XMT AUDIO signal is routed from the audio control module to the COMSEC connector (J5). The CT XMT signal that is returned is a digital data stream.

2-12. DATA RECEIVE SIGNAL PATH.

The rt can receive audio data and digital data. Audio data can be processed using either AD1 or AD2. When the data switch is set to AD1, the analog data signal follows the audio receive path. When AD2 is used, the analog data is converted into 16 kb/s digital data by the transmitter. The receiver converts it bock into analog data. Low speed digital data (75 b/s to 4.8 kb/s) is also transmitted as 16 kb/s digital data. Majority logic error correction is provided for AD2 and low speed digital data. The data rate adopter performs the data rate conversion and error correction.

The RADIO PTT-N line is held at logic 1 during receive mode. The data signal is recovered from the carrier by the rf section, which routes it to the switching module os FM DEMOD. See FO-5. A crossover detector senses the presence of the signal. The bit sync/digital squelch network synchronizes the local clocking with the data. When synchronized, the BS/TONE SQUELCH line is set to logic 1. PT DIGITAL CLK provides clocking for the data signals. It is a 16 kHz square wave, at logic O/l levels, that is generated by the switch control. RCV PT DATA and PT DIGITAL CLK are routed to the audio section of the rt.

The data and clocking signals are buffered and routed to the audio control module. Audio control processes and switches the signal thru to the audio/data I/O module. The signals ore amplified to the correct levels and output to the rt AUD/DATA connector (J4). DIGITAL DATA RCV (DDR) and DIGITAL DATA CLK OUT (DDCO) output signal levels ore 5 V for logic 0 and -5 V for logic 1. Analog data signal levels are 0.77 V rms ±3 dB.

When operating in FH mode, data receive signals are routed through the ECCM module. The switching module sends the bit-synchronized data (BS DATA) to the ECCM for de-interleaving. FH DATA is returned to the data receive path.

Receive data cipher text (RDCT) is routed to the COMSEC connector from the switching module when the rt operates in cipher text mode. The COMSEC unit decodes the signal and returns the data receive signal (AR/DDR) to the audio control module. The COMSEC unit generates a clock signal for the data (AT/DDCO) and routes this to the audio control module also.

Each data transmission is preceded by a sync preamble. This preamble is generated by the data rate adapter. It provides a synchronization source, tells the rt a data transmission is being received, and whether the signal is plain or cipher text. During receive mode, the data rate adapter monitors the RCV DATA output from the audio control module. When the preamble is detected, the NO CODE DETECT line will set to logic 0. CODE X/R ENBL is at logic 1 during preamble detection.

When the DATA switch is set to AD2 or one of the data rates, the audio control module sends the signals to the ‘data rate adopter (RN DATA and RCV CLK). The data and clock signals are converted to LO-SPD DATA and LO-CLK. LO-SPD DATA SEL-N at logic 0 switches these LO-SPD signals back into their paths.

The AD2 signal is topped from the LO-SPD DATA line. It is shaped by on RC circuit into the necessary analog signal at the audio/data I/O module.

2-13. TRANSMIT DATA SIGNAL PATH.

The rt con process analog data and digital data. Analog data is input on J4 pin D (AT/DDCO). See FO-6. If the DATA switch is set to AD2, J4 pin F (ADMC/DDT) must be grounded for proper operation. The analog data signal will be converted to 16 kb/s digital data by the rt. If the DATA switch is set to AD1, the signal follows the audio path. Digital data is input on J4 pin F (ADMC/DDT). Pin E (DDMC) must be grounded. The rt provides a clock on J4 pin D (DDCO) and the digital data signal must be synchronized with the clock.

For AD2, the analog data signal must be FSK modulated at 1200/2400 Hz. It is routed through the audio/data I/O module. An AGC amplifier and limiter adjust the level and the signal is output as LIMITED ANALOG DATA. The audio control module demodulates the FSK signal to convert it into a low speed digital signal. This signal is routed through the data rate adapter where it is converted into a 16 kb/s digital data stream (XMT DATA). It is routed back through the audio control module to the audio power supply, The signal is buffered then routed through the switching module to the exciter/power amplifier.

The digital data transmit (DDT) signal will be input as a ±5 V square wove. It is converted to logic O/l levels by the audio/data I/O module. The logic O/l level signal (DIGITAL DATA XMT) is routed to the audio control module. If it is anything other than 16 kb/s, it is routed to the data rate adapter. It converts the data rate to 16 kb/s and returns the signal to the audio control module. The signal is routed to the audio power supply where it is buffered and sent to the switching module. The switching module routes the signal to the exciter/power amplifier.

In the FH mode, the BS DATA signal in the switching module is sent to the ECCM module for interleaving. The FH DATA signal is returned to the switching module to continue the data signal path.

In the cipher text mode, the DIGITAL DATA signal in the audio control module is routed to the COMSEC connector. The COMSEC device encrypts the signal and returns the VIN CT XMT signal.

The digital data clock out (DDCO) originates in the switching module (PT DIGITAL CLK-R), the COMSEC device (CT DIGITAL CLK), or the data rate adapter (LO SPD CLK).

2-14. PRIMARY CONTROL SIGNALS.

The primary control signals originoae at the front panel. They direct the operation of the rt. The connectors, switches, controls, and circuitry on the front panel are connected to the parent board through three connectors. They are the front panel switches connector (J1), the display connector (J2). and the audio/data connector (J3). See FO-7.

The function of the radio is controlled by the FCTN switch. When it is set to OFF, primary power is removed from the rt. The switch position is checked by the control module. If the switch is set to TST, SQ OFF, RXMT, REM, LD, LD-V, or Z-A, the corresponding line to the control module is set to logic 1 by the switch. If none of these lines are at logic 1, the control module sets the rt for SQ ON operation.

Primary power (PRI 13 V DC) for the rt is also routed through the FCTN switch. Primary power must be provided at either pin L of the system connector (P1) or at the battery connector (J6). The 13 V dc will be applied lo the SWITCHED 13 V DC line when the FCTN switch is at any position other than OFF or STW. The SWITCHED 13 V DC provides the input voltage for the power supply (1A3 pins B and C). If the FCTN switch is set to OFF, the 13 V dc will be applied to the OFF 13 V DC line. Both SWITCHED 13 V DC and OFF 13 V DC lines are routed to the display CCA where they are used to power the PRI BTRY PRES and V HOLD lines.

Two voltages ore available to retain the fill information in the control module and the ECCM module. They are V BATT and V HOLD. V BATT is provided by the holding battery and is routed through the FCTN switch. V HOLD is provided by the display CCA. It is derived from the primary input voltage. If both ore present, V HOLD will be used instead of V BATT. Both are turned off when the FCTN switch is set to STW.

The control module also checks the MODE, CHAN, and RF switch positions. The control module sets the MODE SW COM line to logic 1 except during remote operation. The control module checks the FH and FH/M lines. If neither is at logic 1, the rt is set for SC operation. The CHAN switch is BCD encoded as follows:

2-14. PRIMARY CONTROL SIGNALS. Continued

CHAN	PRESET 0	PRESET 1	PRESET 2
MAN	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
CUE	1	1	1

When the rt is transmitting, the T/R line is set to logic 1 by the control module. It checks the MED PWR, HI PWR/M, and HI PWR/V lines from the RF switch. If none ore at logic 1, the rt rf output is set for low power operation. The SIG display circuit uses the RF DETECT, RF PWR A, RF PWR B, HI PWR XMT, PA PWR LVL, and T/R lines during transmit to drive the display. The SIG STR RCV signal is used during receive.

During retransmit operation, all of the RXMT connector I/O is controlled by the switching module. See paragraph 2-17 for a description of retransmit operations.

The keyboard display is controlled by the control module. The SERIAL DATA, DISPLAY CLK, and DISP EN-N provide the information needed by the display drivers. A DISPLAY INHIBIT line is used by the remote I/O to turn the display off during remote operation.

The keyboard is made up of 16 switches (keys). They are arranged in a four-by-four switch matrix. The control module checks the X and Y lines to see if a key has been pressed. The Y lines (rows) are normally at logic 1. The X line (columns) are normally at logic 0. When a key is pressed, the Y line will be pulled to logic 0. The X line will be pulled high (to about 6 V dc).

2-15. FREQUENCY HOPPING OPERATIONS.

The programming for FH operation is stored in the ECCM module ROM. The control module executes these commands to control the rt while in FH.

Received FH signals are digital signals. The switching module digital processing produces bit synchronized data. See figure 2-10. BS DATA is the RCV FH signal synchronized with the internal rt clocks and converted to rt digital signal levels. BS DATA goes to the ECCM module interleaver circuits. The interleaver removes synchronization and frequency hopping information that is embedded in the signal. After de-interleaving, the signal is reclocked at a 16 kb/s rate. It is now the FH DATA signal. In RCV DATA mode, FH DATA is routed to the switching module. When receiving audio, FH DATA is converted bock to an analog signal by the continuously variable slope detector (CVSD) in the ECCM module. The RCV FH AUDIO output is also routed to the switching module.

Two signals are required by the ECCM module during FH transmit. They are BS DATA and XMT PT AUDIO. BS DATA goes directly to the interleaver. It is interleaved with the synchronization and FH information needed by the receiving rt to coordinate communications. The CVSD converts XMT PT AUDIO to a 16 kb/s digital signal output as CVSD DATA to the interleaver. It too is interleaved with data, re-clocked to 20 kb/s, and output on the FH DATA line to the switching module.

The interleaver supplies the control and data signals needed by the time sync/correlator. The correlator's function is to synchronize the operation of the rt and the ECCM module. It manipulates control signal outputs such os HOP-TIME and SYNC. These and others control rt operations in FH mode. They shut down reception/transmission during frequency shifts, provide the next frequency to the control module (via the data and address busses), and supply clocking for the ECCM module.

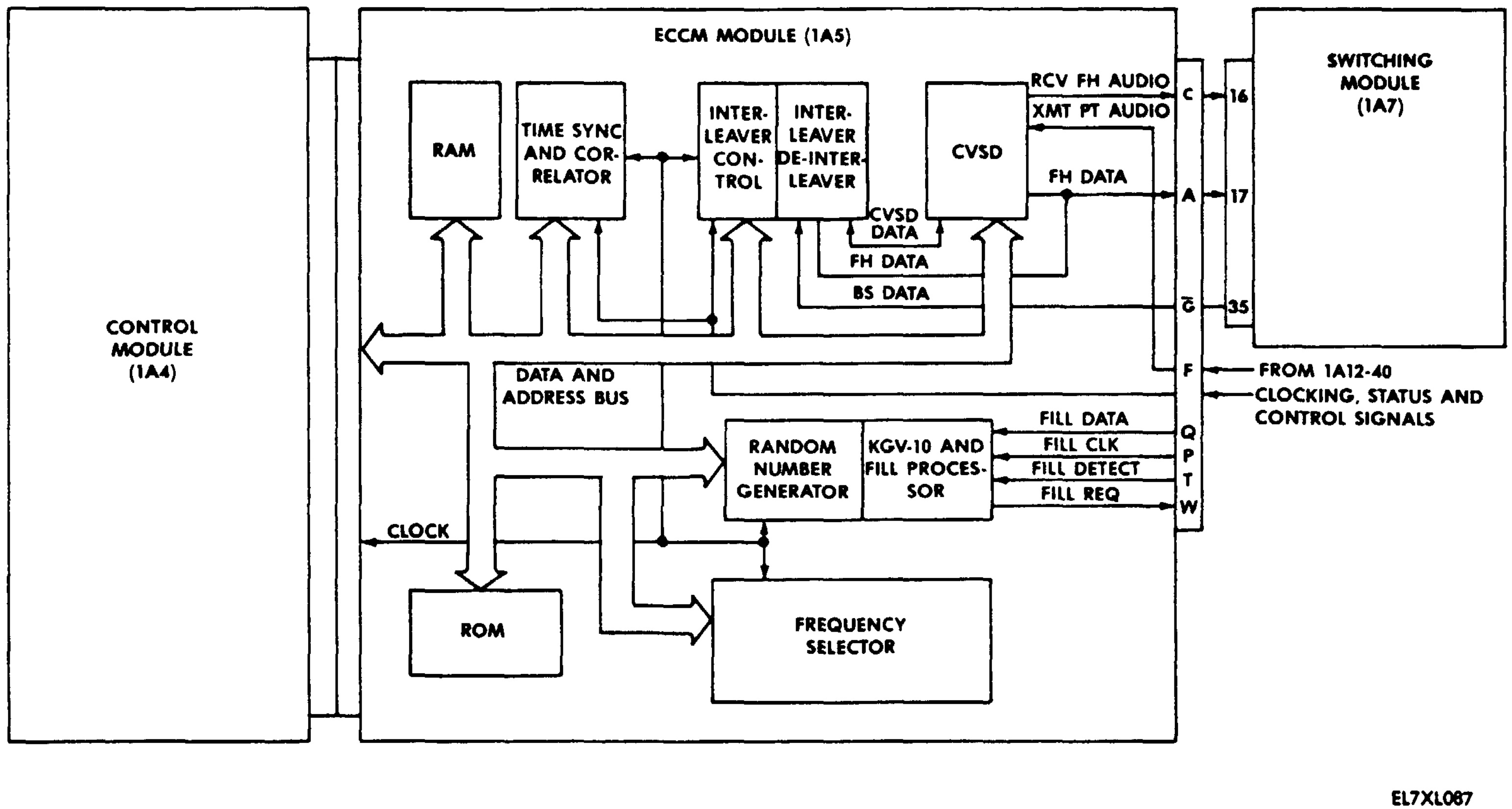


Figure 2-10. FH Block Diagram

2-15. FREQUENCY HOPPING OPERATIONS. Continued

The ECCM module is also responsible for: storage of the FH operation programming, generation of random numbers for hopping frequency selection, and processing and storage of FILL data. The rt chooses the frequencies in FH by pseudo random number generation. The TRANSEC variable, TOD, and net ID number ore used to select the next frequency. The control module uses the hopset and lockout set to create a look-up table in memory of frequencies for the net. The ECCM module picks one of these frequencies from the table. The result is passed to the control module over the data bus. The control module informs the rest of the modules of the frequency selected by the SERIAL DATA LINE.

2-16. SELF-TEST.

The rt self-test is performed at several levels. When the FCTN switch is set to TST, the control module begins the self-test routines. The rt receive path, ECCM module, and data rate adapter will be checked. A test line to the COMSEC and SYSTEM connectors is activated. This allows the rt to report the results of COMSEC and SNAP self-tests. A self-test of the remote control modules con be performed separately.

a. Display Checks. "E d" should be the first display when the FCTN switch is set to TST. The control module checks for the presence of the ECCM module and the data rate adopter. The ECCM module grounds the FH HERE-N line. The data rate adapter grounds the DATA MODULE PRESENT-N line. See FO-8.

If either module was absent, its letter in the display would be replaced with a dash (-).

The next display is "88888". It permits checking of the display segments. The SIG display con also be checked during self-test. All display segments are lit sequentially with 9 remaining lit.

b. Receive Path lest (FAIL1). The receive path is tested in four steps. First, the control module performs o memory check (RAM and ROM). Second, the control module checks the TONE SQUELCH line. It should be at logic 0 since there is no received signal. Third, the receive path is checked at eight frequencies in the SC mode. See FO-8. The 150 Hz tone is sent from the switching module (FM MOD) to the exciter/power amplifier.

The exciter/power amplifier uses the 150 Hz tone to modulate its 3.9 MHz output. The harmonics from the 3.9 MHz are used os the test frequencies. The tuner/mixer and synthesizer ore steped through eight frequencies. The 150 Hz squelch tone presence is checked at each frequency. Because the tuner/mixer and synthesizer have several bands, it is possible that only one or two frequencies will fail. The last step repeats the receive path checks for two frequencies in the FH mode.

There ore secondary displays for each failed test. They will be displayed when a keyboard button is pressed as the FCTN switch is set to TST. They ore:

SECONDARY DISPLAY	FAILED TEST
1--01	Control module RAM
1--02	Control module ROM
1-03	150 Hz detect line stuck at logic 1
1-04	Receive at 78.0 MHz, SC
1--05	Receive at 66.3 MHz, SC
1--06	Receive at 58.5 MHz, SC
1--07	Receive at 50.7 MHz, SC
1--08	Receive at 46.8 MHz, SC
1--09	Receive at 39.0 MHz, SC
1--10	Receive at 35.1 MHz, SC
1--11	Receive at 31.2 MHz, SC
1--12	Receive at 78.0 MHz, FH
1--13	Receive at 35.1 MHz. FH

2-16. SELF-TEST. Continued

The audio present during the "88888" display is a result of the receive tests. There will be 10 short bursts of unsquelched rushing noise. However, because they are so quick and close together, they are difficult to count.

c. Data Rate Adaptor Test (FAIL2). The data rate adapter will perform a self-test when the TEST line is set to logic 1. It also requires the RCV CLK and 192 kHz CLK signal to perform self-test. If the data rate adapter passes self-test, then the DATA MOD STATUS line is set to logic 1. If it does not, the line stays at logic 0 and "FAIL2" will be displayed.

d. ECCM Module Tort (FAIL3). The ECCM module also performs an independent self-test. It checks the ECCM module's RAM, ROM, interleaver, linear sequence generator, and other circuits. If it does not pass self-test, "FAIL3" will be displayed. The beep heard at the end of the "88888" display indicates the presence of the ECCM module.

e. Remote Operation Test (FAIL4). The remote operation test checks the remote I/O module and the two-wire interface. It is performed separate from the above tests. The test is initiated when the FCTN switch is set to REM and the BATT/CALL key and PTT switch are pressed. If the test is passed, "CALL" will be displayed. If it is not, "FAIL4" will be displayed.

f. COMSEC and SNAP Tests (FAIL5 and FAIL6). The TEST signal is also routed to the COMSEC connector and the SYSTEM connector. The rt is capable of interpreting o self-test failure response from external equipment connected to either connector. A failure response at the COMSEC connector will be indicated by a "FAILS display. (Most COMSEC devices, such os the TSEC/KY-57, cannot use this copability.) A failure response at the SYSTEM connector will be indicated by a "FAIL6" display. See para 2-21.

2-17. RETRANSMIT OPERATIONS.

The retransmit (RXMT) function allows two rt's to be used as a radio relay. The only additional equipment required is a special cable. (See FO-9. It is not pin-to-pin.)

When the FCTN switch is set to RXMT, the rt operates as in SQ ON. The main difference is the use of the RXMT connector for keying and audio input/output. The switching module controls retransmit operation. See FO-9. The receiving rt demodulates the rf as described in para 2-8. The signal is routed to pin B of the RXMT connector (RXMT SIG OUT). The switching module sets the RXMT CONTROL OUT line to logic 0 when a signal is received.

The cable that connects the two t-t's routes the receiving rt OUT lines to the transmitting rt IN lines. When the RXMT CONT IN line is at logic 0, the rt is keyed. The RXMT SIG IN is routed through the switching module to the audio/data section. The audio/data section processes the signal and routes it to the exciter/power amplifier.

Pin F of the RXMT connector is used to select the analog or digital mode. The analog mode is selected if it is open (about 2.5 V). The digital mode is selected if it is grounded.

During FH operation, the received signal is de-interleaved and the digital data stream is routed to the RXMT connector.

During cipher text operation, the operator of the retransmit station con monitor the traffic if a COMSEC device is properly installed. A COMSEC device is not required for operation of the retransmit station.

2-18. FILL OPERATION.

The ECCM module requires electronic data for FH operation. The data is in the form of TRANSEC variables, hopsets, and lockout sets. The process of providing the data (variables) is called the fill operation. It can be performed two ways. All variables can be loaded locally using the rt AUD/FILL connector. The second method is the ECCM remote fill (ERF). It can only be used for hopsets and lockout sets. ERF is relatively automatic. The ECCM module odds a preamble to the transmitted data that identifies it as fill data. The ECCM module in the receiving rt detects the preamble and stores the data in holding memory.

2-18. FILL OPERATION. Continued

local fill is illustrated in figure 2-11. The fill is initiated by the operator. The ECCM module puts a -6.75 V pulse on the FILL REQ line. The request is routed to the AUD/FILL connector. The FILL INFO signal is input from the fill device. It is the serial data stream that contains the variable to be stored in the ECCM module. The FILL IA is a clock signal from the fill device. It is used to synchronize the rt with the data stream.

The audio power supply buffers the signals for isolation. The signals are processed to produce the inputs for the ECCM module. FILL IA is processed into FILL CLK and FILL DET. FILL CLK follows FILL IA at rates from 1 to 4 kHiz. When the FILL device is attached, FILL IA is detected and FILL DET drops to logic 0. FILL SEL is created from processing FILL REQ and FILL IA. FILL SEL will drop to logic 0 at the same time as FILL REQ.

The rt has two interlock switches. If either cover is removed, the TRANSEC ZERO-N line is grounded. If that happens, the TRANSEC variable stored in the ECCM module will be zerozied.

2-19. REMOTE CONTROL OPERATION.

When the rt FCTN switch is set to REM, it con be controlled by a remote control unit. There are two remote control modes. One mode provides for complete remote control of all front panel functions. It is called the 2-WIRE mode. It allows remote input/output of audio and data signals. The other mode is called the 6-WIRE mode. Remote control is limited to rt MODE, RF, and CHAN. The audio and data signals are input and output at the rt. The control-monitor uses this mode. When the remote control unit establishes contact with the rt, it identifies which mode the rt is to use.

The two modules that provide the remote control capability ore the two-wire interface (1A6) and the remote I/O module (1A2). See FO-10. The link between the rt and the remote control unit is the 2 WIRE I/O and 2 WIRE I/O RTN lines. Control signals are FSK modulated onto a 2888 Hz carrier. Audio and data signals are modulated onto a 40 kHz carrier (2-wire mode only).

The two-wire interface sends and receives signals on the 2 WIRE I/O lines. When receiving, it separates the two carriers. The control information is routed to the remote I/O module. The audio/data information is routed to the switching module. The remote I/O module decodes the control information and routes it to the control module. During remote operation, the control module executes instructions from the remote I/O module, not the front panel. When sending data to the remote control unit, the above process is reversed.

The remote control unit can turn off the rt. The two-wire interface puts 6 V dc on the PS ON-N line to disable the power supply outputs. The two-wire interface will draw power from the rt dc power input that is routed through the front panel display board.

The remote I/O module has a self-test function. It is initiated when the rt is in remote and the BATT/CALL key and the handset PTT switch ore pressed. If self-test is passed, “CALL” will be displayed. If it is not, “FAIL4” is displayed.

The following signals must be present for proper remote operation. See FO-10.

SIGNAL NAME	DESCRIPTION
REM PTT	PTT request from remote control unit, logic 1 = PTT.
2/6 WIRE MODE	Logic 1 = 6 wire mode (control-monitor). Logic 0 = 2 wire mode (complete remote control).
REM DDMC	Digital data mode control, logic 0 = digital, logic 1 = anolog.
RADIO SQUELCH	Logic 1 indicates a received signal.
AUDIO MODULE PTT-N	PTT generated by rt.

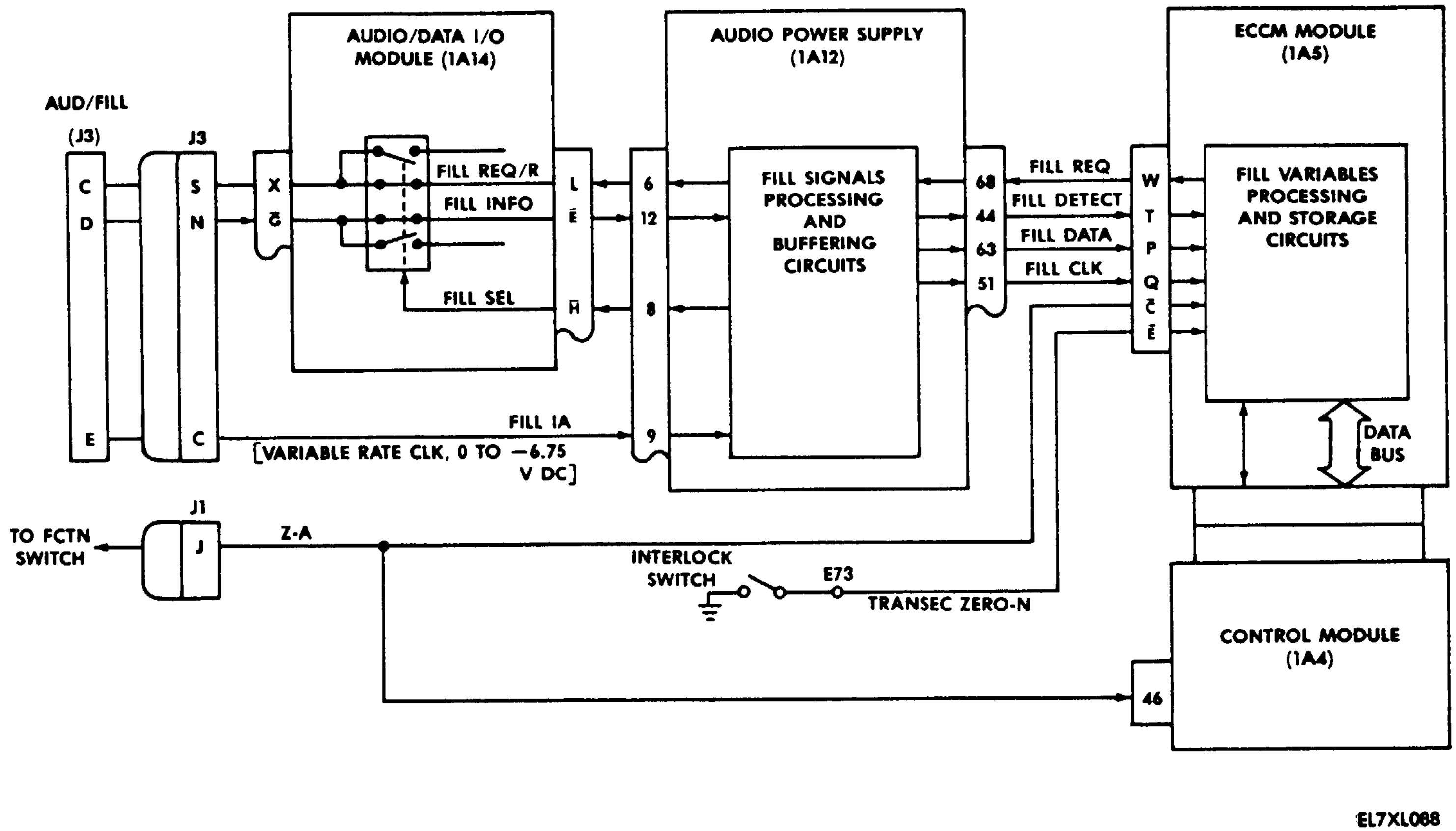


Figure 2-11. Fill Circuit Block Diagram

2-19. REMOTE CONTROL OPERATION. Continued

SIGNAL NAME	DESCRIPTION
SIDETONE DISABLE	Logic 1 disables sidetone.
40 kHz XMT DATA	Data signal from remote control unit to be transmitted by rt.
XMT REM AUDIO	Audio signal from remote control unit to be transmitted by rt.
REM	Set to logic 1 by FCTN switch.
REM 8 CLK	320 kHz clock in groups of 8. Used with 8-bit data.
REM 8 STROBE	Logic 1 pulse used with 8-bit data.
REM DATA	Remote control data to control module, both 8-bit and 24-bit.
REM 24 CLK	320 kHz clock in groups of 24. Used with 24-bit data.
REM 24 STROBE	Logic 1 pulse used with 24-bit data.
SERIAL DATA	Data from control module to be sent to remote control unit and display.
DISPLAY CLK	320 kHz clocks used with SERIAL DATA in groups of 10.
DISPLAY GATE-N	Logic 0 pulse used with SERIAL DATA.
DATA AVAIL	Logic 1 indicates data is available.
DISPLAY INHIBIT	Logic 1 turns off rt display.
REM CLR-N	Logic 0 pulse when FCTN is set to REM.
TRI-STATE EN	Logic 0 pulse when FCTN is set to REM.
40 kHz DET	Logic 1 indicates presence of 40 kHz carrier.
40 kHz A/D SEL	Indicates type of signal to be modulated onto 40 kHz carrier. Logic 1 = analog. Logic 0 = digital.
40 kHz XMT EN	Logic 1 enables 40 kHz carrier.
2880 DET-N	Logic 0 indicates presence of 2880 Hz carrier.
2880 RCV DATA	Serial input of 2880 Hz carrier.
2880 XMT EN	Logic 1 enables 2880 Hz carrier.
CONT FSK DATA	Data to be FSK modulated onto 2880 Hz carrier.
A/D RCV REM SEL	Logic 0 = digital. Logic 1 = analog.
INTERCOM XMT EN	Logic 1 = intercom mode.

2-20. CIPHER TEXT.

The rt can be used with COMSEC units to receive and transmit cipher text (CT) information. The COMSEC unit is cabled to the rt at connector J5. Audio, data, and control signal ore routed automatically.

When a cipher text signal is received, it is routed through the COMSEC unit. See FO-11. The COMSEC unit will ground the IRNSTI-P line to indicate CT operation. The received signal (RDCT) is routed to the COMSEC unit. The decrypted signal (AR/DDR) is returned to the rt. If it is on audio signal, it follows the normal audio path. If it is a digital signal, it will follow the normal digital path. The COMSEC unit provides the DDCO signal.

When an audio signal is received in the FH and CT modes, the ECCM module de-interleaves the data stream. The COMSEC unit recovers the audio signal from the data stream.

When transmitting, the signal sent to the COMSEC unit can be either audio (AT) or 16 kb/s digital (DDT). See FO-12. The RED DDMC-N line is set to logic 1 for audio. It is set to logic 0 for digital. The COMSEC PTT-N line is grounded for transmit. The audio control module routes the signals to the COMSEC unit. The encrypted signal (VIN CT XMT) is returned and routed to the switching module.

Audio and data signals are interleaved in the FH mode after encryption.

2-21. SNAP INTERFACE.

The rt provides seven signals for operation with a SNAP. The SNAP is cabled to J10 on the mounting adapter. See FO-14. They are os follows:

SIGNAL	DESCRIPTION	SOURCE
FH	Logic 1 = FH, logic 0 = SC.	1A4-30
SERIAL DATA	Digital data stream that provides operating frequency,	1A4-48
TUNE GATE-N	Logic 0 pulse used with SERIAL DATA.	1A4-49
TUNE CLK	Clock used with SERIAL DATA.	1A4-51
TEST	Directs SNAP to perform self-test.	1A4-38
SNAP DISABLE	Logic 0 indicates rt is changing frequency.	1A12-75
SNAP XMT/RCV	Logic 1 = transmit, logic 0 = receive.	1A12-76

The SNAP returns the results of its self-test on the FAULT6 line. If it fails self-test, the rt will display “FAIL6”.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

2-22. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

2-23. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required for I(DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

2-24. REPAIR PARTS.

Repair parts are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering I(DS) maintenance for this equipment.

Section III. TROUBLESHOOTING

2-25. GENERAL.

This section provides the troubleshooting procedures used to fault isolate a defective rt. The troubleshooting information is presented in the form of flow charts. They systematically get from a symptom to the bad module.

2-26. TROUBLESHOOTING.

Troubleshooting is done on a faulty rt. The steps to determine if an rt is faulty and how to troubleshoot it are illustrated in the flow chart (next page). The following is a description of the flow chart. (See paragraph 2-28 for a description of the symbols.)

a. When an rt is received from unit maintenance, inspect it for damage. Repair any damage before proceeding with testing. See section IV if repairs ore necessary.

b. Perform the pre-troubleshooting check in paragraph 2-29. In many cases, it will identify the defective module or the troubleshooting flow chart to use. If the check is passed, use the symptom and the MAPS to locate the troubleshooting flow chart to use. See paragraph 2-30 for the MAPS.

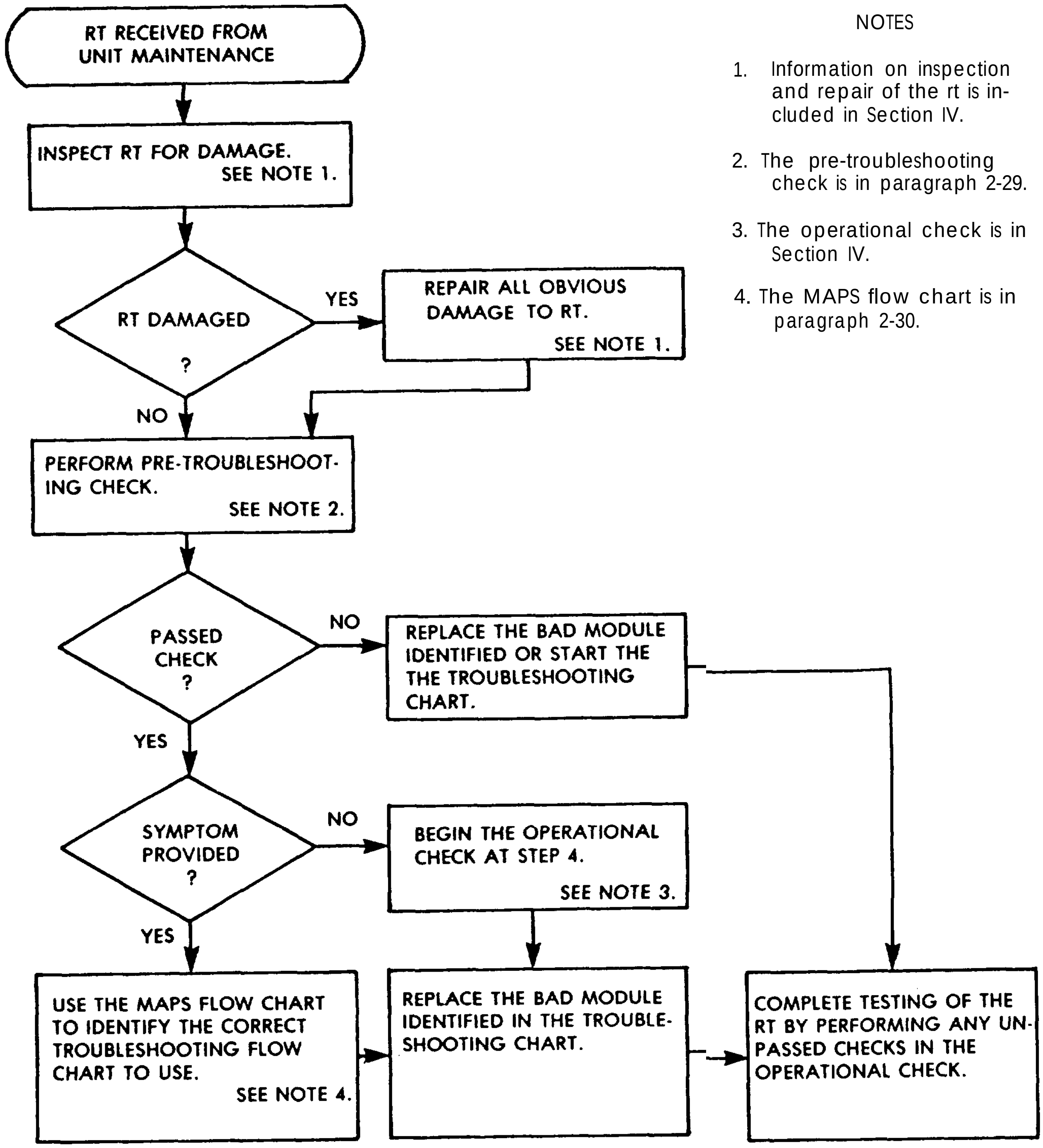
c. Using the troubleshooting flow chart identified, troubleshoot to the defective module.

d. Replace the defective module. Follow the procedures in section IV.

e. Verify the repair. Perform the operational check in section IV. When the operational check (OP CHECK) is passed, the rt con be returned for use.

2-26. TROUBLESHOOTING. Continued

The Troubleshooting Process for the RT



NOTES

1. Information on inspection and repair of the rt is included in Section IV.
2. The pre-troubleshooting check is in paragraph 2-29.
3. The operational check is in Section IV.
4. The MAPS flow chart is in paragraph 2-30.

2-27. TEST PRECAUTIONS AND NOTES.

WARNING

Set the test power supply to OFF before connecting or disconnecting a test setup. Current capacities are large enough to cause personal injury. Equipment can also be damaged if core is not taken.

High voltage is present in the test adapter (200 V dc) and in the rt (60 V dc). Use caution when troubleshooting to avoid personal injury. Set test radio CB1 to OFF before connecting or disconnetting a tort setup.

CAUTION

Static electricity and stray voltages can damage the rt modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

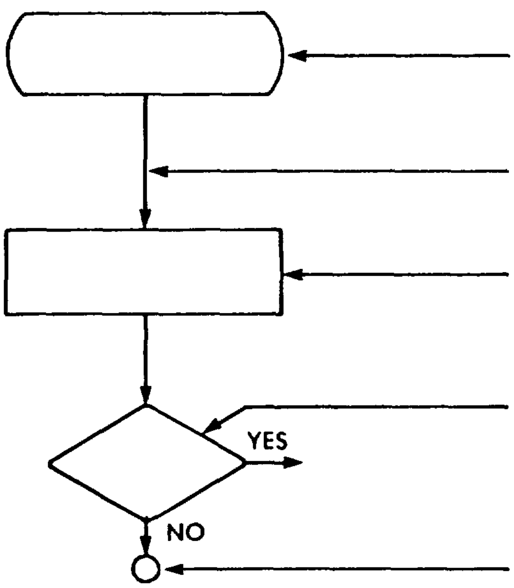
NOTE

The Principles of Operation section, functional block diagrams, and FO-1 through FO-12 can be used to fault isolate any unusual problems that may not be covered in the troubleshooting procedures.

2-28. EXPLANATION OF SYMBOLS AND NOTES.

SYMBOL

EXPLANATION



Test Procedures Start: (Rectangle with rounded sides) Indicates start of the test procedure and contains a brief description of the symptom of trouble.

lest Procedure flow Line: (Heavy line and arrowhead) Indicates direction of the procedure flow.

Test Procedure Instruction: (Rectangle) Provides instructions for doing a specific test.

Decision: (Diamond) Indicates that a decision must be mode (YES or NO) in answer to a question about the previous test. Path token depends on the answer (YES or NO).

Connector: (Circle) Directs user to an entry point of another chart. Contains on entry number that is some as entry number of other chart and a sheet number (Sh No.) that indicates the number of follow-on pages.

In the MAPS, it is also used to identify the operational check step(s) to be followed to verify a symptom and identify the troubleshooting flow chart to be used.

2-28. EXPLANATION OF SYMBOLS AND NOTES. Continued

SYMBOL	EXPLANATION
NOTES	Notes Column: Presents additional information, such as: more specific instructions about how to do a test, cautions and warnings that must be observed when doing a test, and additional information about what to do after doing a test. Also provides references to appropriate circuit diagrams.

2-29. PRE-TROUBLESHOOTING CHECK.

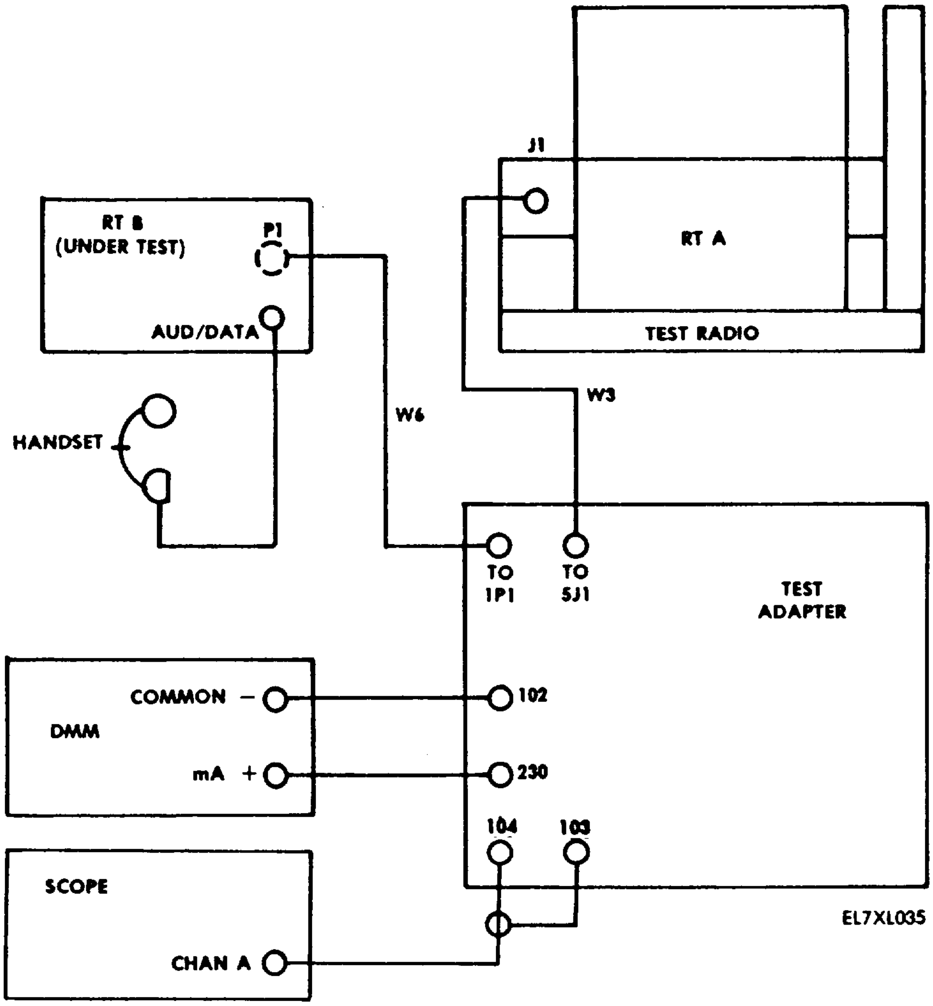
When an rt is received for repair, the pre-troubleshooting check should be the first electrical check performed. It is divided into three steps. The first step verifies that the rt will turn on and does not draw too much current. It also checks the rt memory with the Z-A function. The second step runs the rt self-test. The last step checks the keyboard interface and load functions. Single channel frequencies ore loaded into all of the channels. These ore standard test frequencies and should not be changed unless directed to do so. Follow the instruction in the "Action" column. Check the response. If the response is correct, proceed with the next lettered step. When a STEP has been completed, proceed with the next STEP. A "No response" in the "Response" column means that any response is not of interest.

If one of the steps is not passed, the troubleshooting flow chart or bad module will be identified. If the pre-troubleshooting check is passed, use the MAPS and the symptom to find the correct troubleshooting chart. If you do not have a symptom, then perform the operational check in section IV. The first three steps of the operational check can be skipped; they are the same as the pre-troubleshooting check.

Step 1. CURRENT CHECK

Action	Response
a. Connect equipment as shown in figure 2-12.	a. No response.
b. Rt B FCTN: Z-A	b. Responses: (1) Multimeter reading is greater than 0 A but not greater than 800 mA when rt display is on. (2) Rt displays Good" for 7 seconds. (3) Multimeter reading is not greater than 350 mA when rt display is blank. IF: / THEN: Current 0 or high with display on — Chart 1 "Good" not displayed correctly — Chart 2 Current high with display blank — Chart 3
c. Set rt FCTN switch to LD-V then Z-A. Check operation of DIM control.	c. Ccw dims and cw brightens display. If not, rt chassis (1A16) is bad.

2-29. PRE-TROUBLESHOOTING CHECK. Continued



EQUIPMENT PRESETS

RT B:
FCTN: STW
DATA: OFF
MODE: SC
CHAN: MAN
DIM: FULL CW
VOL: MID-RANGE
REMOVE TOP COVER AND PULL TRANSEC INTERLOCK SWITCH OUT.

TEST RADIO
CB1: ON
RT A FCTN: OFF

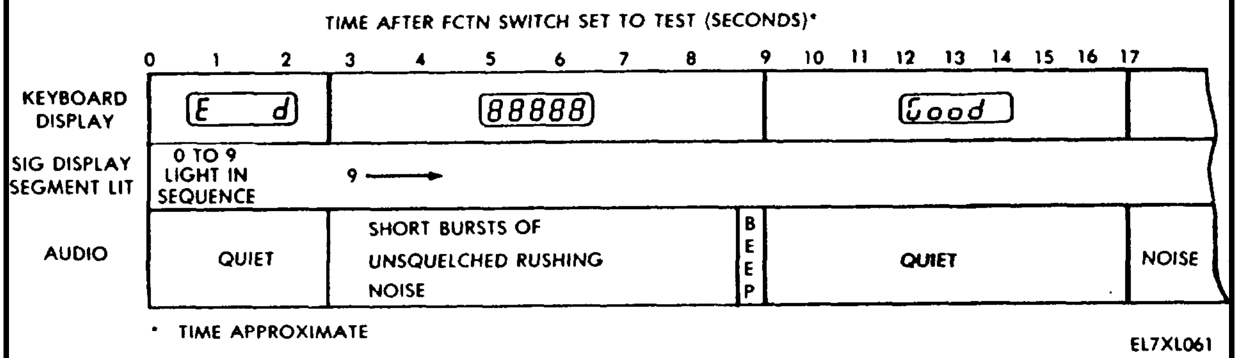
DMM:
2000mA

Figure 2-12. Current Check, Self-Test, and SC Load Check Test Setup.

2-29. PRE-TROUBLESHOOTING CHECK. Continued

Step 2. SELF-TEST

Action	Response
a. Rt FCTN: TST:	



Action	Response
	IF: / THEN:
	Any SIG display segment does not light — Rt chassis (1A16) is bad
	No "E d" display — Chart 4
	Any keyboard display segment does not light — Rt chassis (1A16) is bad
	No "rushing noise" — Chart 5
	Audio not correct, or no "Good" display. — Chart 6
	No "BEEP" — Chart 7
b. Rt FCTN: REM.	b. SIG display lights segments 9 through 0 in sequence, then goes blank. If not, rt chassis (1A16) is bad. Scope chan A displays bursts of a greater than 1.5 V p-p, 2870 to 2890 Hz sine wove. If not, go to chart 9.
c. Press and hold rt CALL/BATT button and handset PTT switch.	c. "CALL" displayed on rt. If not, go to chart 11. NOTE If rt is being checked for remote operation fault and has passed step 2, turn FCTN switch out of and into REM 7 or 8 times, then repeat a through c.

2-29. PRE-TROUBLESHOOTING CHECK.

Step 3. SC LOAD CHECK

Action	Response
a. Rt: RF: LO MODE: SC FCTN: LD CHAN: 1 DATA: OFF	a. No response.
b. Press rt FREQ button.	b. "OOOOO" displayed on rt. If not, go to chart 10.
c. Press rt CLR button.	c. "- - - - -" displayed on rt. If not, go to chart 11.
d. Press 3, 7, 8, 7, 5 buttons.	d. Display responds correctly. If not, go to chart 11.
e. Press rt Sto/ENT button.	e. Display blinks then displays "37875." If not, go to chart 11.
f. Load the following frequencies into the channels indicated: CHAN — Frequency 2 — 42975 3 — 43375 4 — 49075 5 — 56200 6 — 68775 CUE — 87975	f. Frequencies load correctly. If not, go to chart 12.

2-30. MAINTENANCE ACTION PRECISE SYMPTOM (MAPS) CHART.

The MAPS chart is used to find the troubleshooting chart to use when a symptom has been provided by unit maintenance. It is a flow chart similar to the troubleshooting flow charts. Do not start the MAPS chart until after the pre-troubleshooting check has been passed.

The purpose of the MAPS chart is to locate the correct troubleshooting flow chart without performing the entire operational check. Many times, multiple symptoms will be present. The MAPS chart identifies which symptom should be checked first.

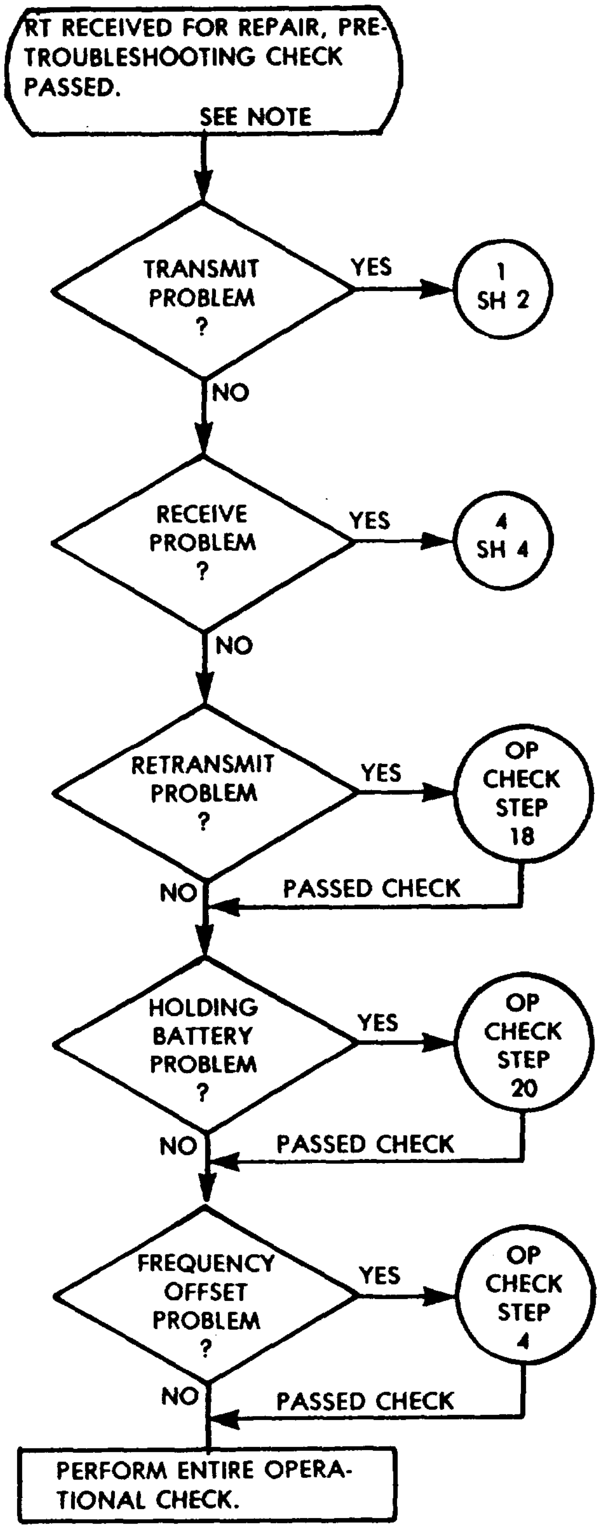
A description of the flow chart symbols is in paragraph 2-28.

To use the MAPS, proceed through the flow chart until a circle is reached that directs you to a step (or steps) in the operational check. Perform that step (or steps) in the operational check. If more than one step is indicated, perform them in the order listed. If all of the checks are passed, return to the MAPS. If the circle has a PASSED CHECK arrow, then return to the MAPS flow chart where indicated. If the circle does not have a PASSED CHECK arrow, then the symptom was not verified. Perform the operational check.

After a bad module has been replaced, repeat the operational check step that was not passed. The entire operational check should be passed before on rt is returned to Unit Maintenance. It is not necessary to repeat steps that were passed as port of the troubleshooting process.

2-30. MAINTENANCE ACTION PRECISE SYMPTOM (MAPS) CHART.

(Sheet 1 of 5)

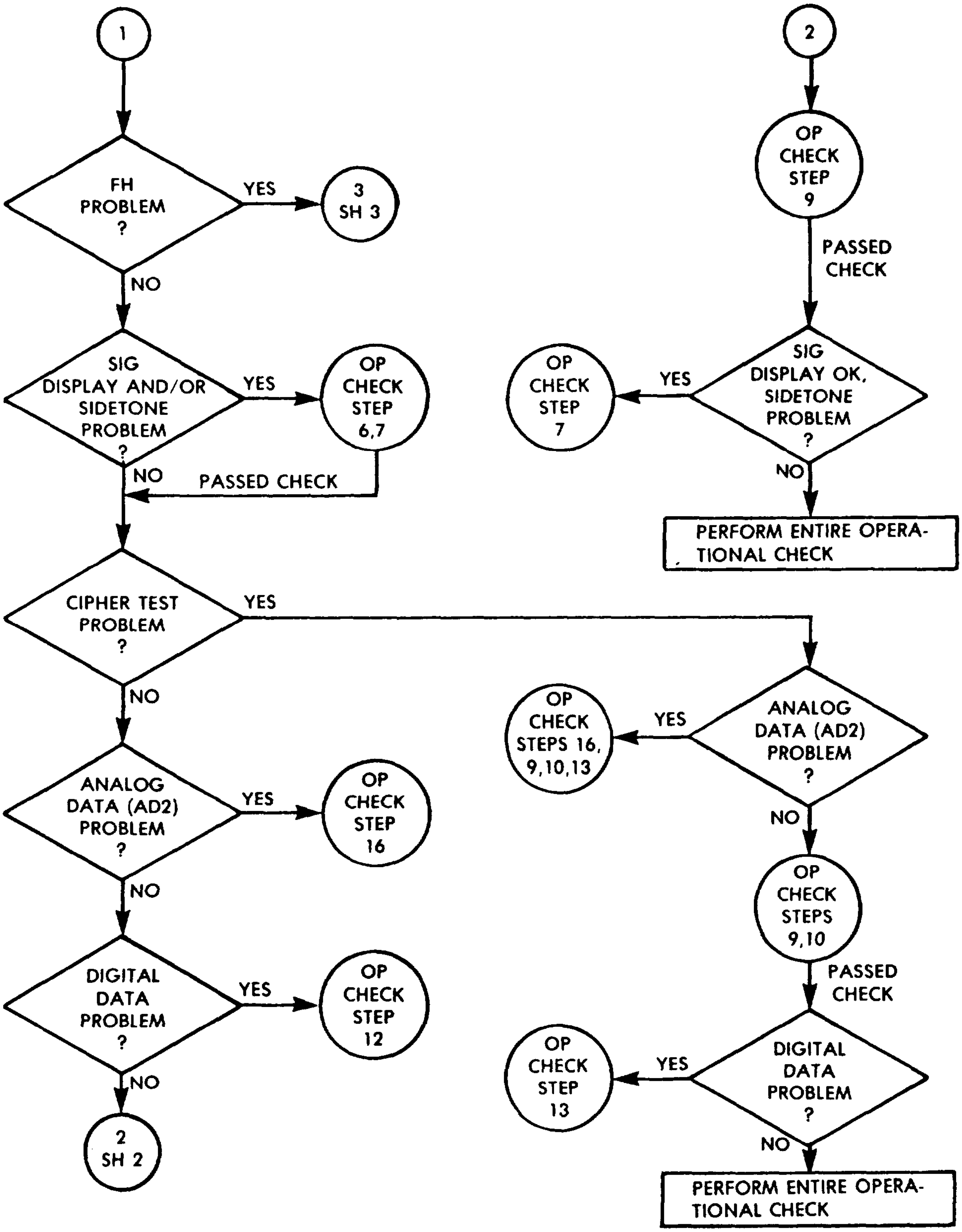


NOTE

If no symptom is available, perform operational check in section IV.

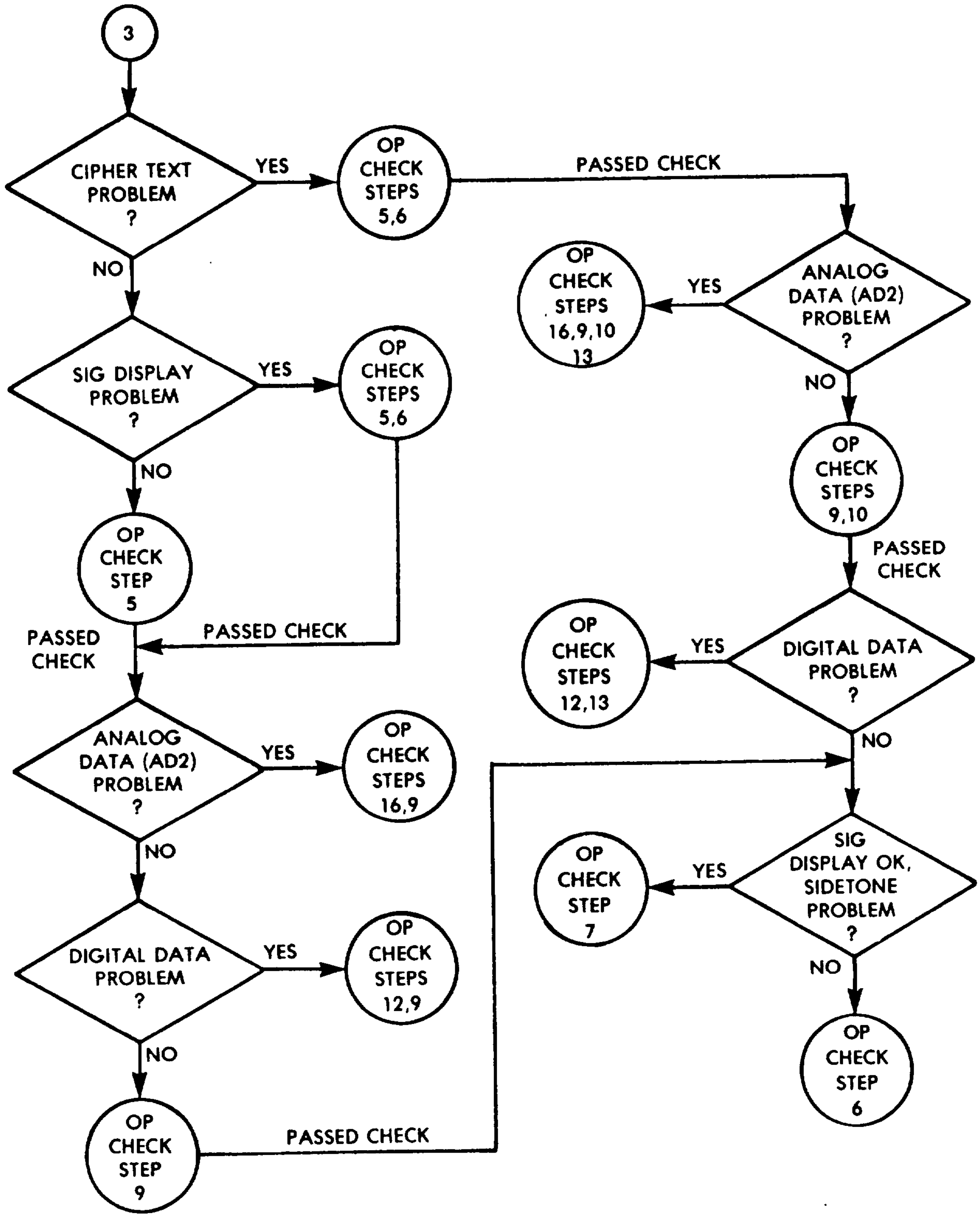
2-30. MAINTENANCE ACTION PRECISE SYMPTOM (MAPS) CHART. Continued

(Sheet 2 of 5)



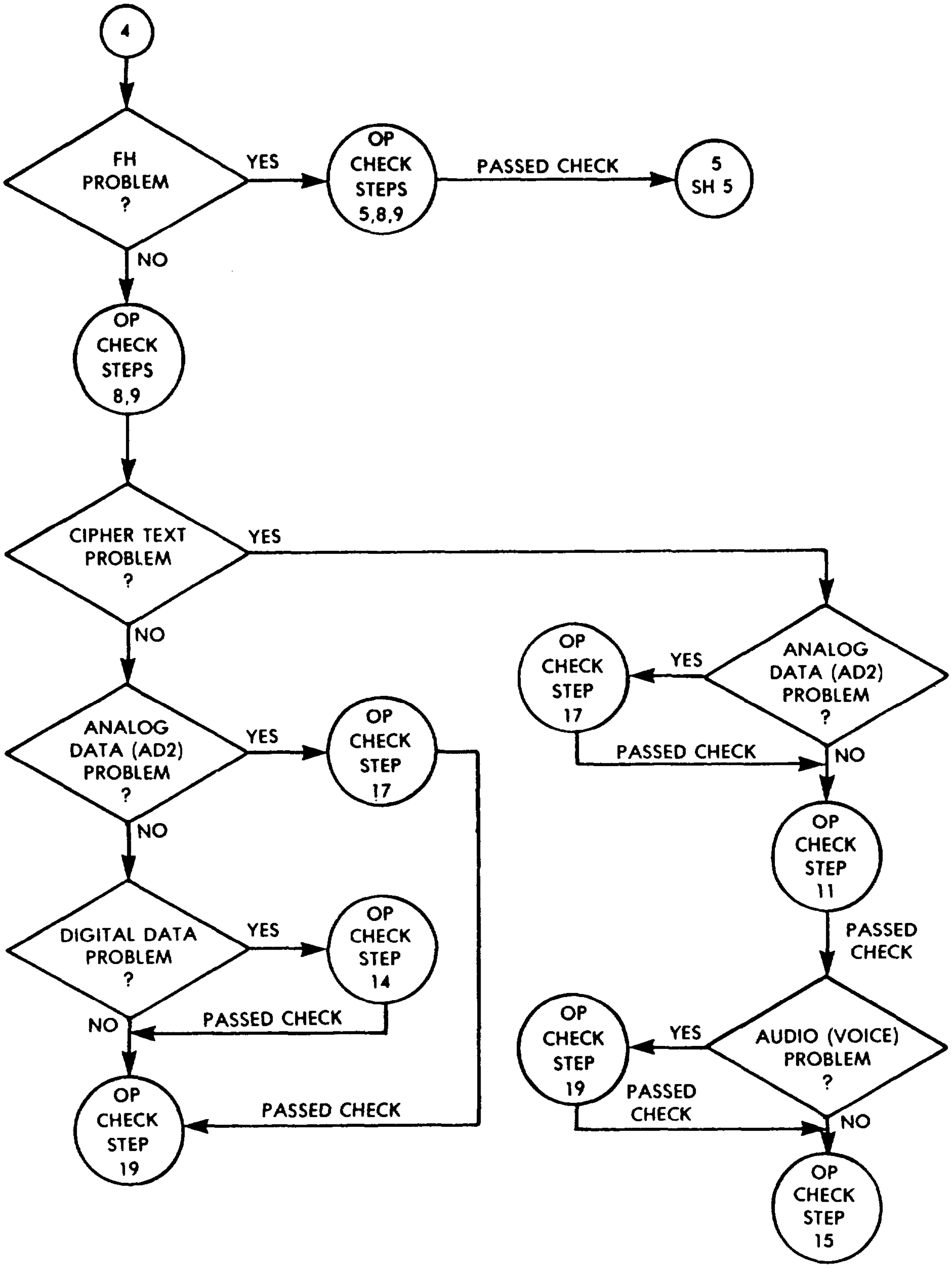
2-30. MAINTENANCE ACTION PRECISE SYMPTOM (MAPS) CHART. Continued

(Sheet 3 of 5)



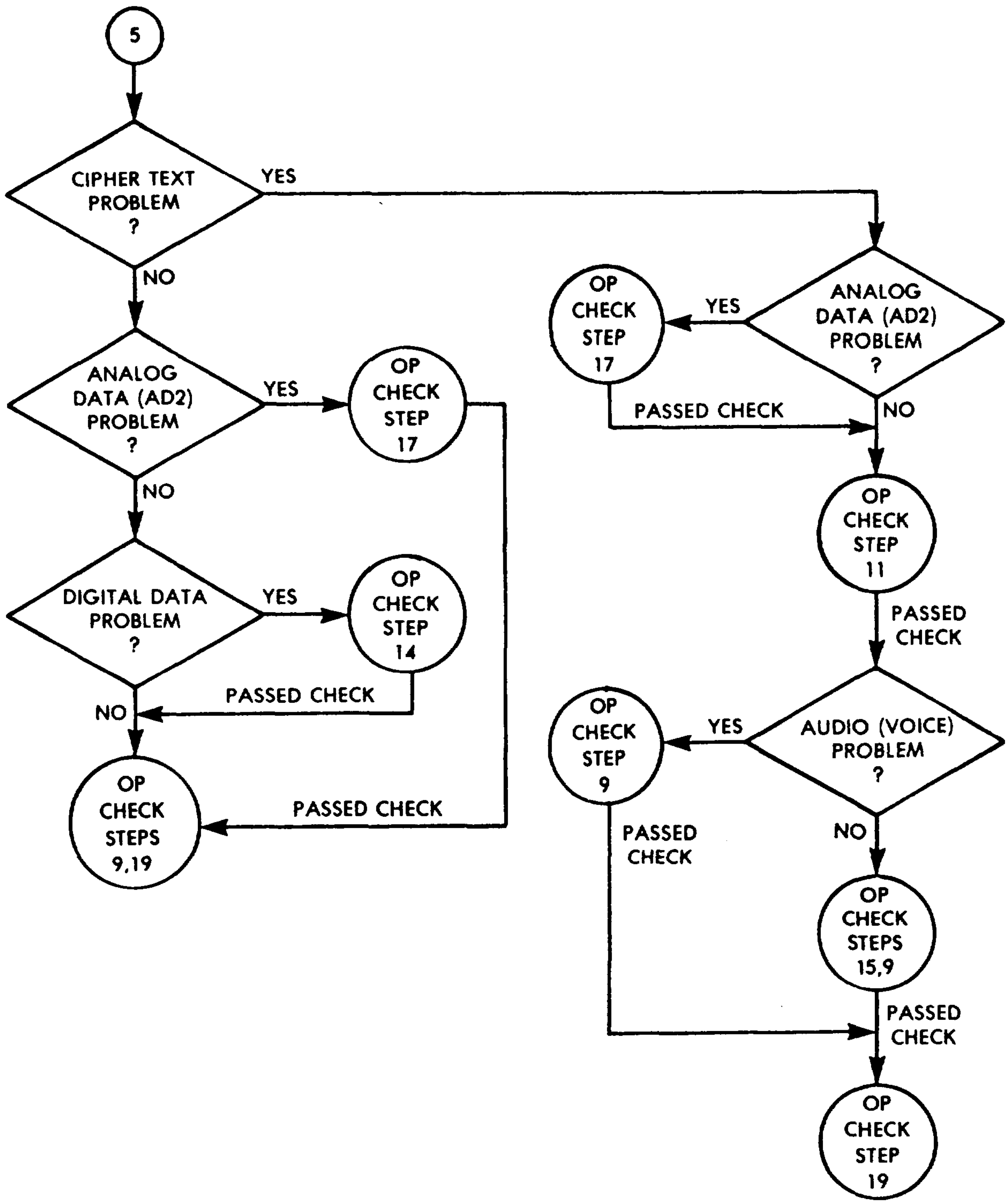
2-30. MAINTENANCE ACTION PRECISE SYMPTOM (MAPS) CHART. Continued

(Sheet 4 of 5)



2-30. MAINTENANCE ACTION PRECISE SYMPTOM (MAPS) CHART. Continued

(Sheet 5 of 5)



2-31. TROUBLESHOOTING FLOW CHARTS.

The following flow charts contain the troubleshooting procedures used to fault isolate on rt to a bad module. Observe the following when using a flow chart:

a. Do not start a flow chart unless directed to it by the pre-troubleshooting check or the operational check.

b. Do not change rt or TMDE switch settings unless directed to do so by the flow chart or the test setup diagram.

c. Refer to Chapter 9 for information on the test radio and the test adapter.

d. The logic levels in the rt are as follows:

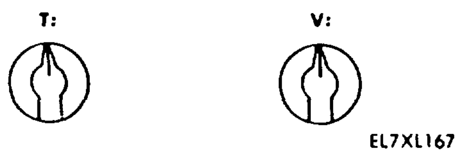
logic 0 = -0.5 to 0.5 V dc
logic 1 = 5.0 to 7.25 V dc
negative logic 1 = -5.0 to -7.25 V dc

The logic 1 level given is typical for a digital output. A good logic 1 level may be as low as 5.0 V dc.

e. See FO-13 for locations on the rt parent board.

f. The test responses at some test points ore not seen immediately. Check the probe location and perform the test again to verify a faulty result. Try re-keying the radio that is transmitting. Test responses that are difficult to detect will be supplied with presets for the scope.

These appear as:

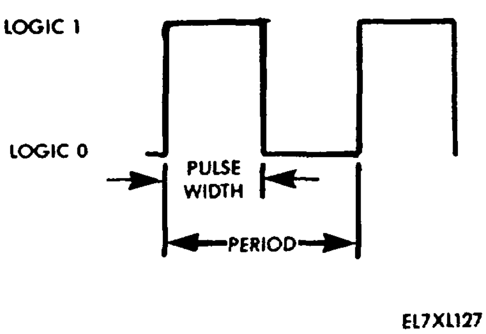


They give the time base (T), and voltage base (V) suggested settings for the scope.

g. The test radio and rt A are part of Maintenance Group OA-9263/GRC.

h. Some of the more common scope waveforms are as follows.

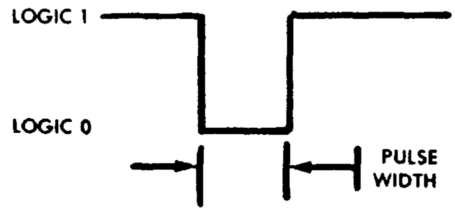
Logic 0/1 square wave:



Frequency	Period	Pulse Width
75 Hz	13 ms	6.7 ms
150 Hz	6.7 ms	3.35 ms
640 Hz	1.6 ms	0.78 ms
1 kHz	1.0 ms	0.50 ms
1.2 kHz	0.83 ms	0.42 ms
2.4 kHz	0.42 ms	0.21 ms
2.88 kHz	0.34 ms	0.17 ms
4.8 kHz	0.21 ms	0.10 ms
8 kHz	125 µs	63 µs
16 kHz	62.5 µs	31 µs
32 kHz	31.25 µs	15.6 µs
40 kHz	25 µs	12.5 µs
192 kHz	5.2 µs	2.6 µs
320 kHz	3.1 µs	1.6 µs
640 kHz	1.6 µs	0.78 µs
3.2 MHz	0.31 µs	0.16 µs

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

Logic 0 pulse:



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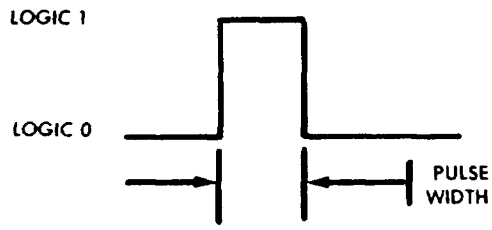
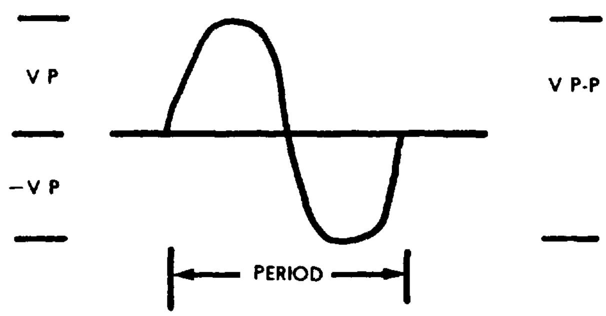
Logic 1 pulse:



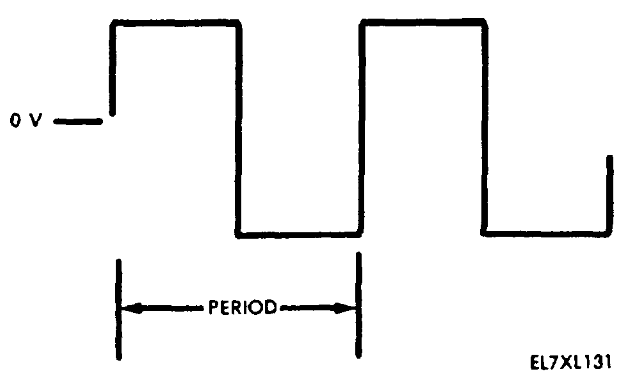
EL7XL129

Sine wave:



EL7XL130

Square wave:



EL7XL131

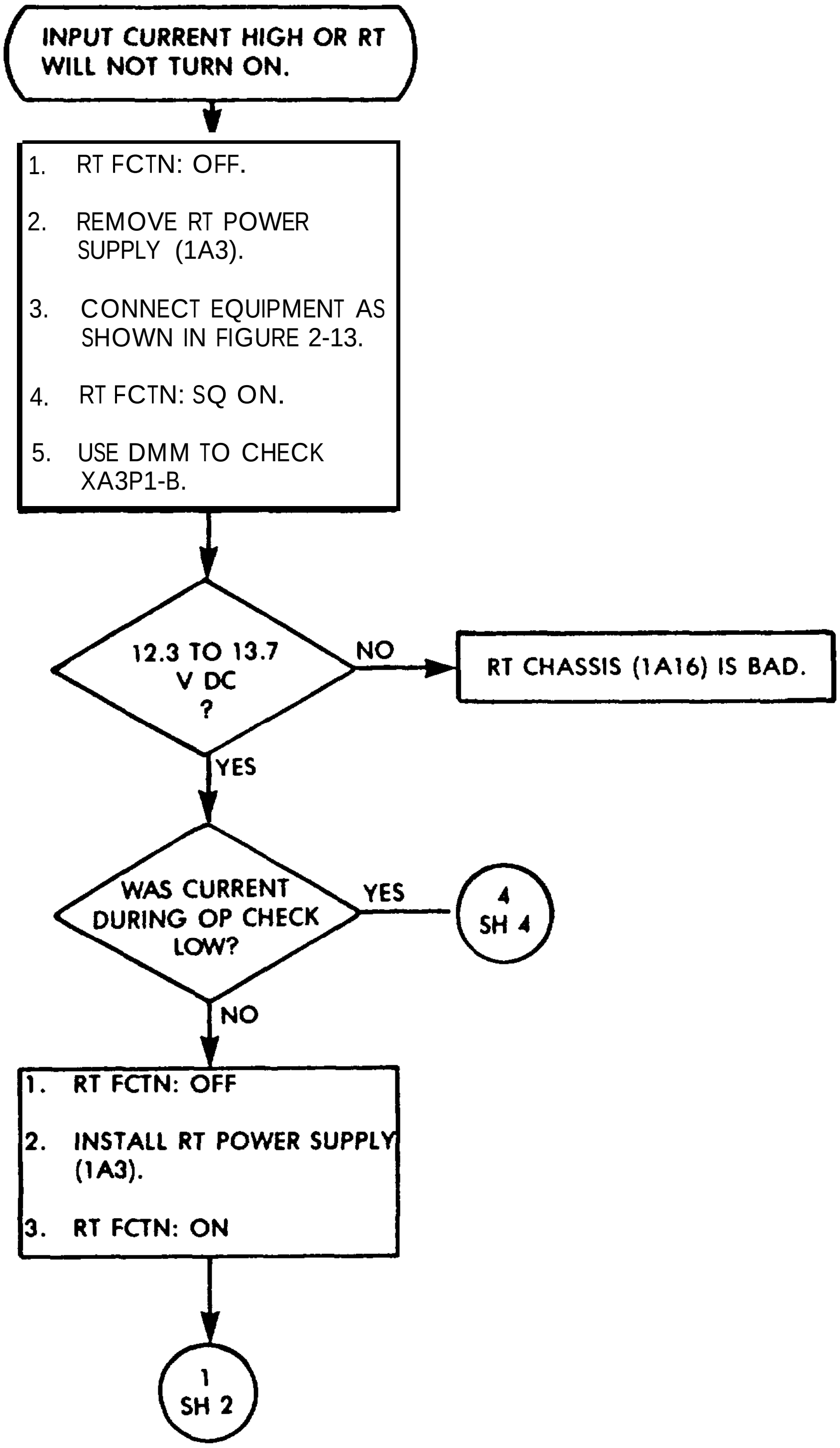
2-31. TROUBLESHOOTING FLOW CHARTS. Continued

Chart	Symptom
1	Input current high or rt will not turn on.
2	Fails Z-A test.
3	Current high in Z-A with display-blank.
4	"E d" not displayed during self-test.
5	No audio output or "FAIL1" displayed during self-test.
6	Some squelch bursts not present, "Good" not displayed.
7	Bad FH Self-test, no "BEEP".
8	VOL control does not work.
9	"FAIL" displayed or remote test failed.
10	Frequency display incorrect.
11	One keyboard button inoperative.
12	Single channel frequency will not load.
13	TRANSEC will not load.
14	FH fill data will not load into holding memory.
15	Rf power output incorrect in HI.
16	incorrect SIG display in transmit.
17	Rf power output incorrect in M.
18	Rf power output incorrect in LO.
19	Sidetone present with high VSWR.
20	Sidetone absent.
21	Rushing noise not present in SQ OFF.
22	Rushing noise present in SQ ON.
23	Will not transmit (SC, audio, PT).
24	Will not transmit (SC, audio, CT).
25	Will not transmit (SC, audio, CT), COMSEC connector fault.
26	Will not receive (SC, audio, CT).
27	Will not transmit (SC, 4.8K).
28	Will not transmit (SC, digital data, CT).
29	Will not receive (SC, 4.8K).
30	Will not receive (SC, 4.8K). clocking fault.
31	Will not receive (SC, 16K, CT).
32	Will not operate FH (SC ok).
33	Will not transmit in AD2.
34	Will not receive in AD2.
35	Will not retransmit.
36	Receive sensitivity low (-118 dBm).
37	Receive sensitivity low (-108 dBm).
38	Fill data lost when power is removed.
39	Will not receive (SC, audio)

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

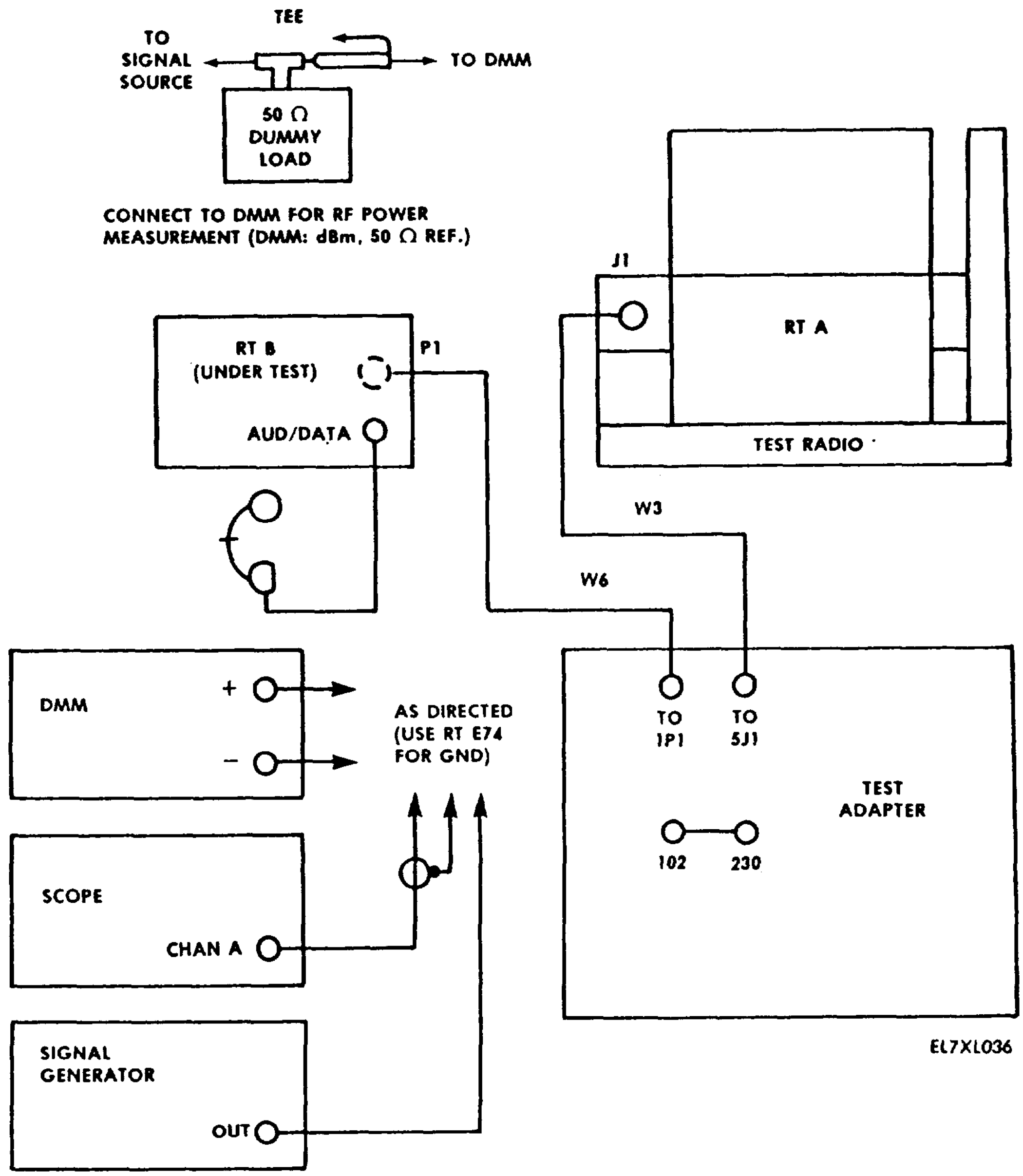
CHART 1

Troubleshooting Power Supply Inputs and Outputs
(Sheet 1 of 8)



NOTES

1. All voltage and resistance checks ore to rt chassis ground (E74).
2. See FO-13 for locations of modules, cables, and test points.
3. Front panel connectors J1, J2, and J3 ore secured to the parent board with 2 captive screws.



EQUIPMENT PRESETS

RT (UNDER TEST)
TOP AND BOTTOM COVERS REMOVED
DO NOT CHANGE SWITCH POSITIONS

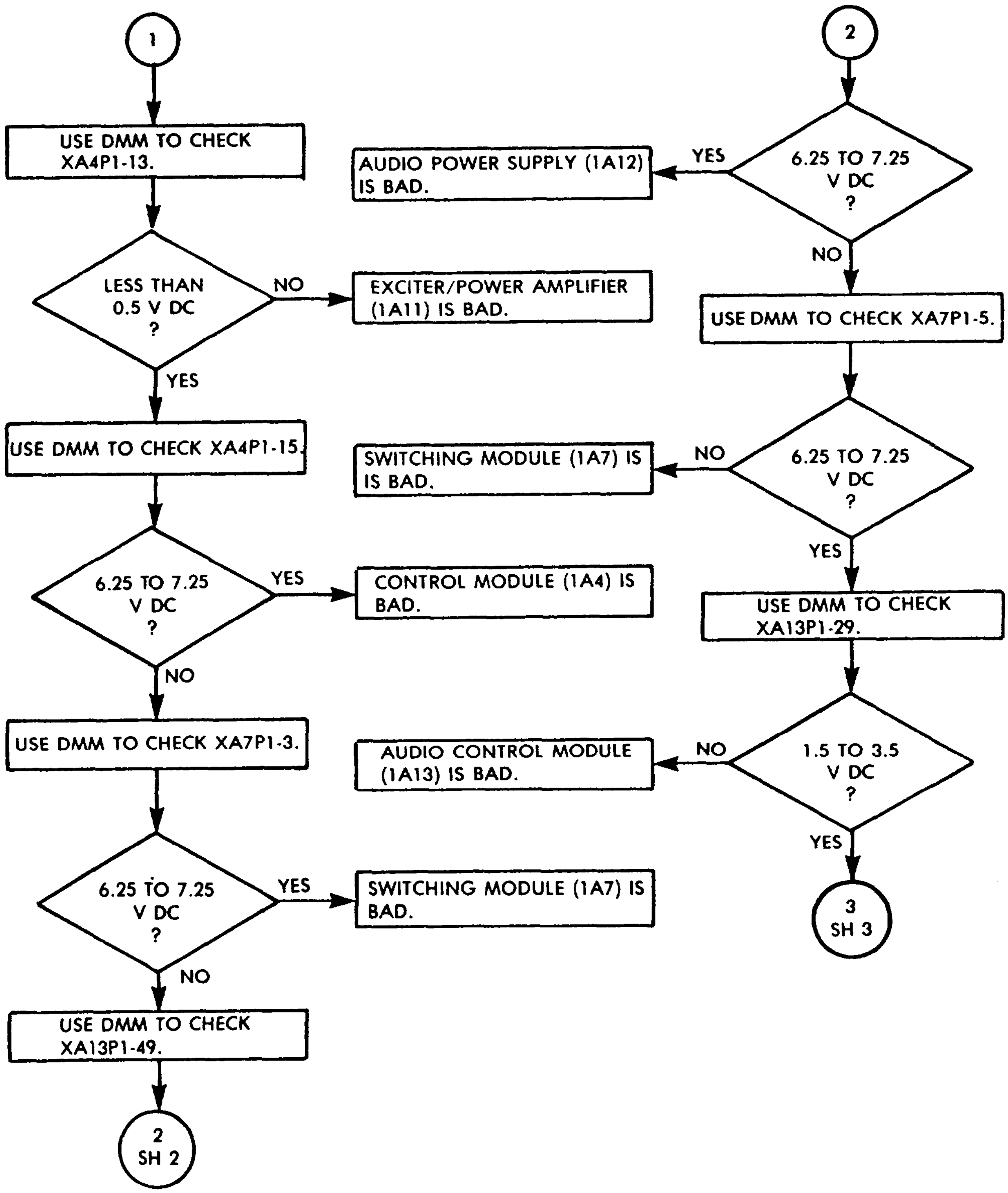
TEST RADIO:
CB1: ON
RT A FCTN: OFF

Figure 2-13. Basic Troubleshooting Test Setup.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

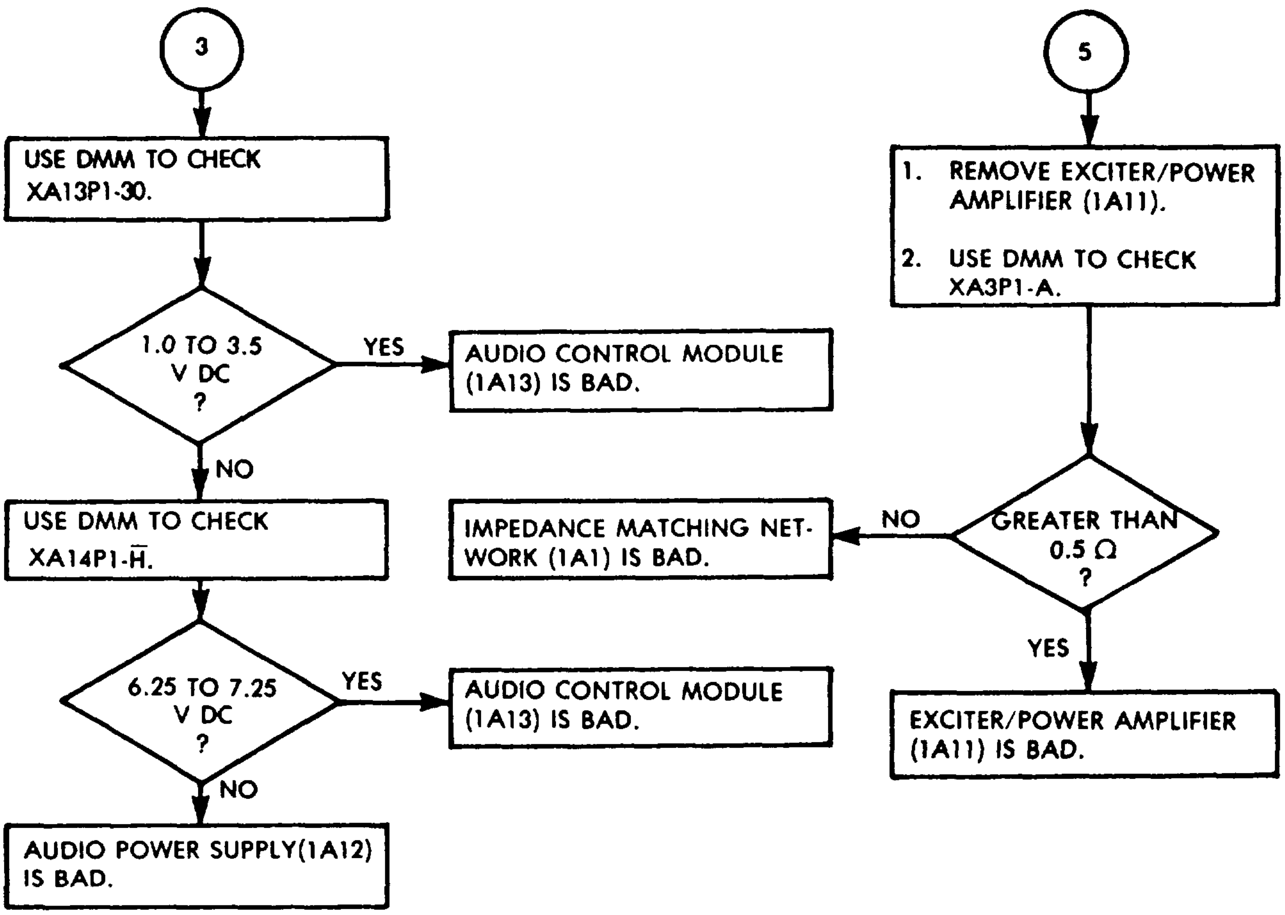
Troubleshooting Power Supply Inputs and Outputs
(Sheet 2 of 8)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

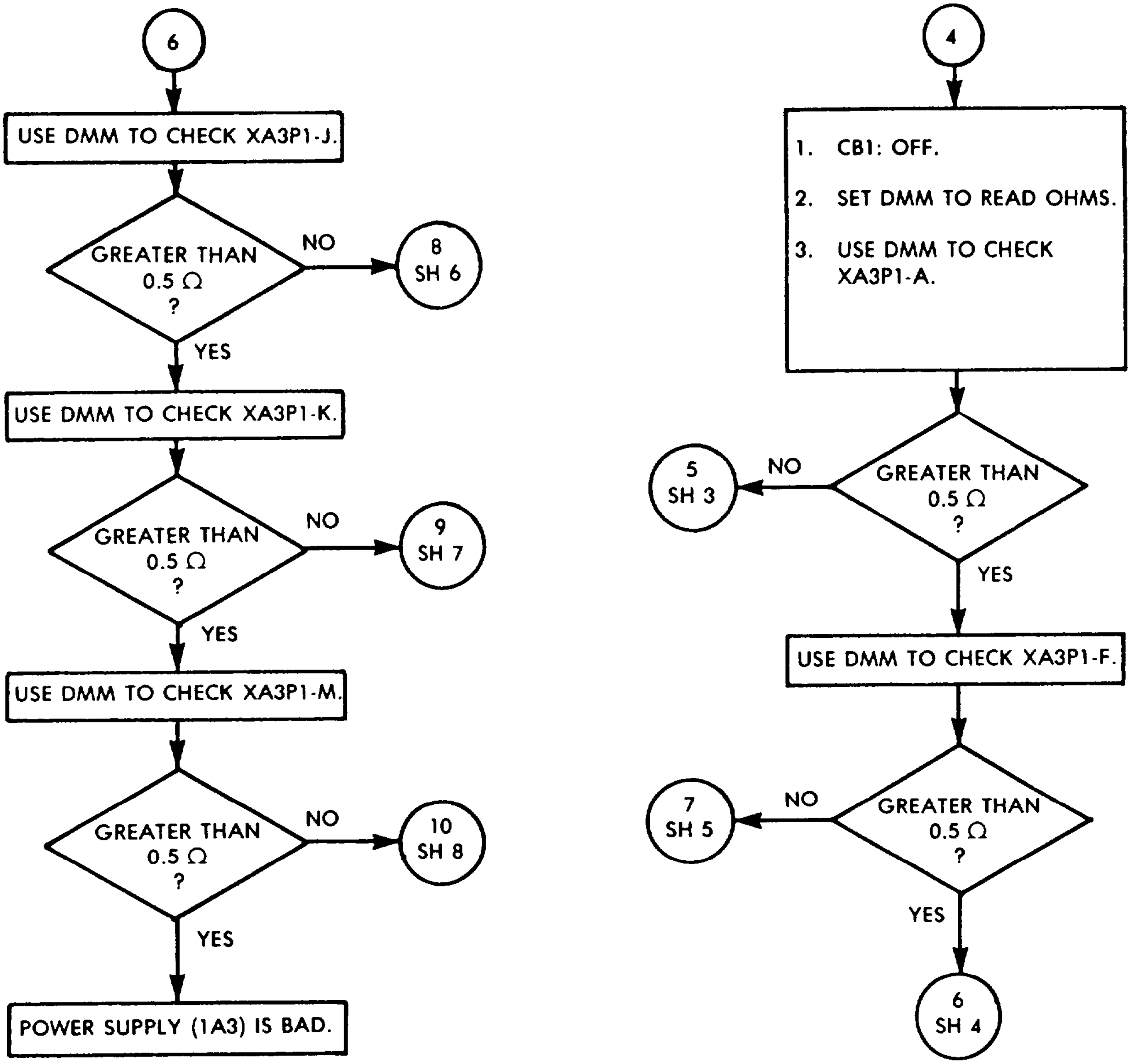
Troubleshooting Power Supply Inputs and Outputs
(Sheet 3 of 8)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

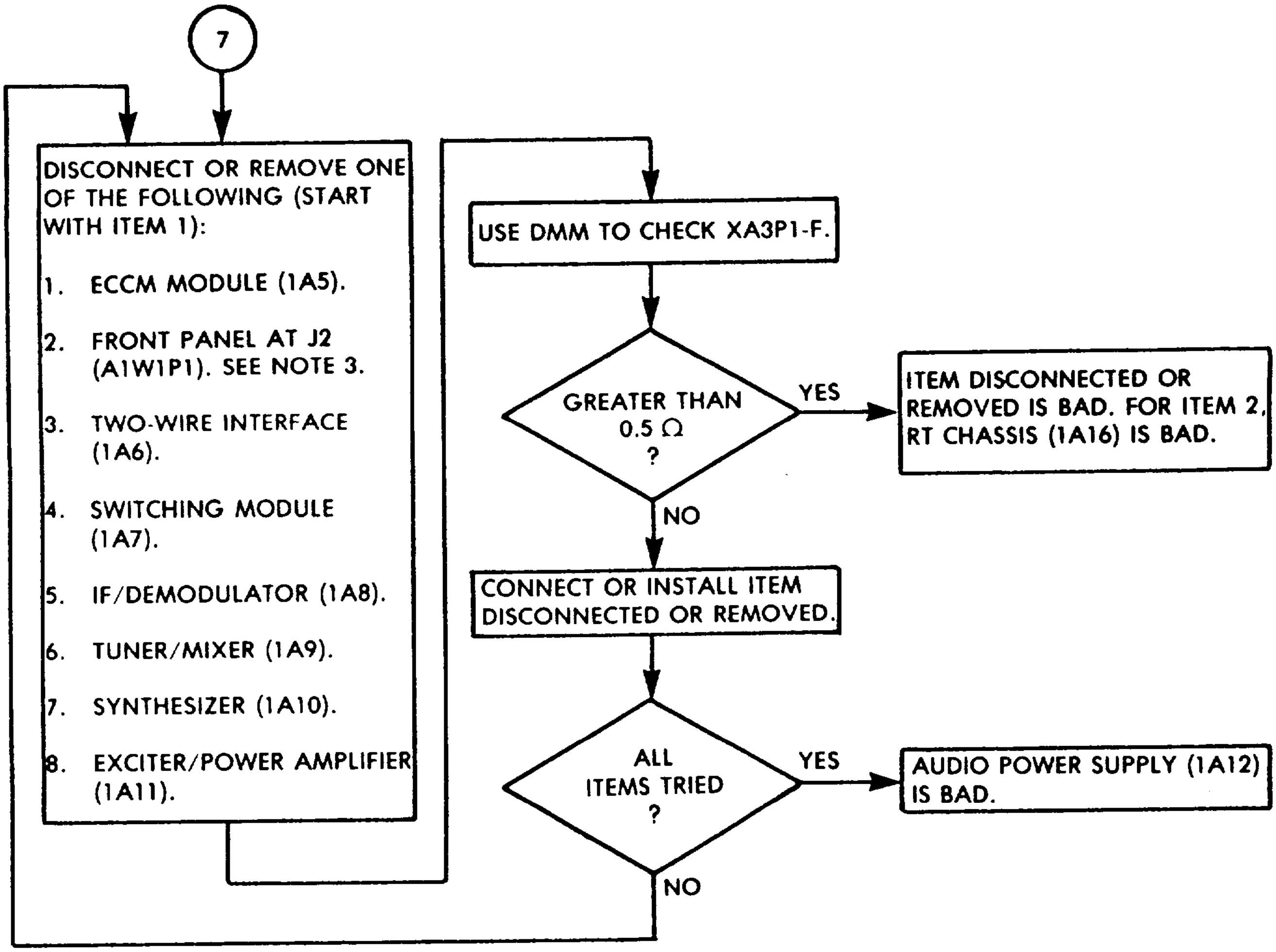
Troubleshooting Power Supply Inputs and Outputs
(Sheet 4 of 8)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

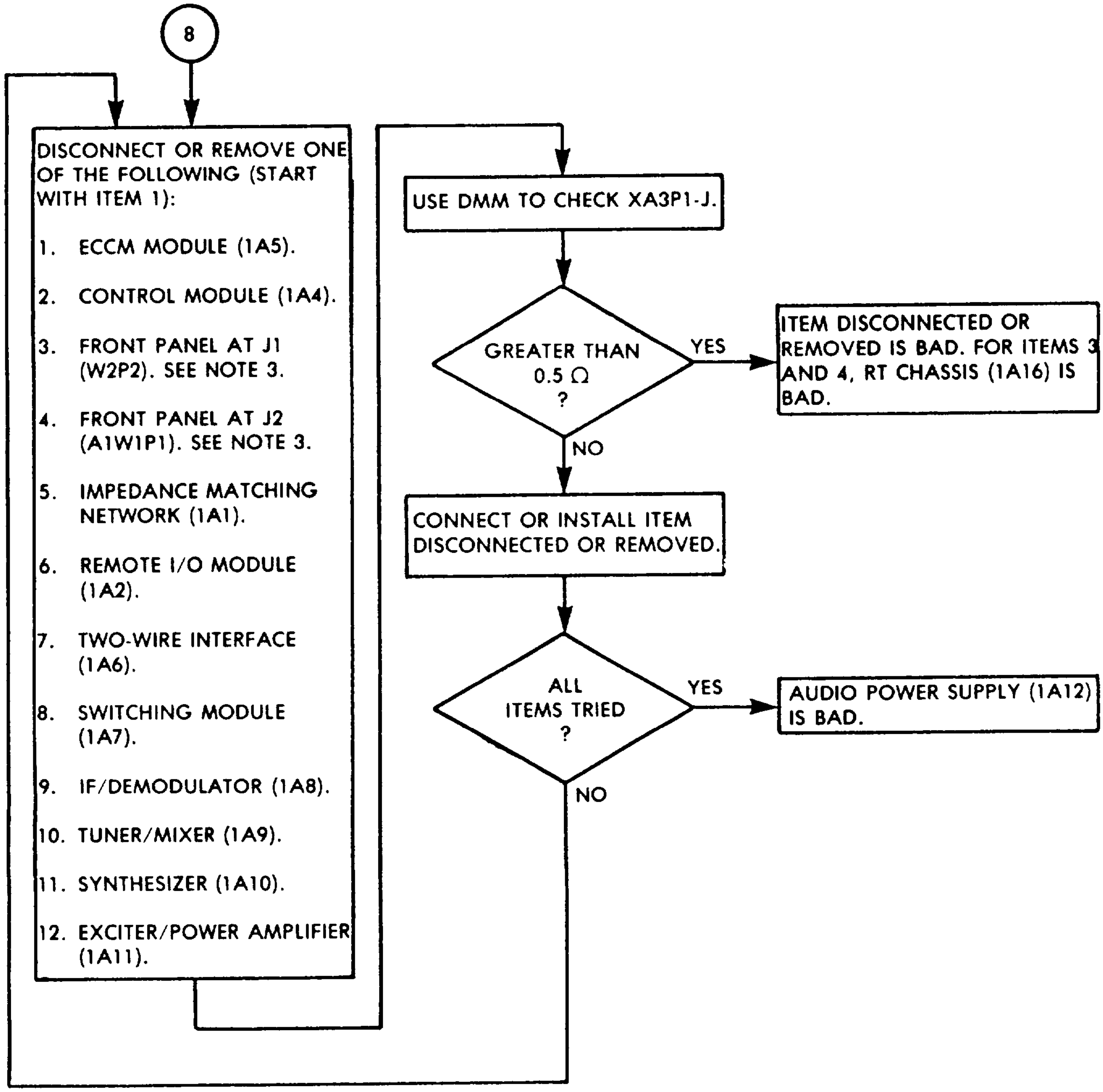
Troubleshooting Power Supply Inputs and Outputs
(Sheet 5 of 8)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

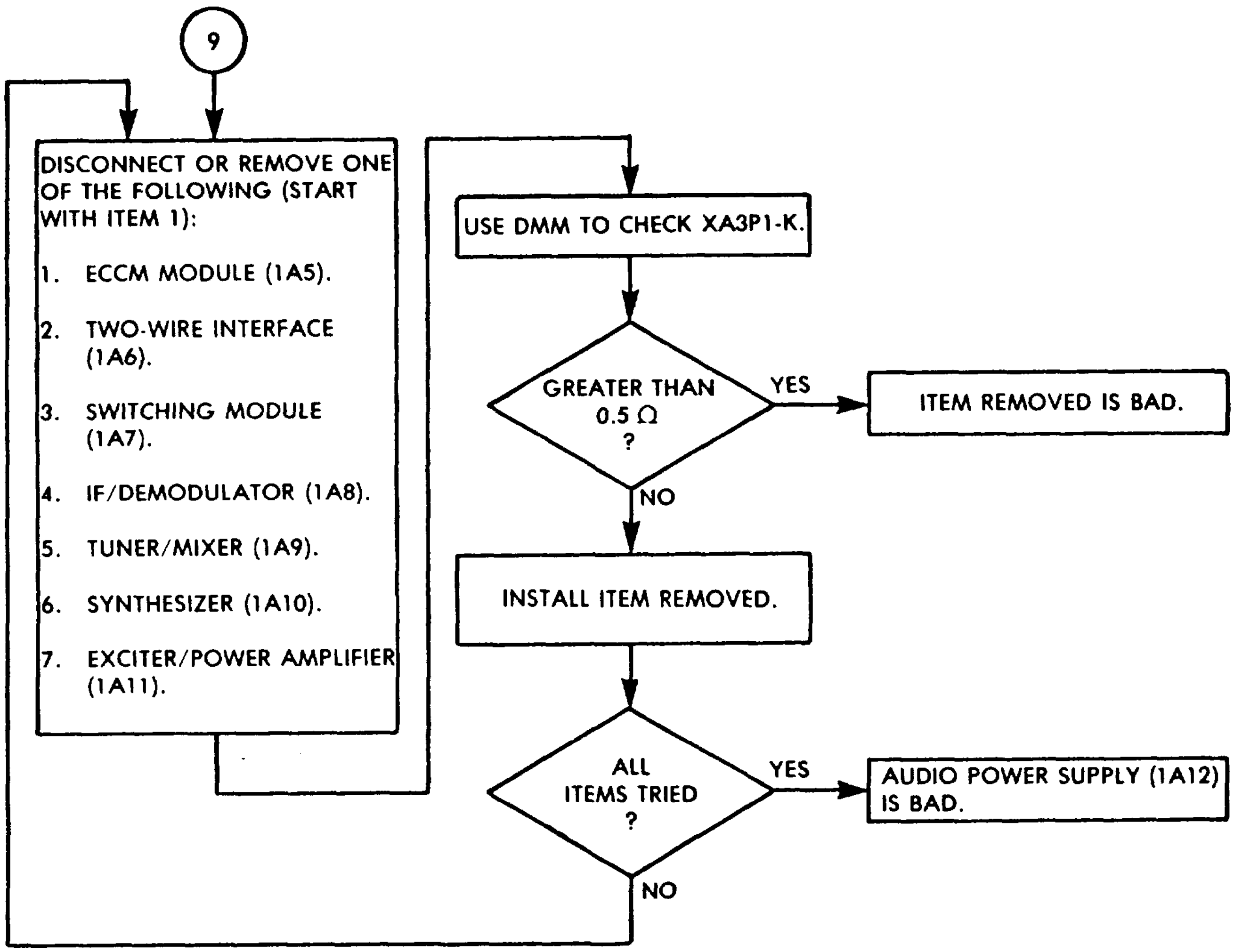
Troubleshooting Power Supply Inputs and Outputs
(Sheet 6 of 8)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

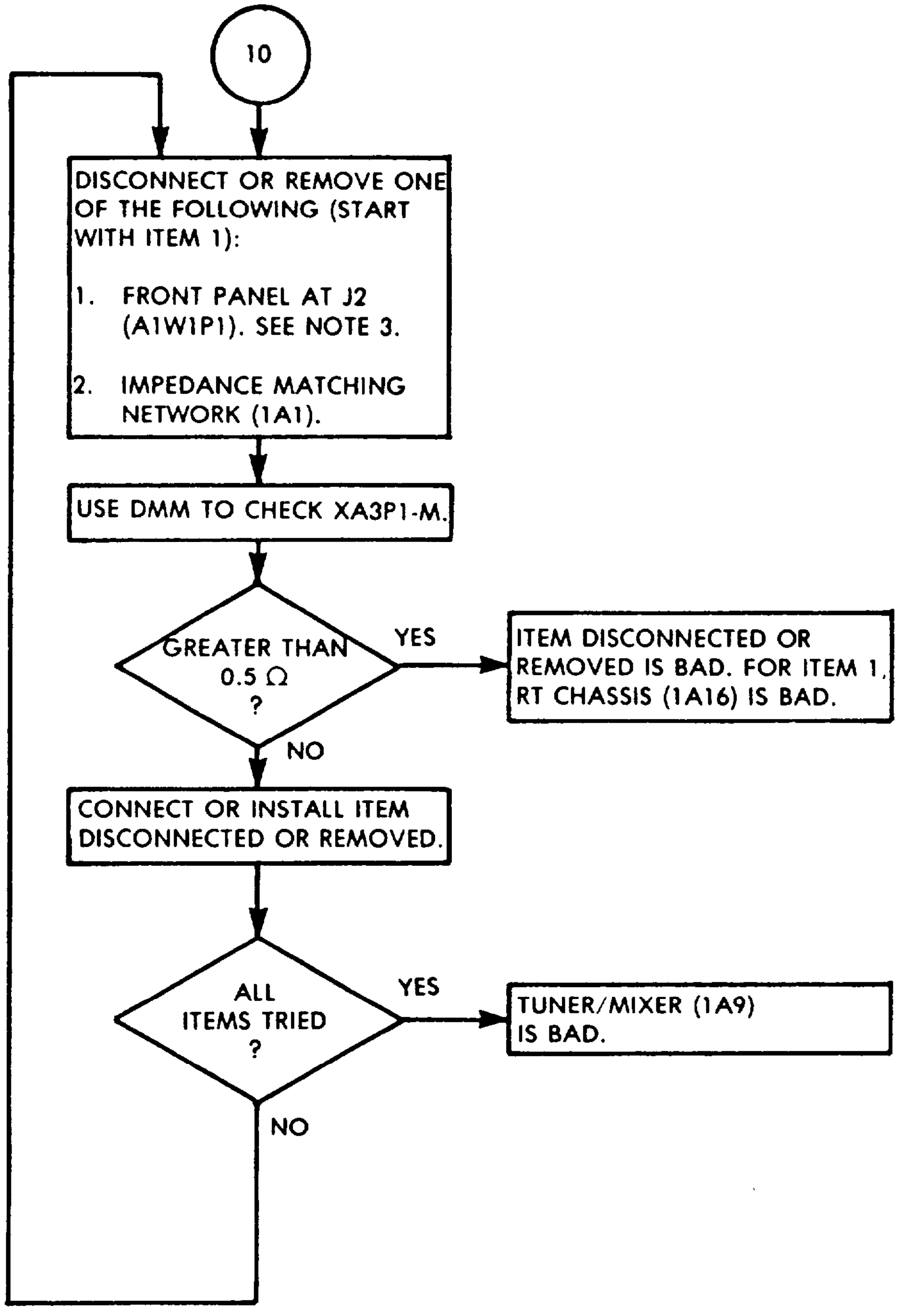
Troubleshooting Power Supply Inputs and Outputs
(Sheet 7 of 8)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

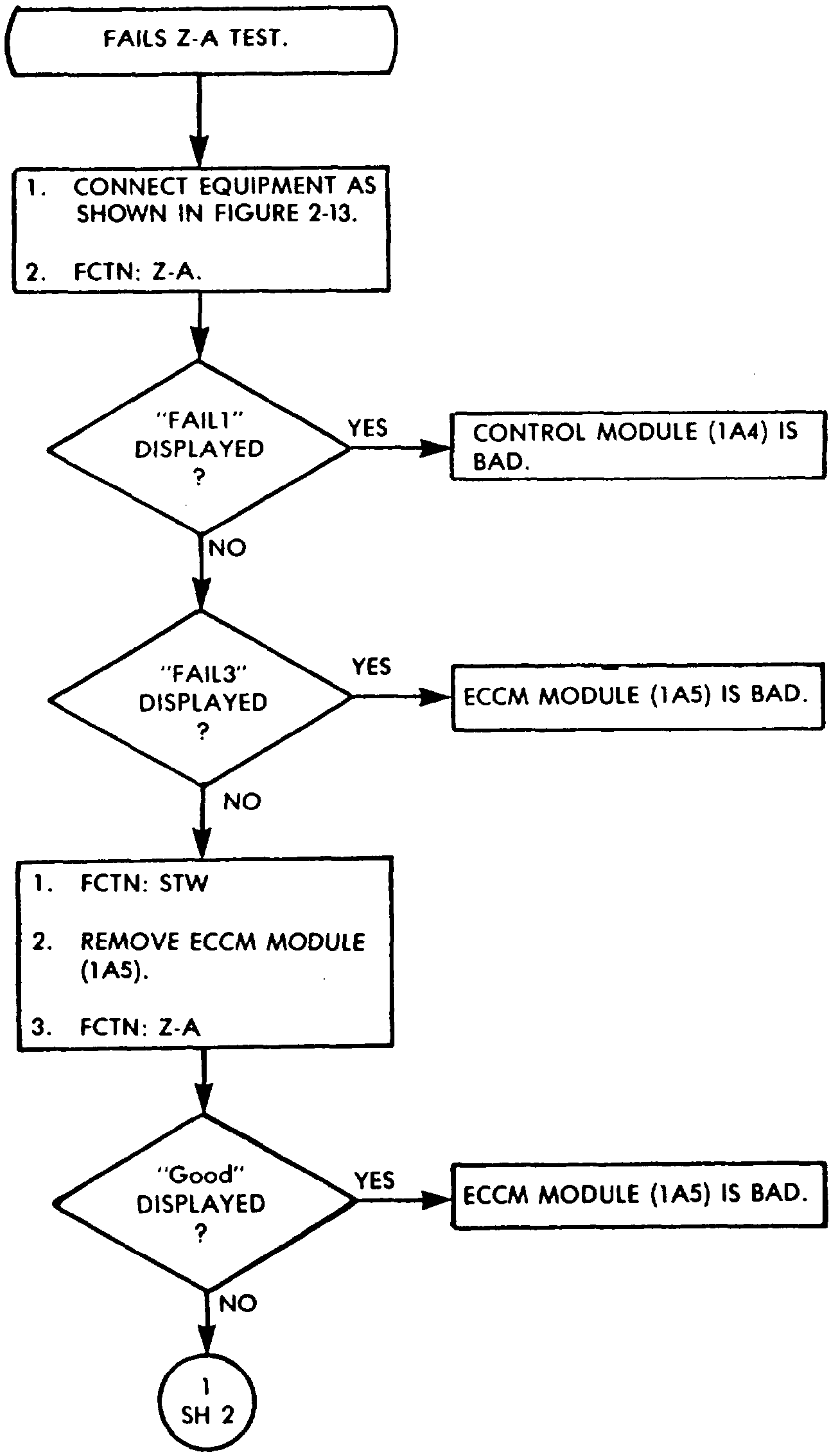
Troubleshooting Power Supply Inputs and Outputs
(Sheet 8 of 8)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

Troubleshooting Z-A Test Failure and Display
(Sheet 1 of 3)



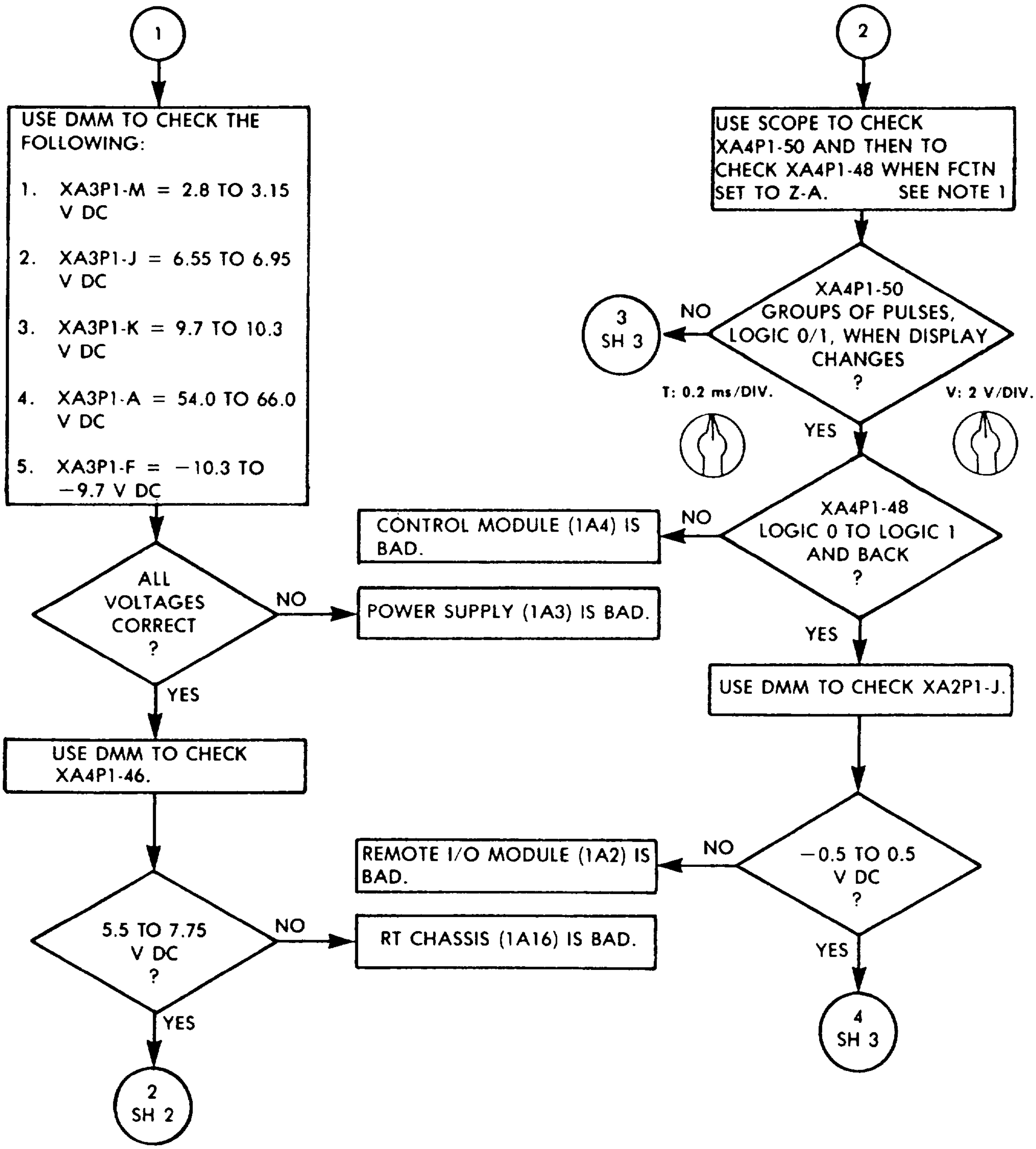
NOTES

1. Setting the FCTN switch to Z-A initiates a sequence of events. Where a reading is to be taken "WHEN FCTN SET TO Z-A", move the FCTN switch to STW then back to Z-A.
2. See FO-13 for location of test points.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

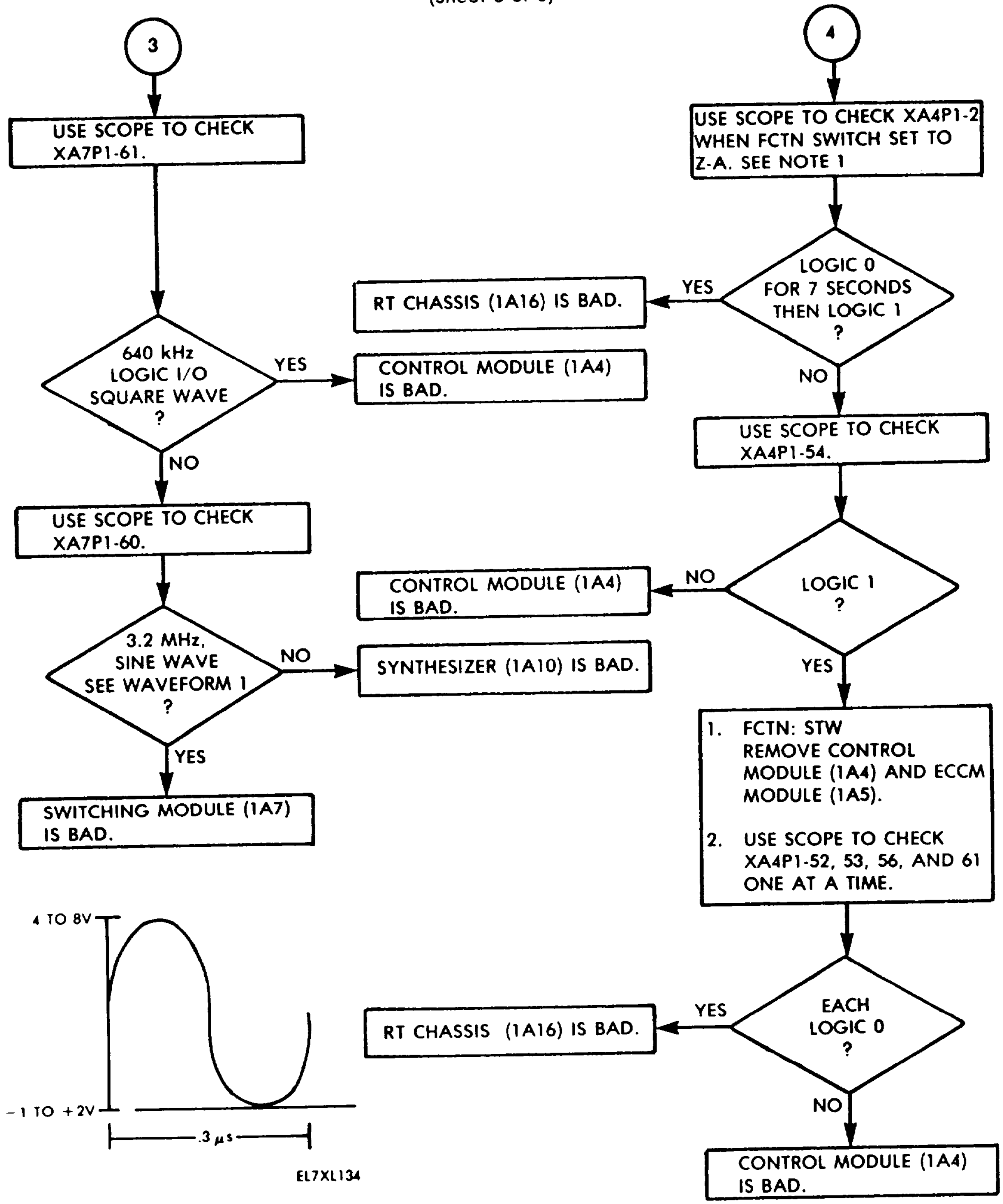
Troubleshooting Z-A Test Failure and Display
(Sheet 2 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

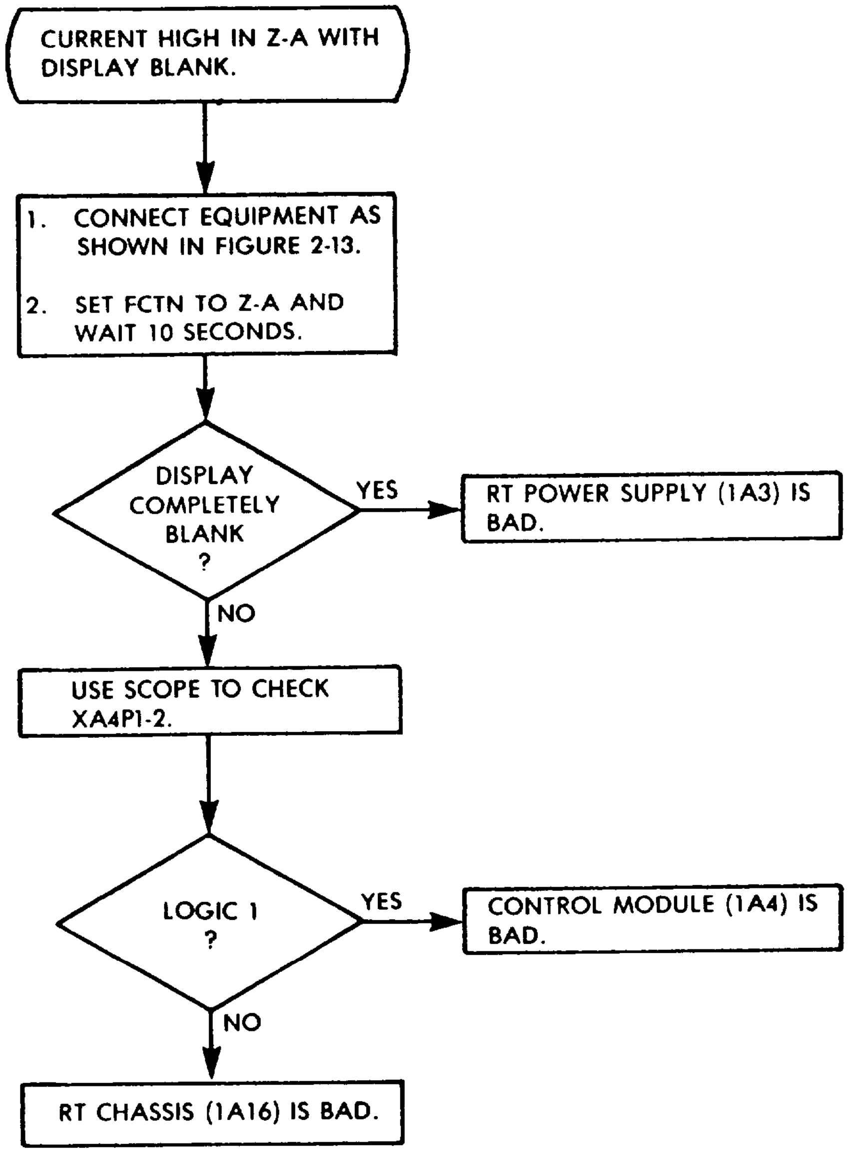
Troubleshooting Z-A Test Failure and Display
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 3

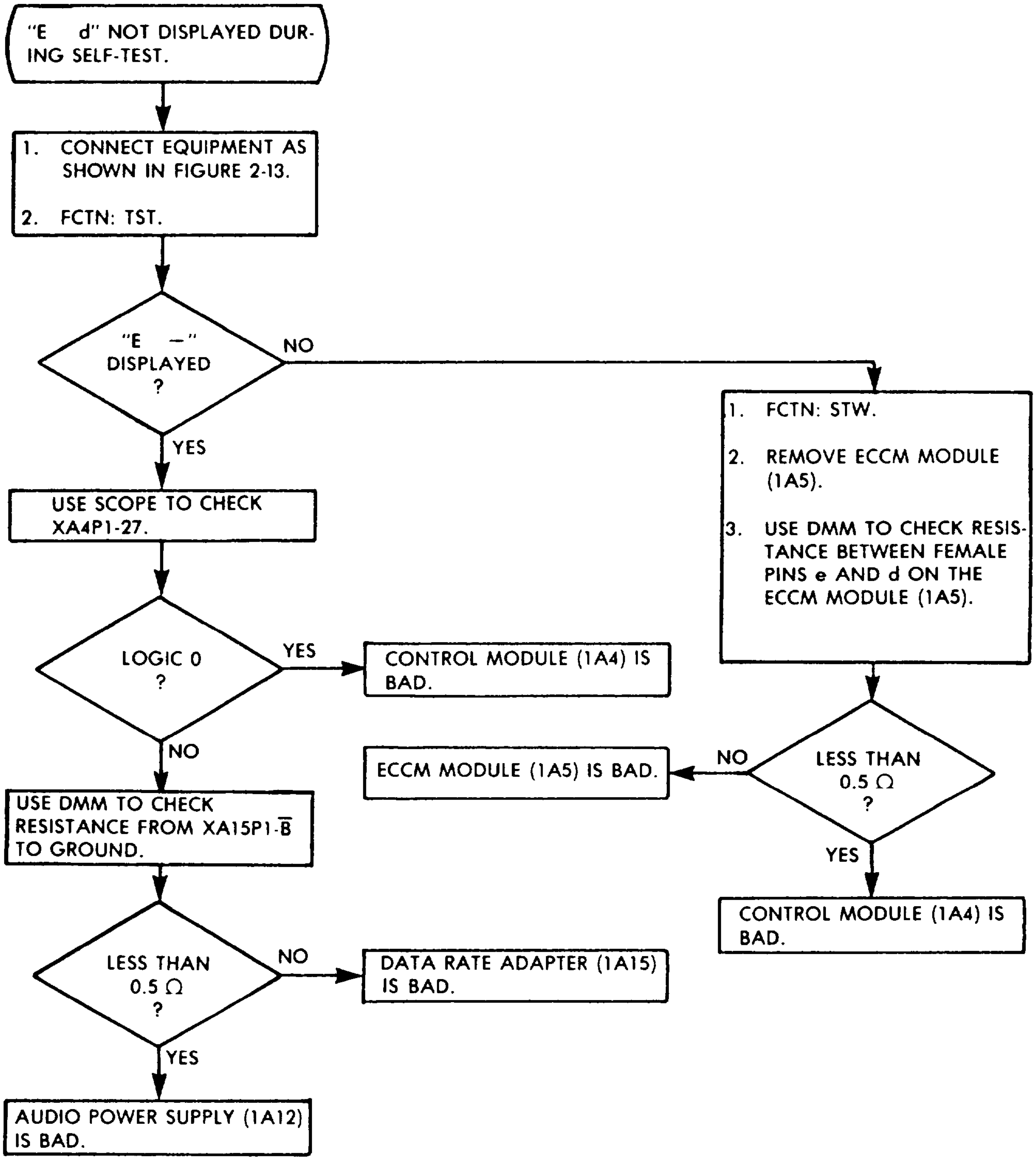
Troubleshooting Display Enable
(Sheet 1 of 1)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 4

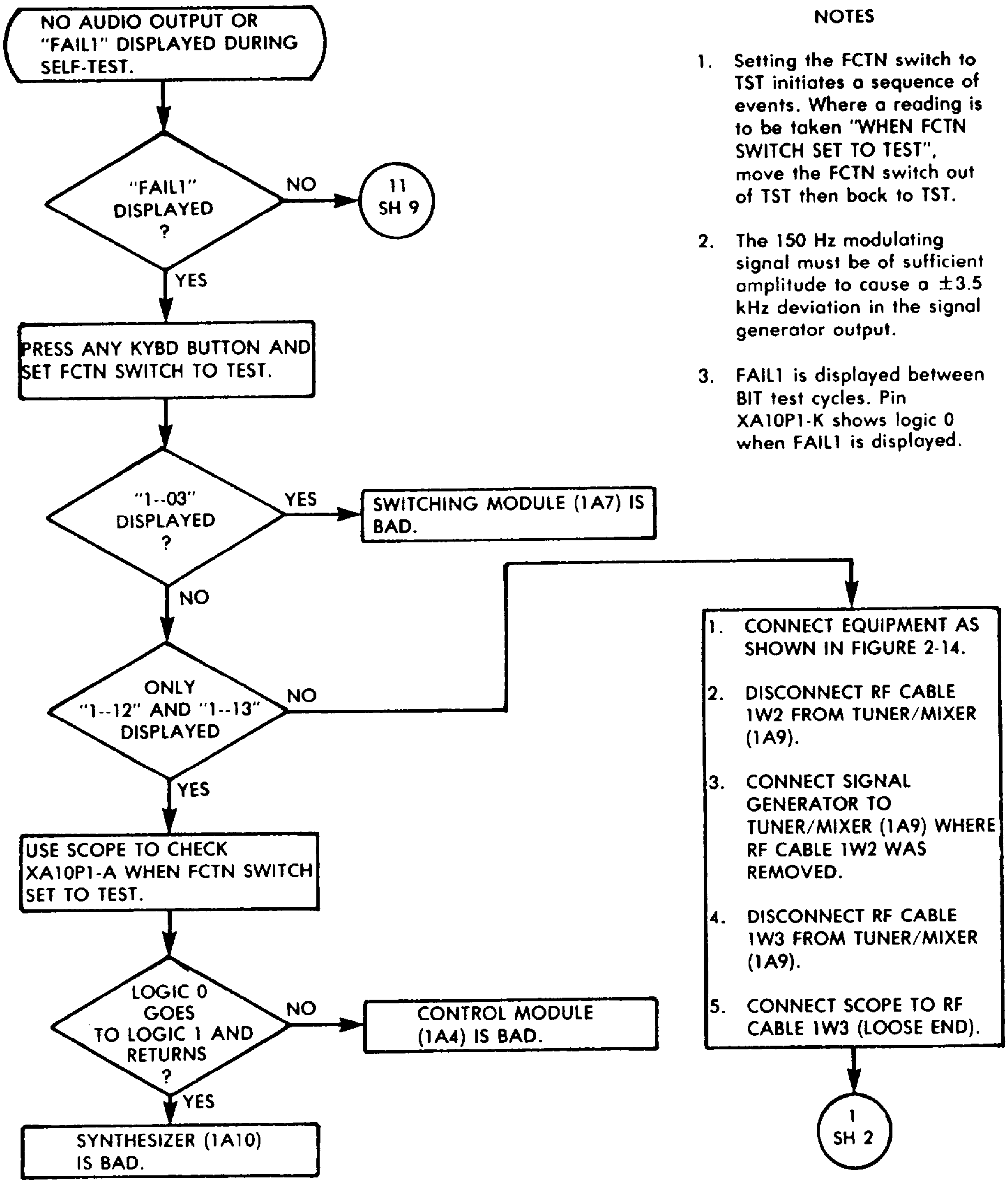
Troubleshooting Incorrect Self-Test "E d" Display
(Sheet 1 of 1)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

Troubleshooting Self-Test and Audio Paths
(Sheet 1 of 11)

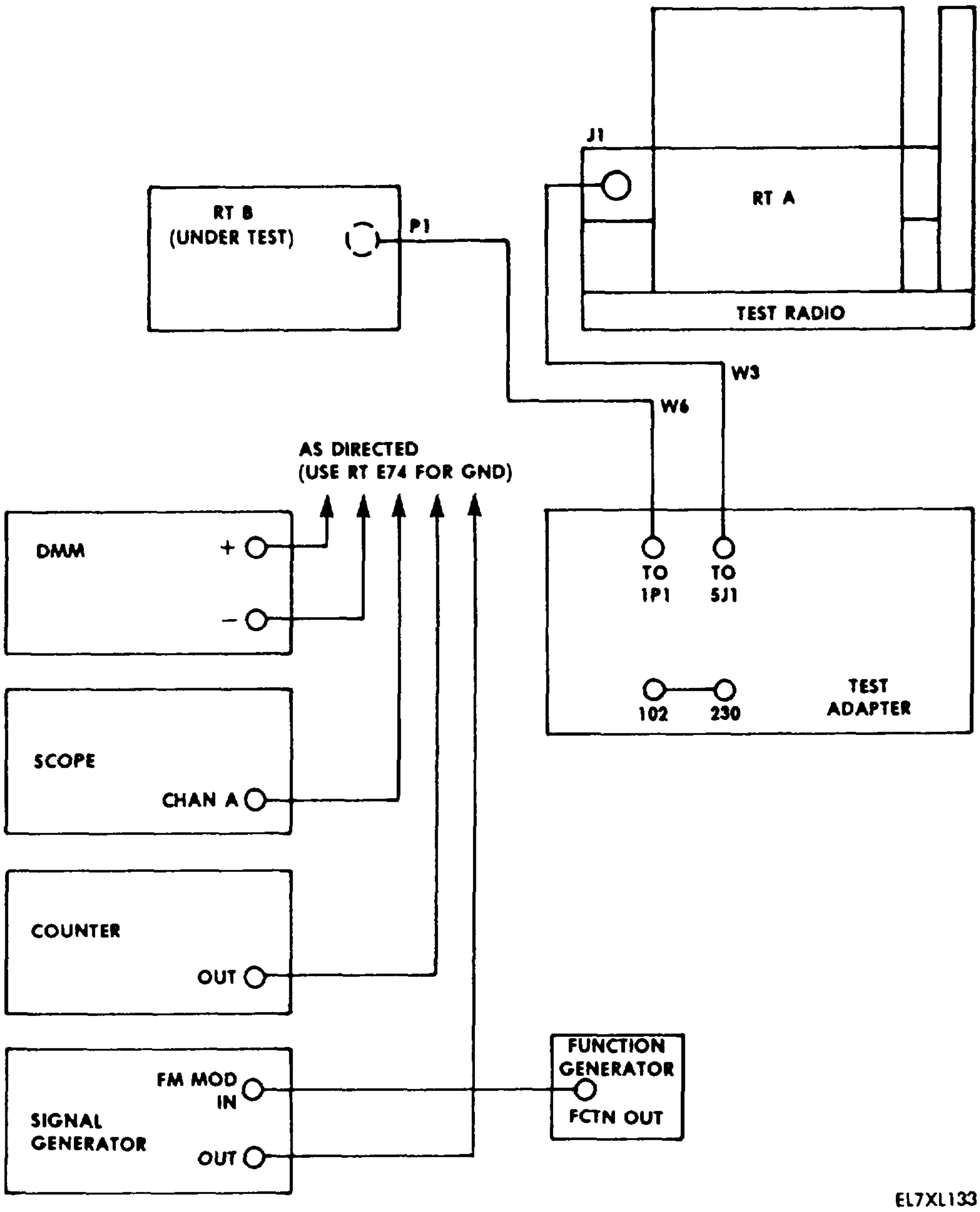


NOTES

1. Setting the FCTN switch to TST initiates a sequence of events. Where a reading is to be taken "WHEN FCTN SWITCH SET TO TEST", move the FCTN switch out of TST then back to TST.

2. The 150 Hz modulating signal must be of sufficient amplitude to cause a ±3.5 kHz deviation in the signal generator output.

3. FAIL1 is displayed between BIT test cycles. Pin XA10P1-K shows logic 0 when FAIL1 is displayed.



EQUIPMENT PRESETS

RT (UNDER TEST)
TOP AND BOTTOM COVERS REMOVED
LOAD CHANNEL 1 WITH 37.875 MHz BEFORE TROUBLESHOOTING.

FCTN:	SQ OFF	RF:	LO
CHAN:	1	MODE:	SC
DATA:	OFF		

TEST RADIO:
CB1: ON
RT A FCTN: OFF

FUNCTION GENERATOR:
150 Hz (149 TO 151 Hz) SINE WAVE AT SUFFICIENT AMPLITUDE TO CAUSE 3.5 kHz DEVIATION IN SIGNAL GENERATOR OUTPUT.

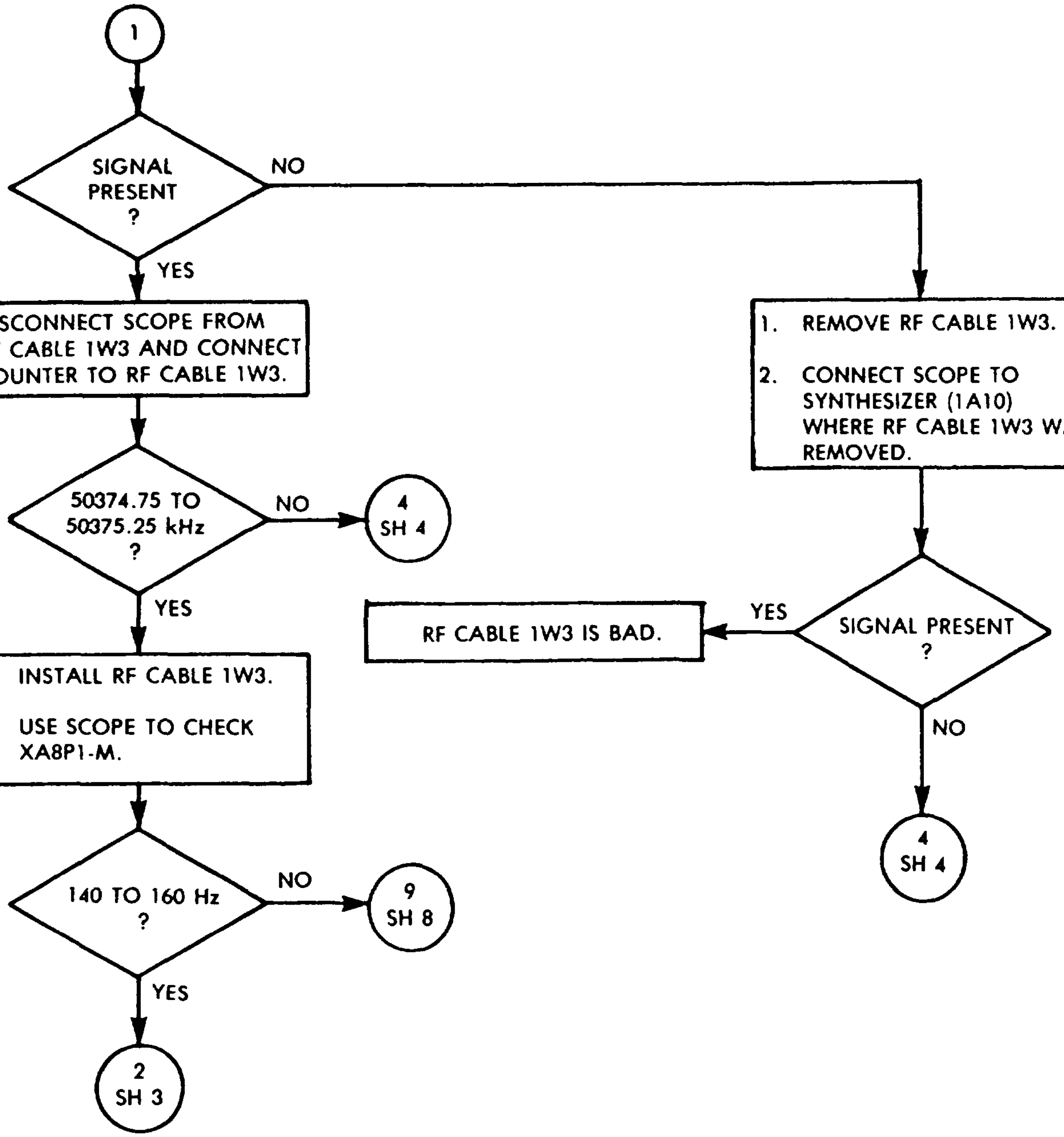
SIGNAL GENERATOR:
FREQ: 37.875 MHz (37.875 TO 37.877 MHz)
LEVEL: -100 dBm (-100.5 TO -99. dBm)
FM MOD: AC

Figure 2-14. "FAIL1" Test Setup.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

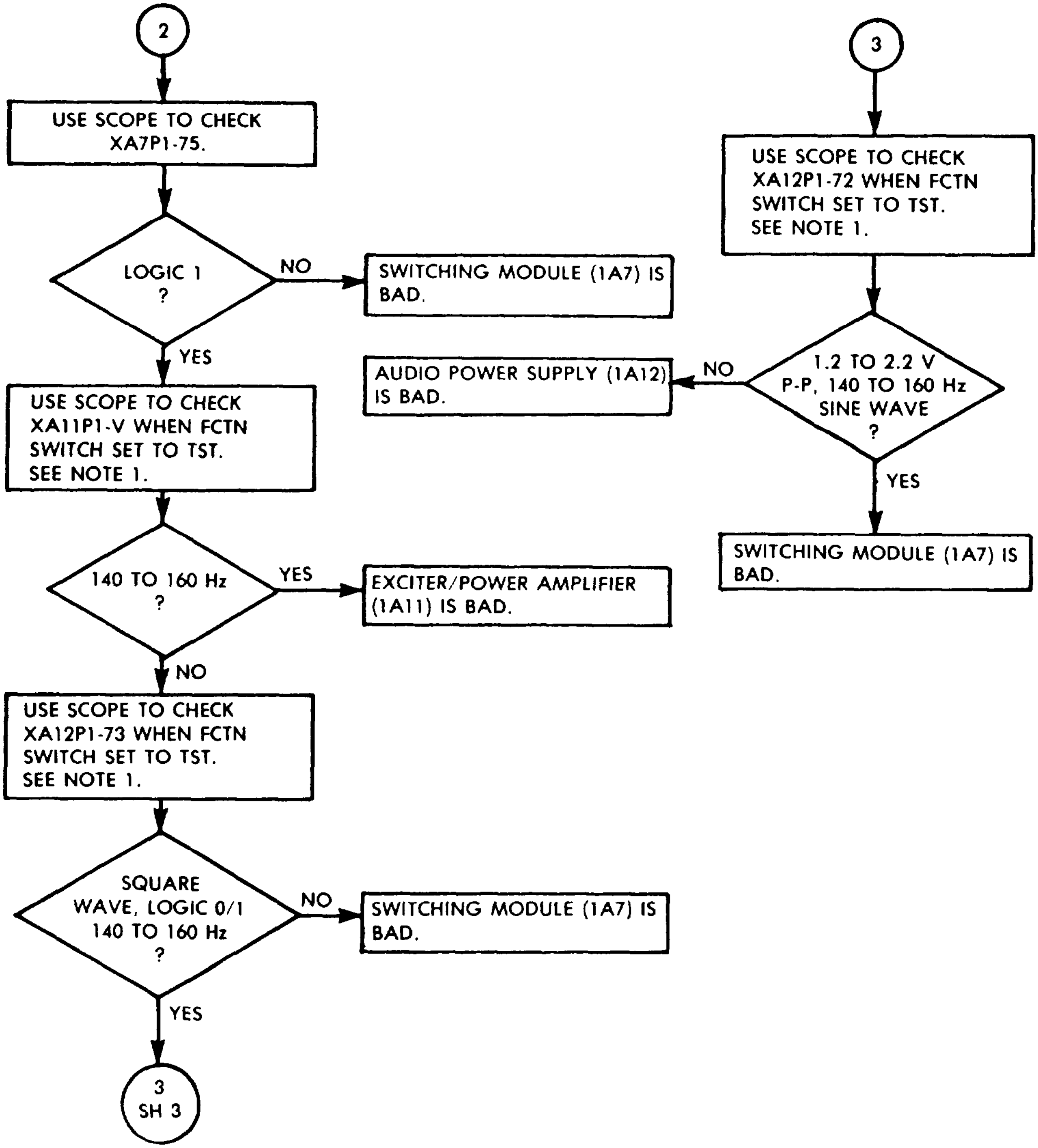
Troubleshooting Self-Test and Audio Paths
(Sheet 2 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

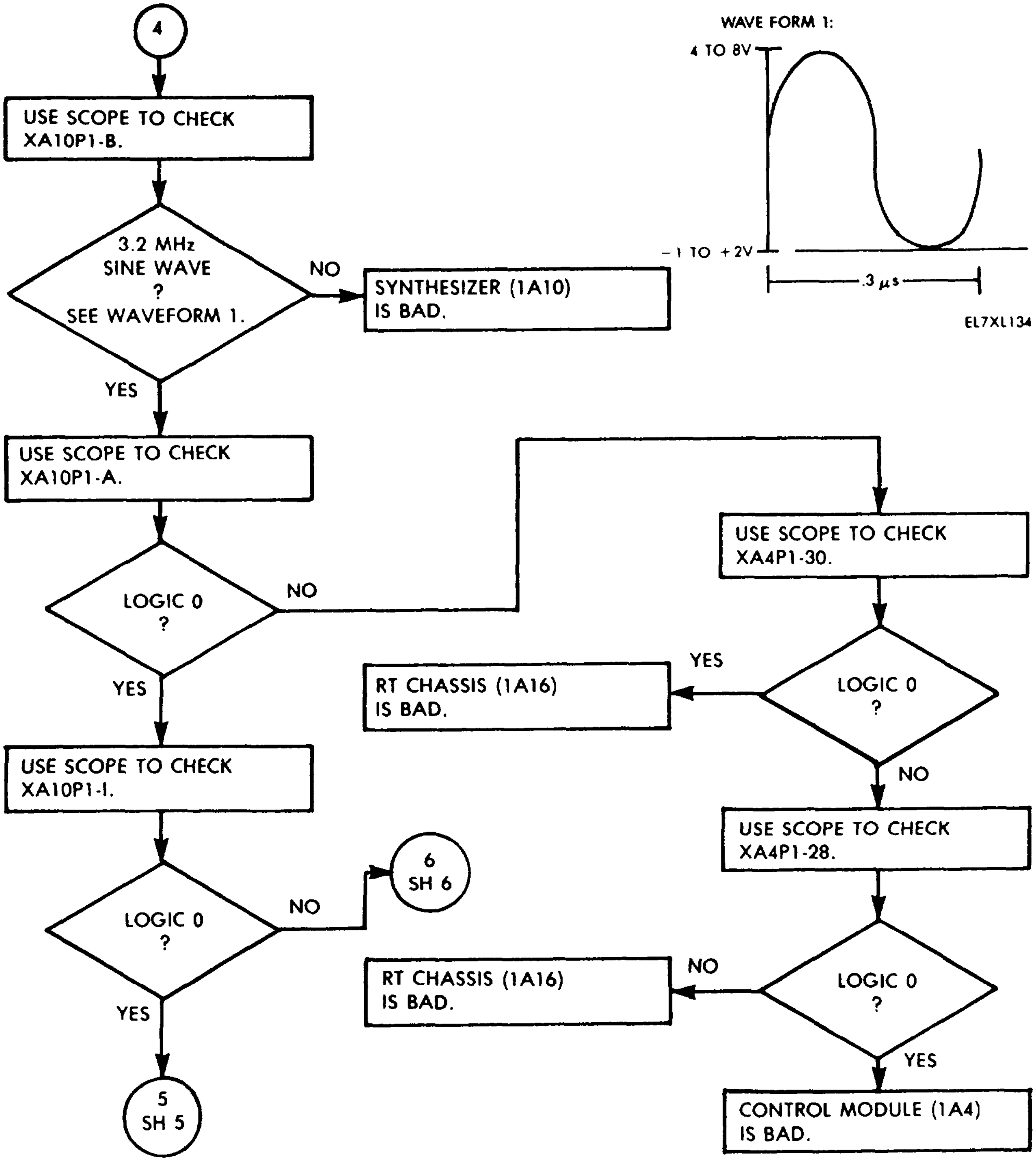
Troubleshooting Self-Test and Audio Paths
(Sheet 3 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

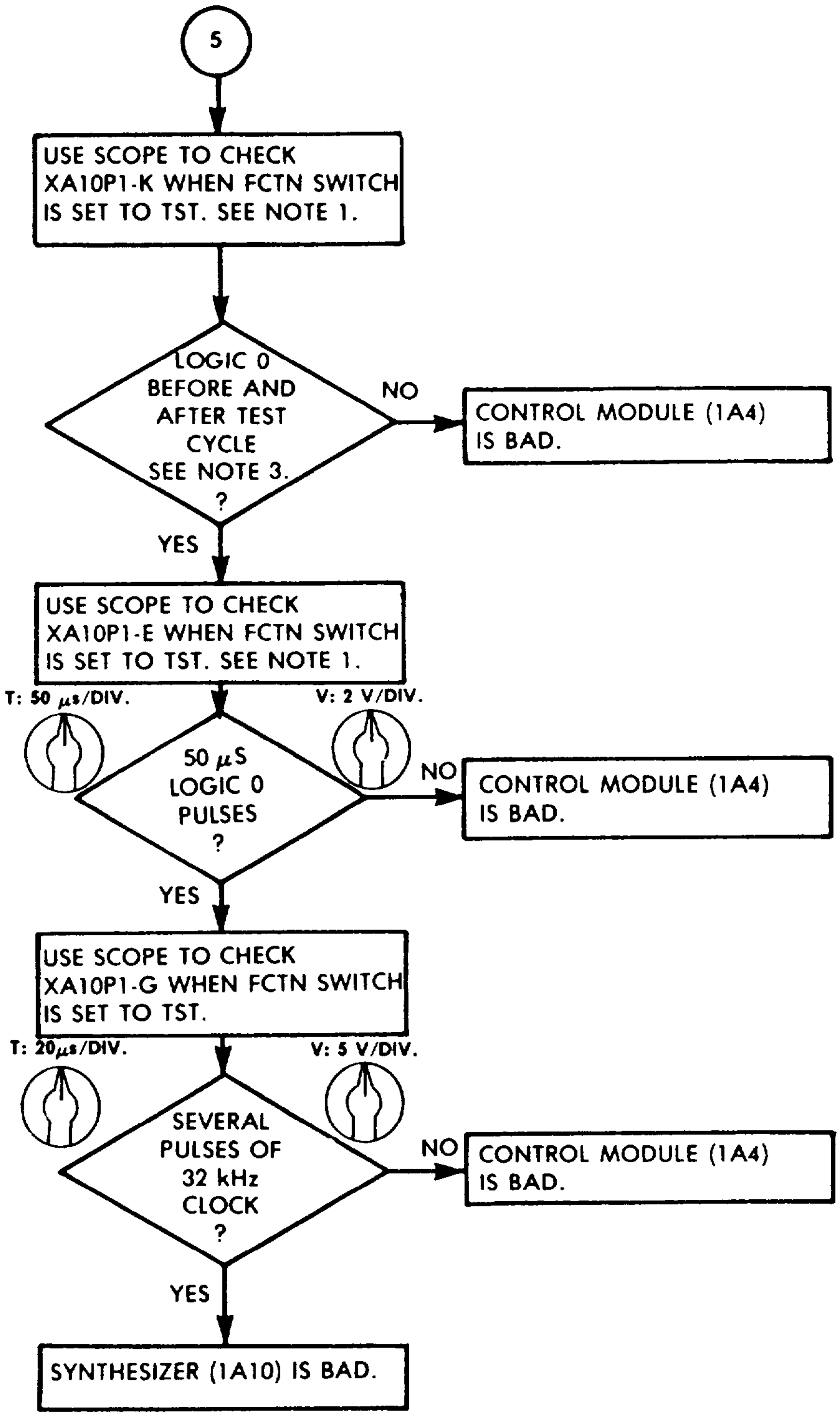
Troubleshooting Self-Test and Audio Paths
(Sheet 4 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

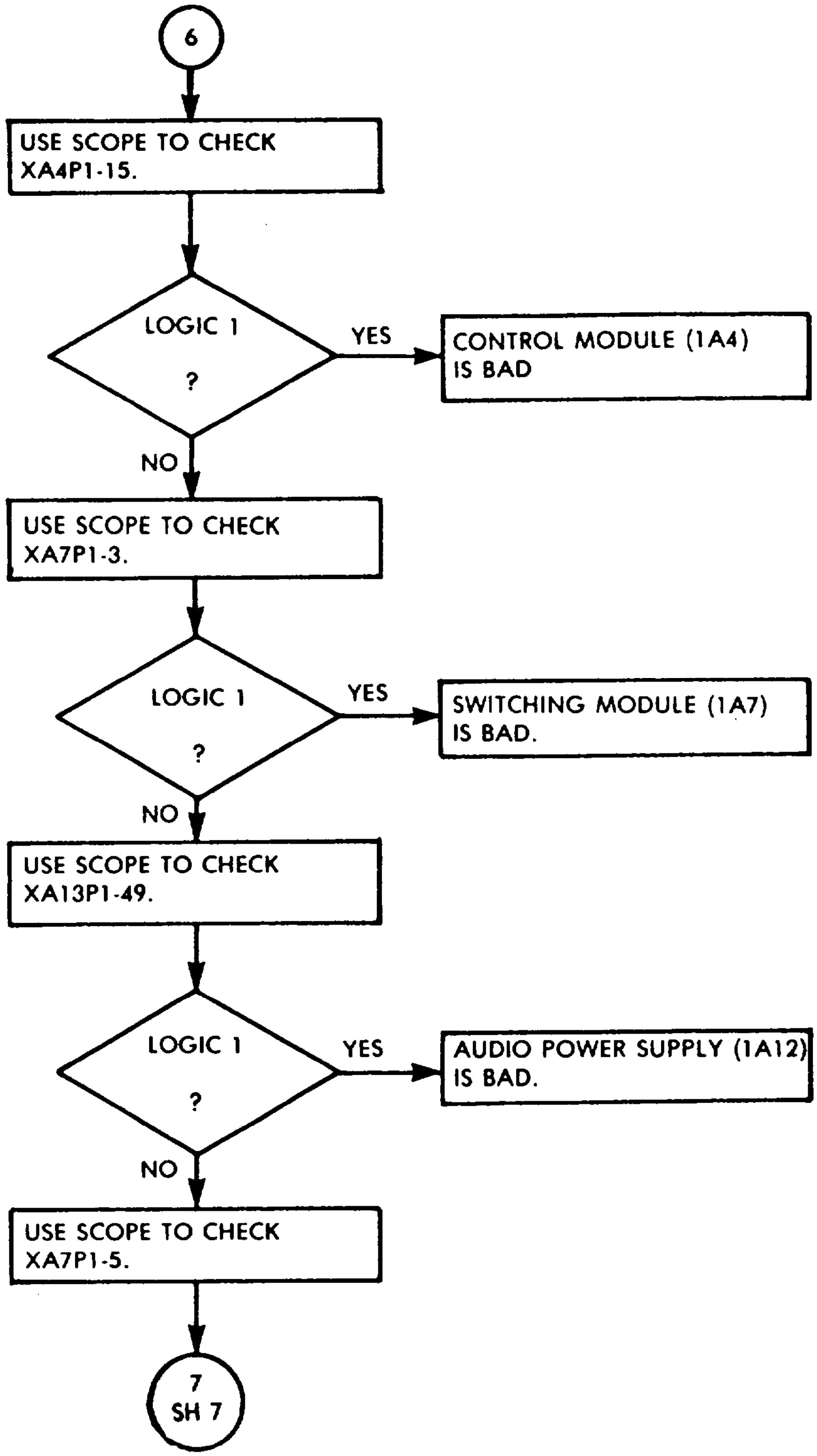
Troubleshooting Self-Test and Audio Paths
(Sheet 5 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

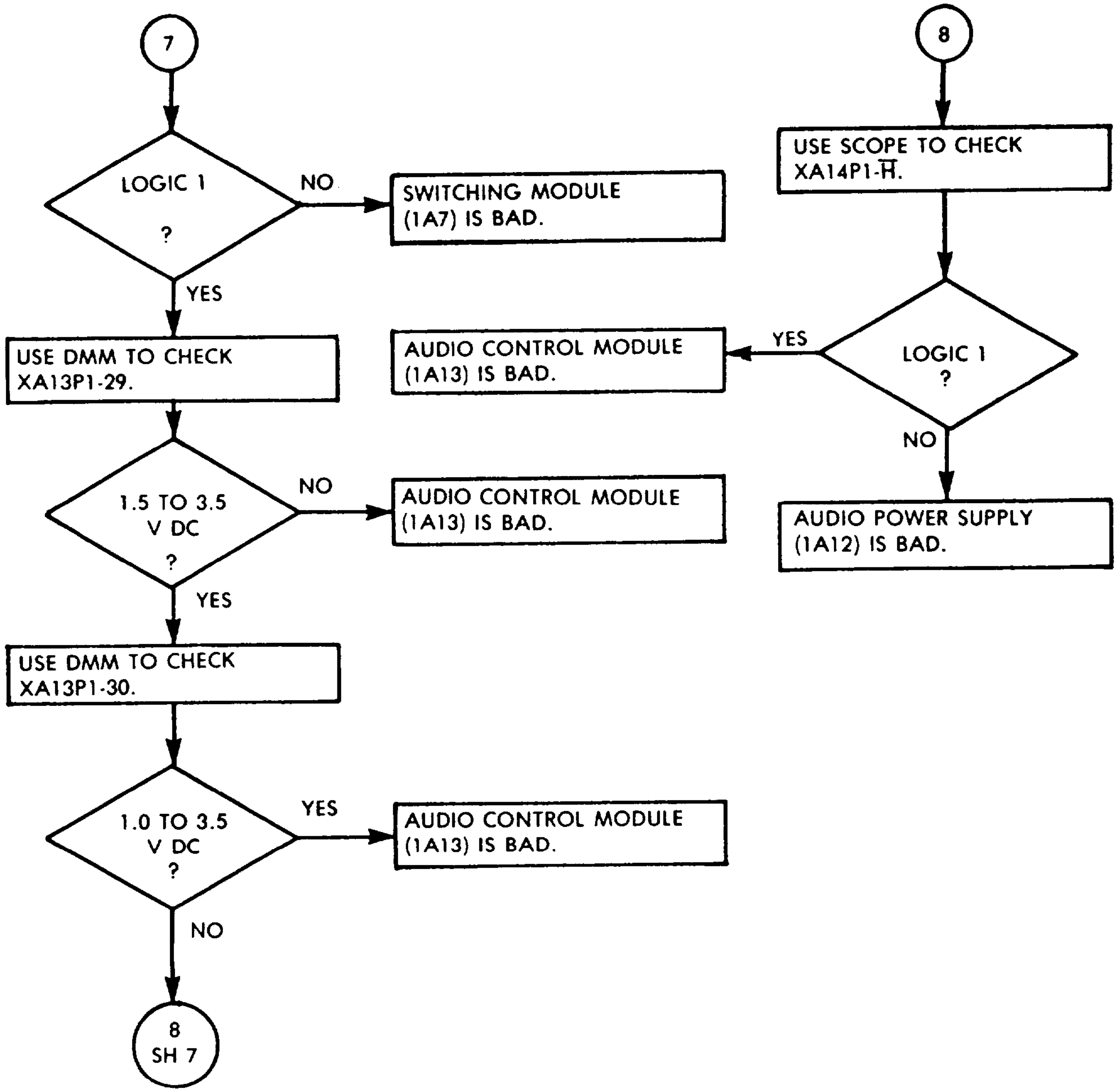
Troubleshooting Self-Test and Audio Paths
(Sheet 6 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

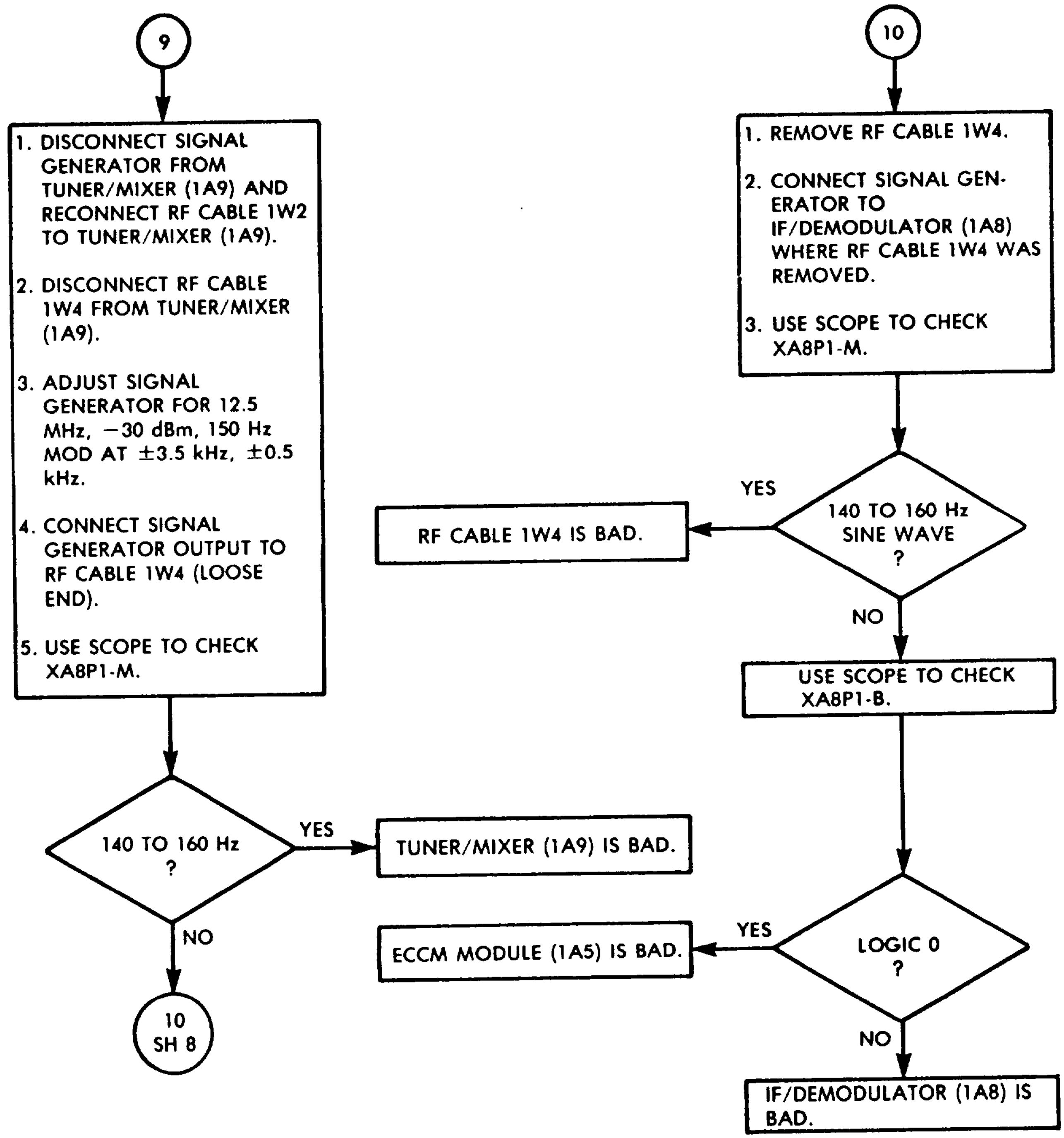
Troubleshooting Self-Test and Audio Paths
(Sheet 7 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

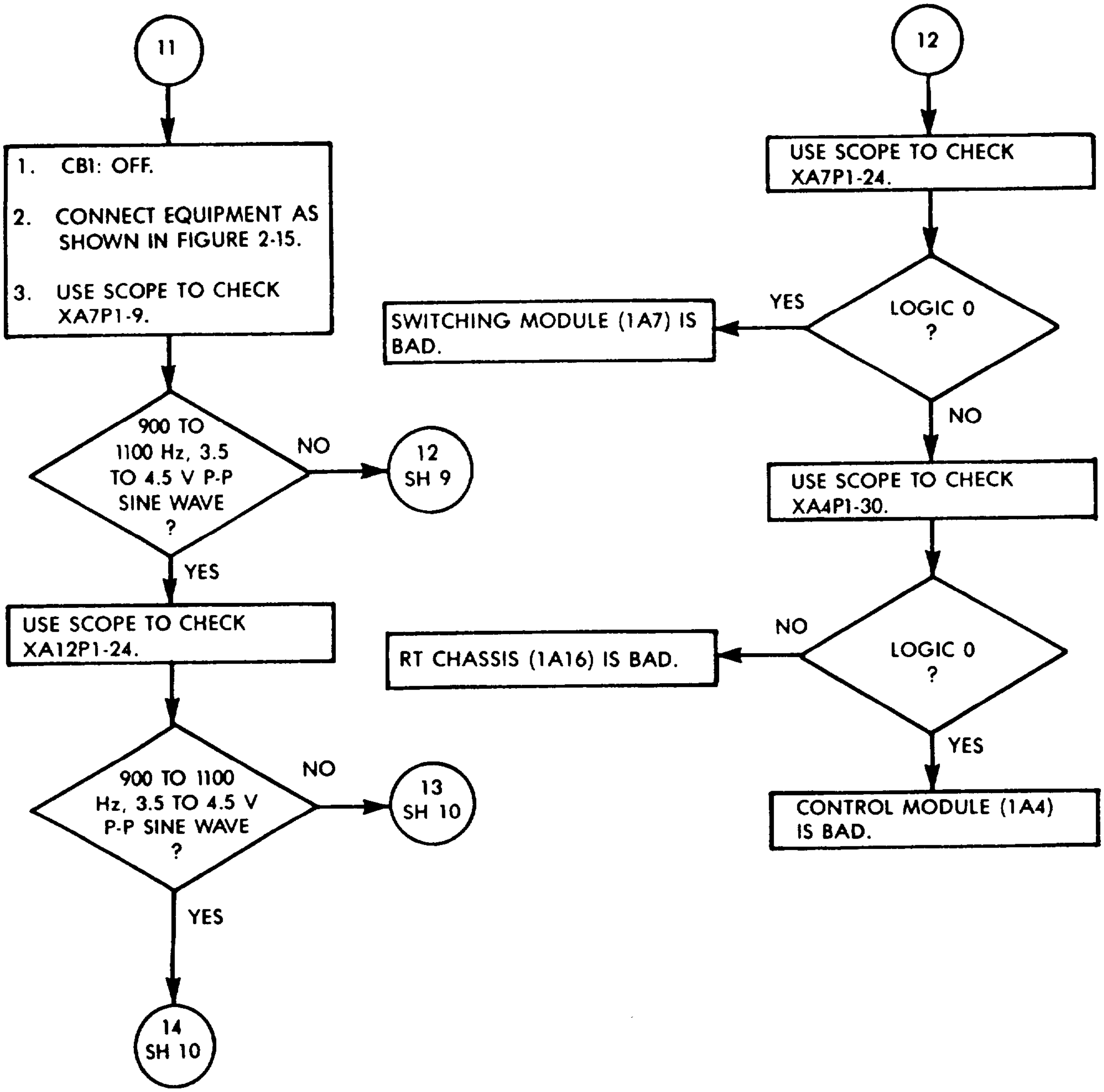
Troubleshooting Self-Test and Audio Paths
(Sheet 8 of 11)

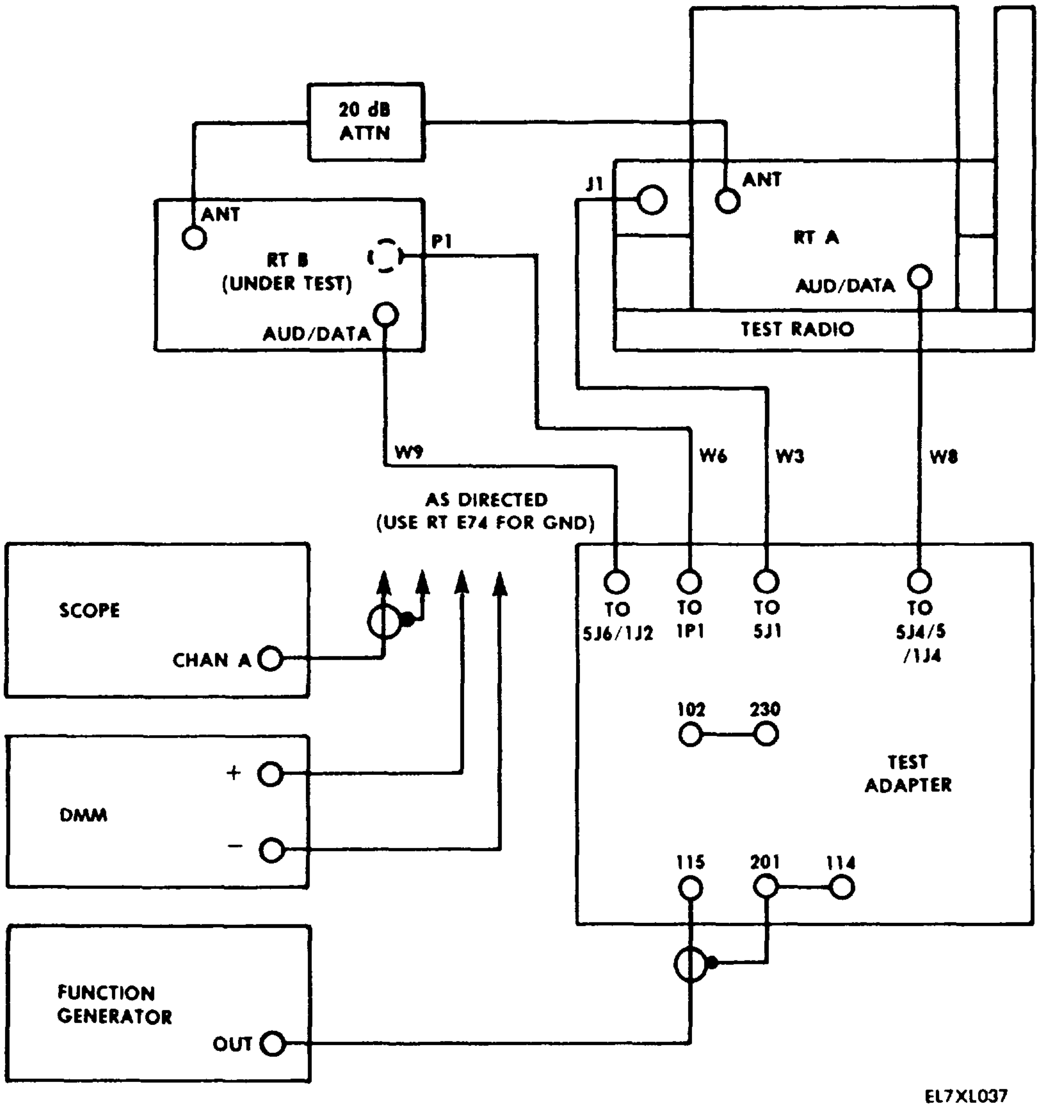


2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

Troubleshooting Self-Test and Audio Paths
(Sheet 9 of 11)





EQUIPMENT PRESETS

RT A AND B:
- RF: LO
- CHAN: MAN
- FCTN: SQ ON
- DATA: OFF
- MODE: SC
- VOL: FULL CW

FUNCTION GENERATOR:
- FREQ: 1000 Hz (900 TO 1100 Hz)
- LEVEL: 120 mV P-P (90 TO 150 mV P-P)
- FUNCTION: SINE

TEST RADIO:
- CB1: ON

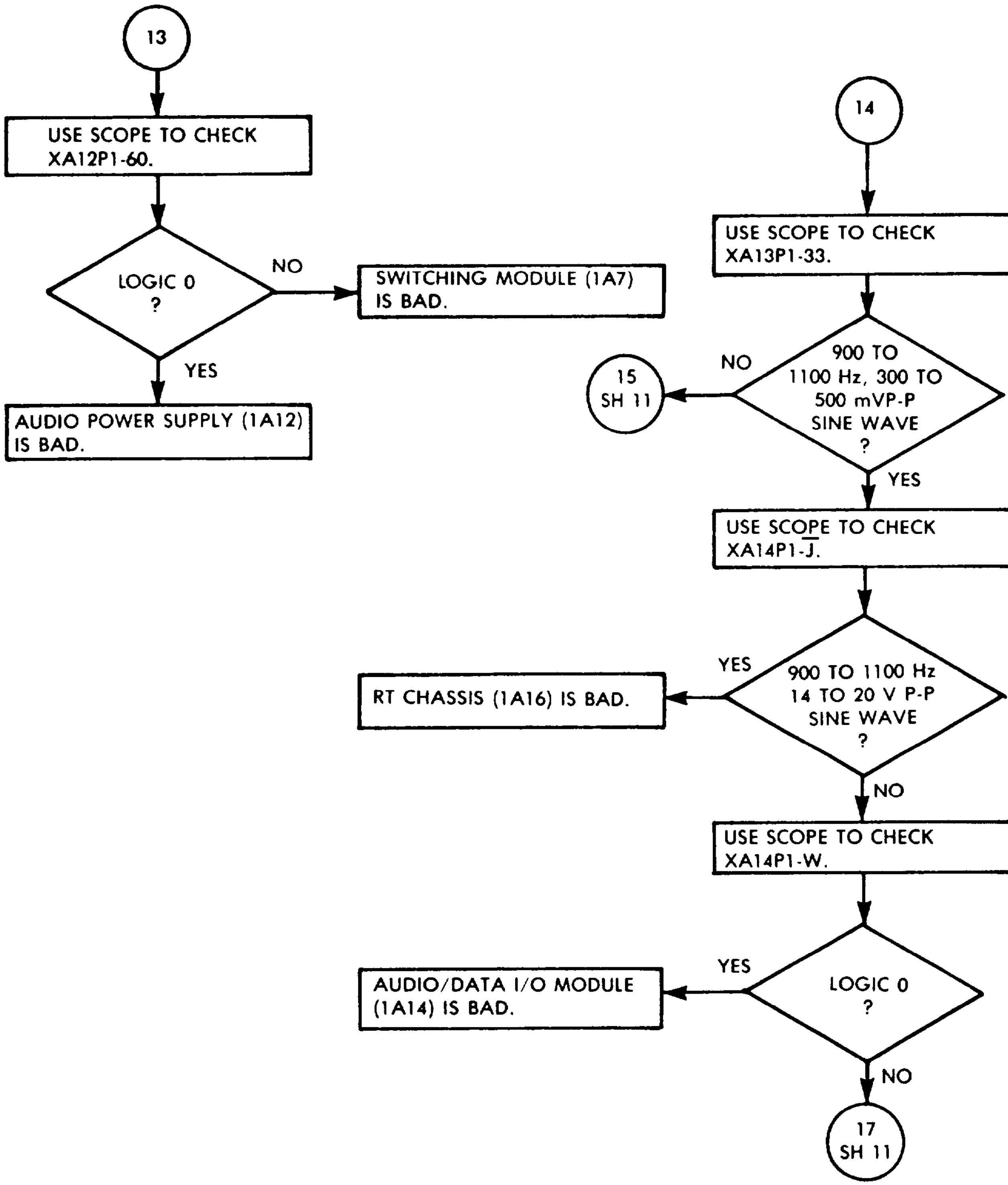
RT B (UNDER TEST): TOP AND BOTTOM COVERS REMOVED.

Figure 2-15. Recieve Path Troubleshooting Test Setup.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

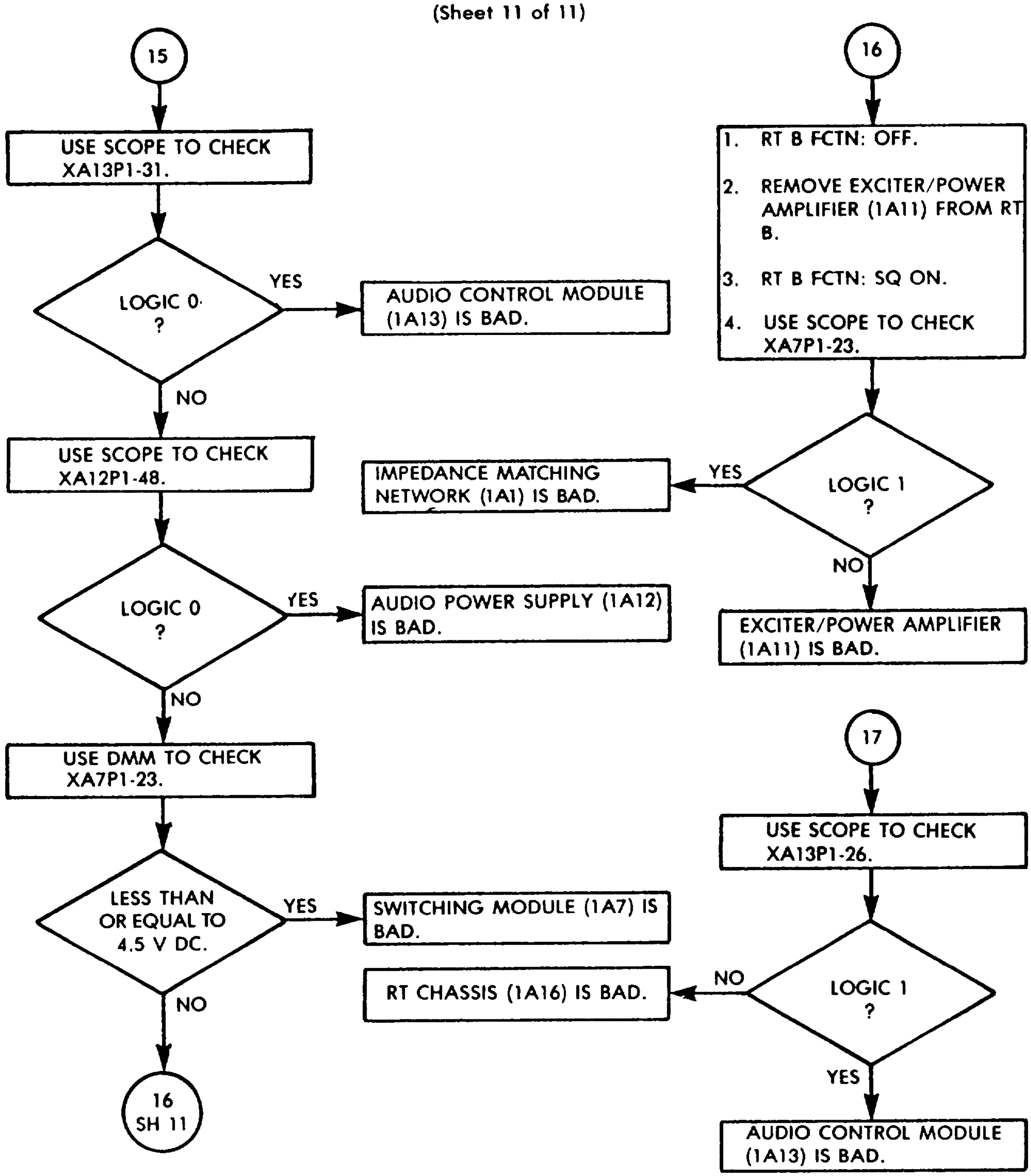
Troubleshooting Self-Test and Audio Paths
(Sheet 10 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

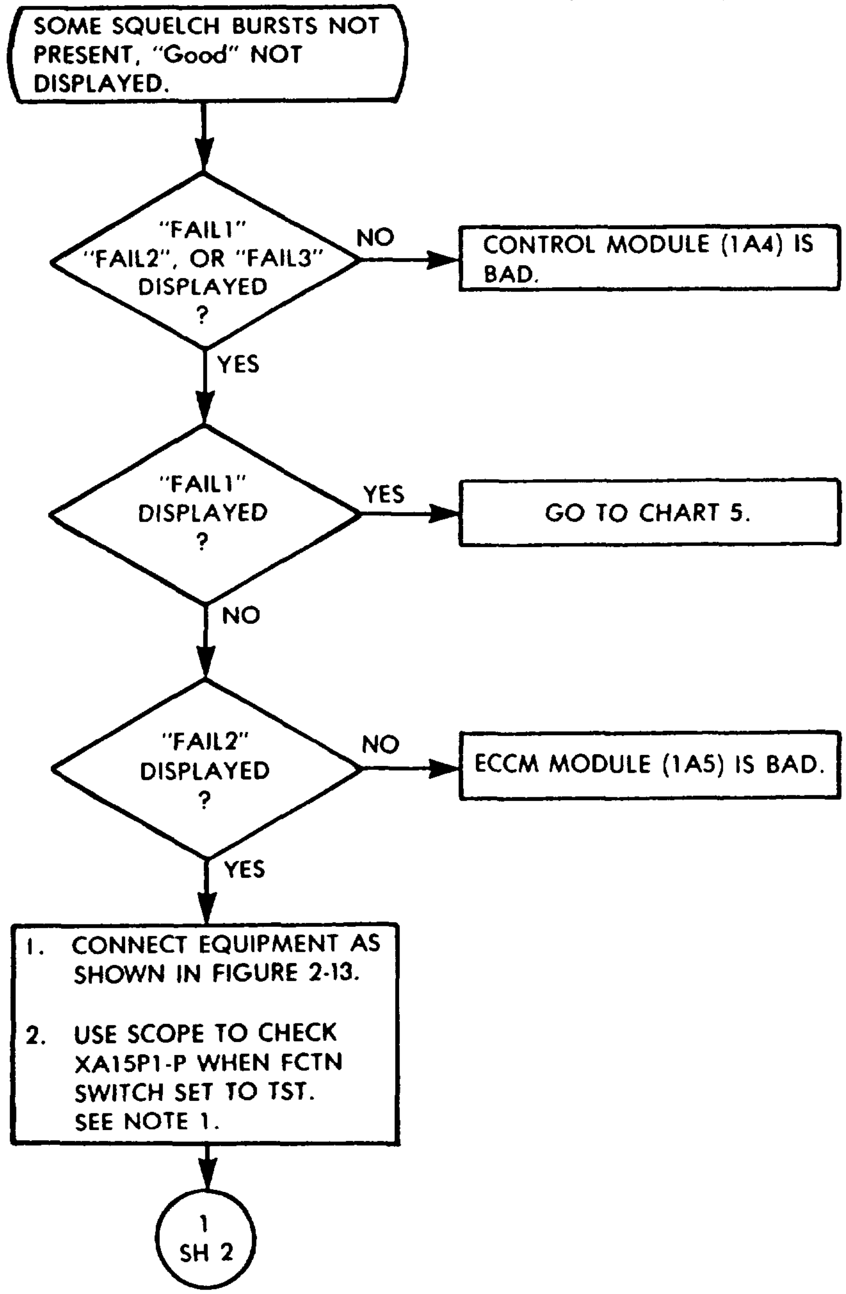
Troubleshooting Self-Test and Audio Paths
(Sheet 11 of 11)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 6

Troubleshooting Self-Test Audio, FAIL 2, and FAIL 3
(Sheet 1 of 3)



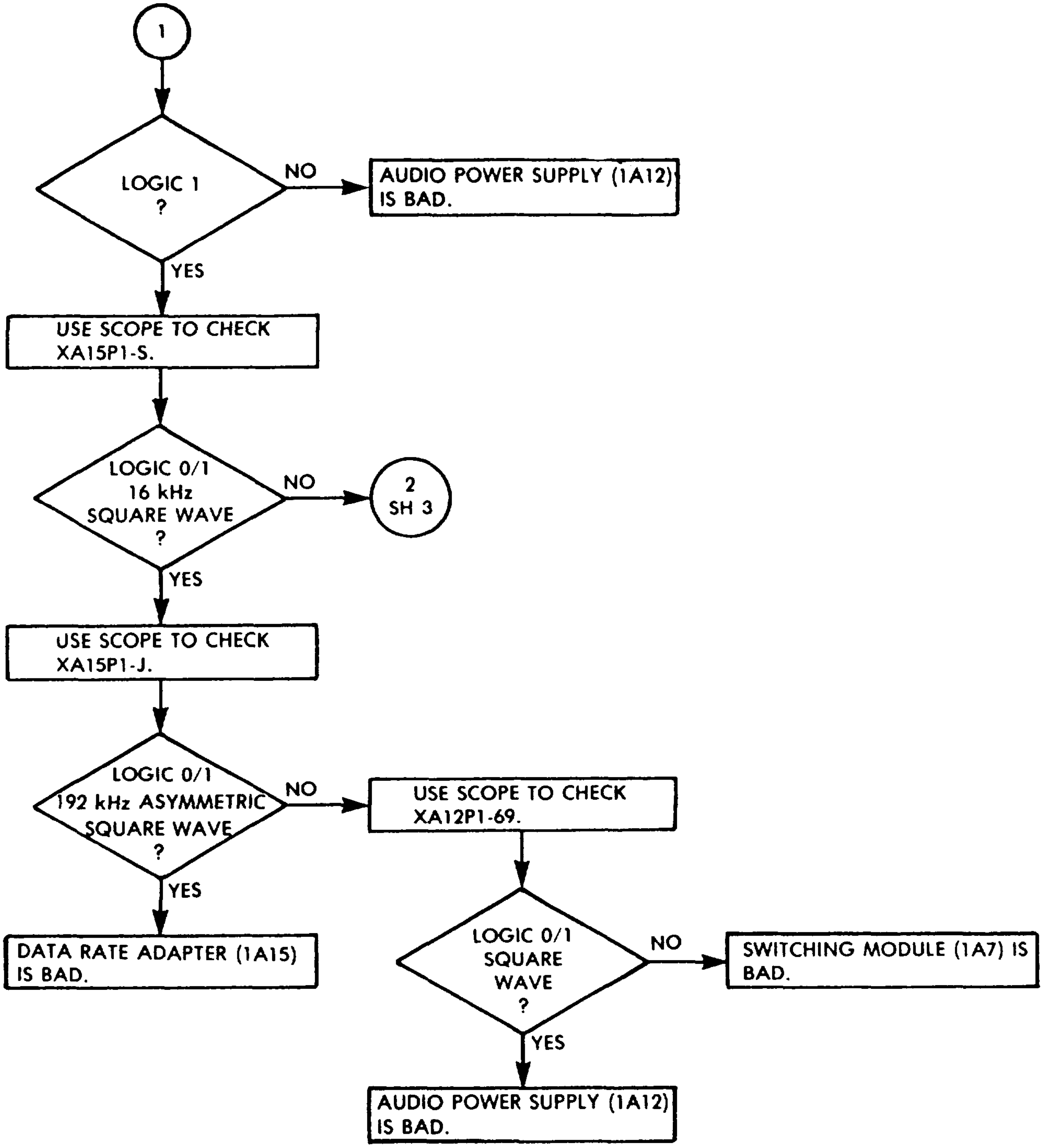
NOTE

Setting the FCTN switch to TST initiates a sequence of events. Where a reading is to be taken "WHEN FCTN SWITCH SET TO TST", move the FCTN switch out of TST then back to TST.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 6

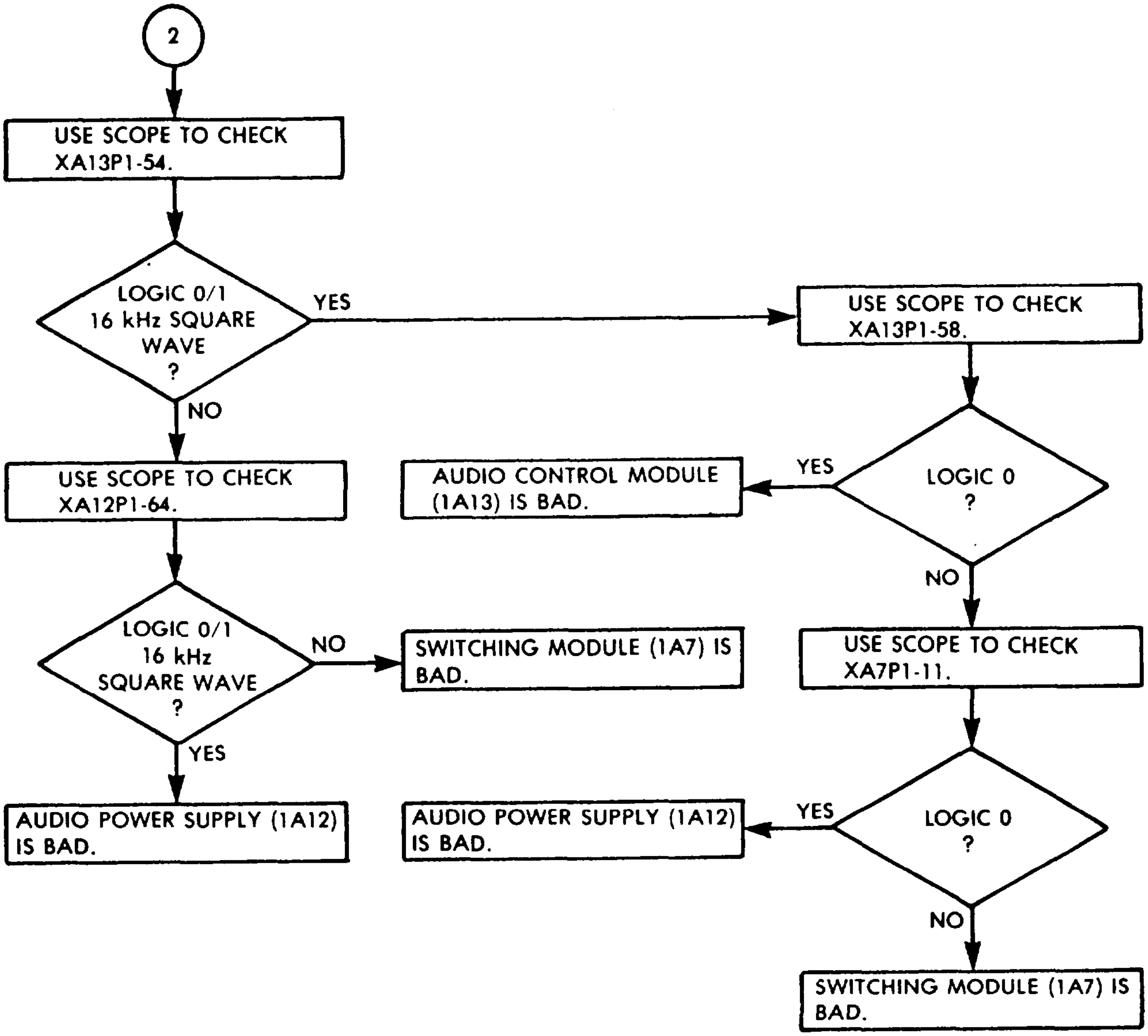
Troubleshooting Self-Test Audio, FAIL 2, and FAIL 3
(Sheet 2 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 6

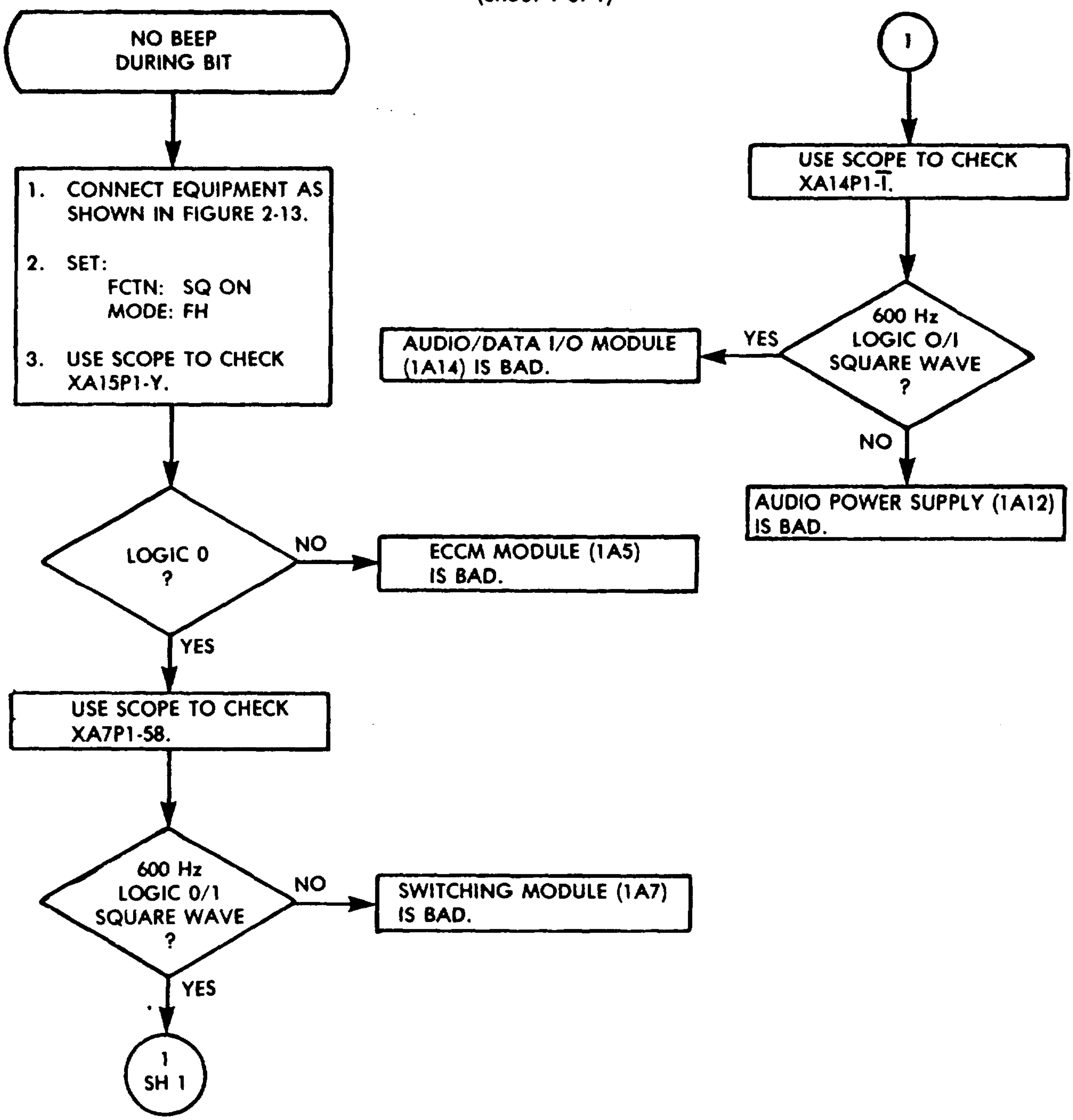
Troubleshooting Self-Test Audio, FAIL 2, and FAIL 3
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 7

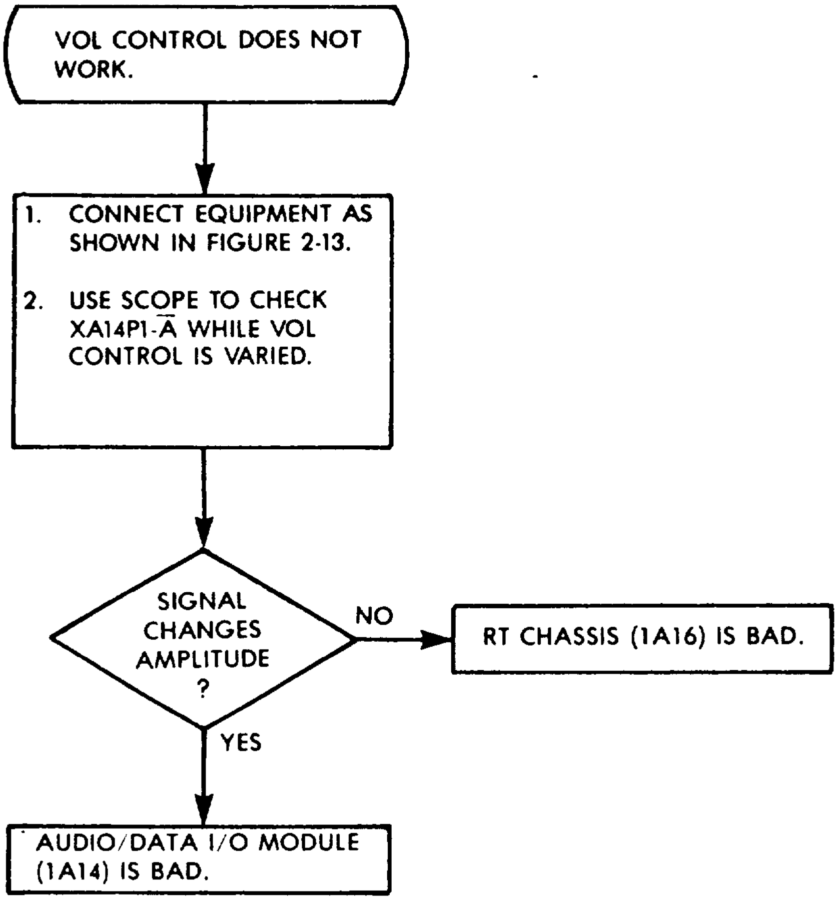
Troubleshooting FH Self-Test
(Sheet 1 of 1)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 8

Troubleshooting VOL Control
(Sheet 1 of 1)



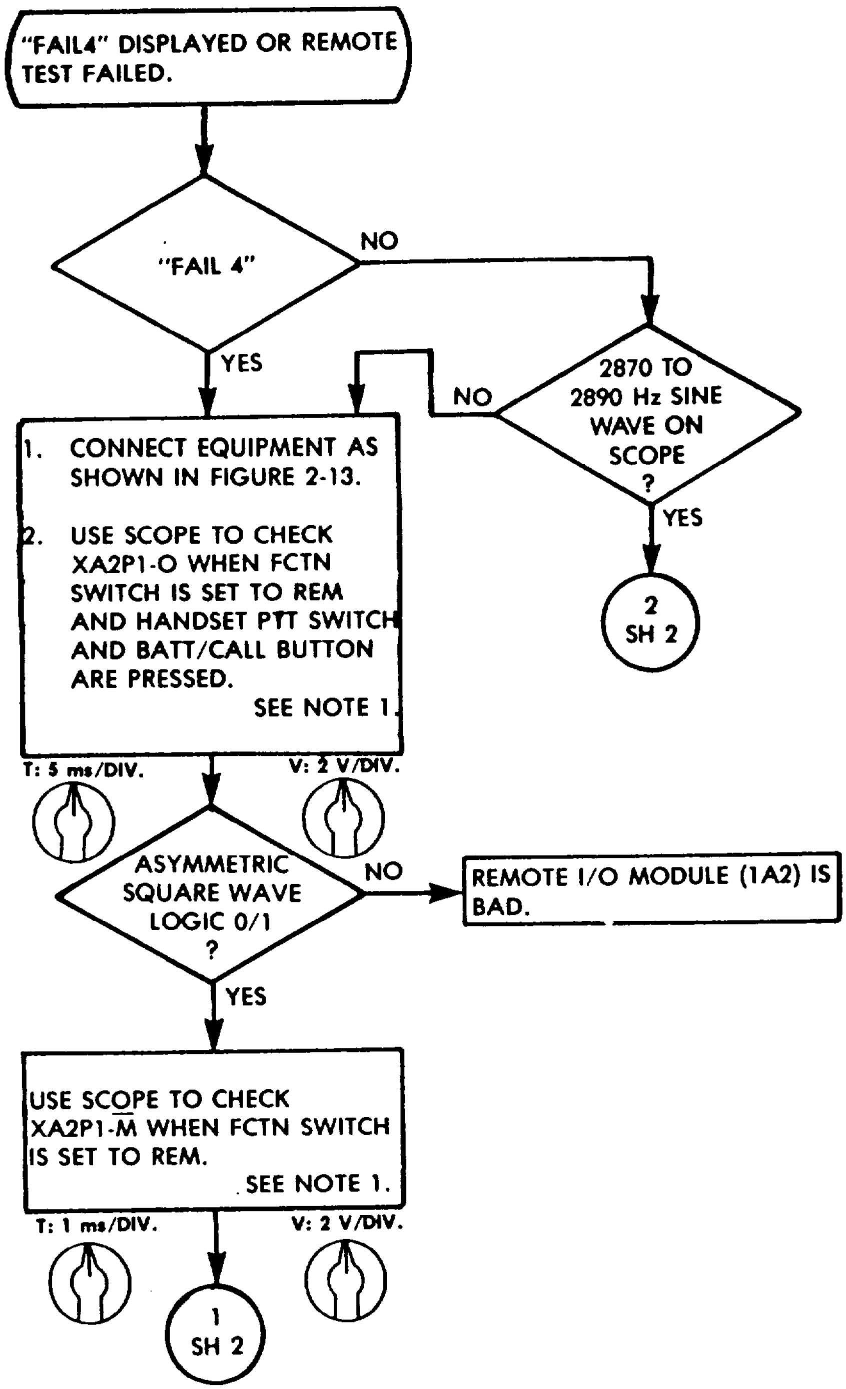
NOTE

See FO-7 for diagram of this circuit path.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 9

Troubleshooting Remote Control Circuits
(Sheet 1 of 7)



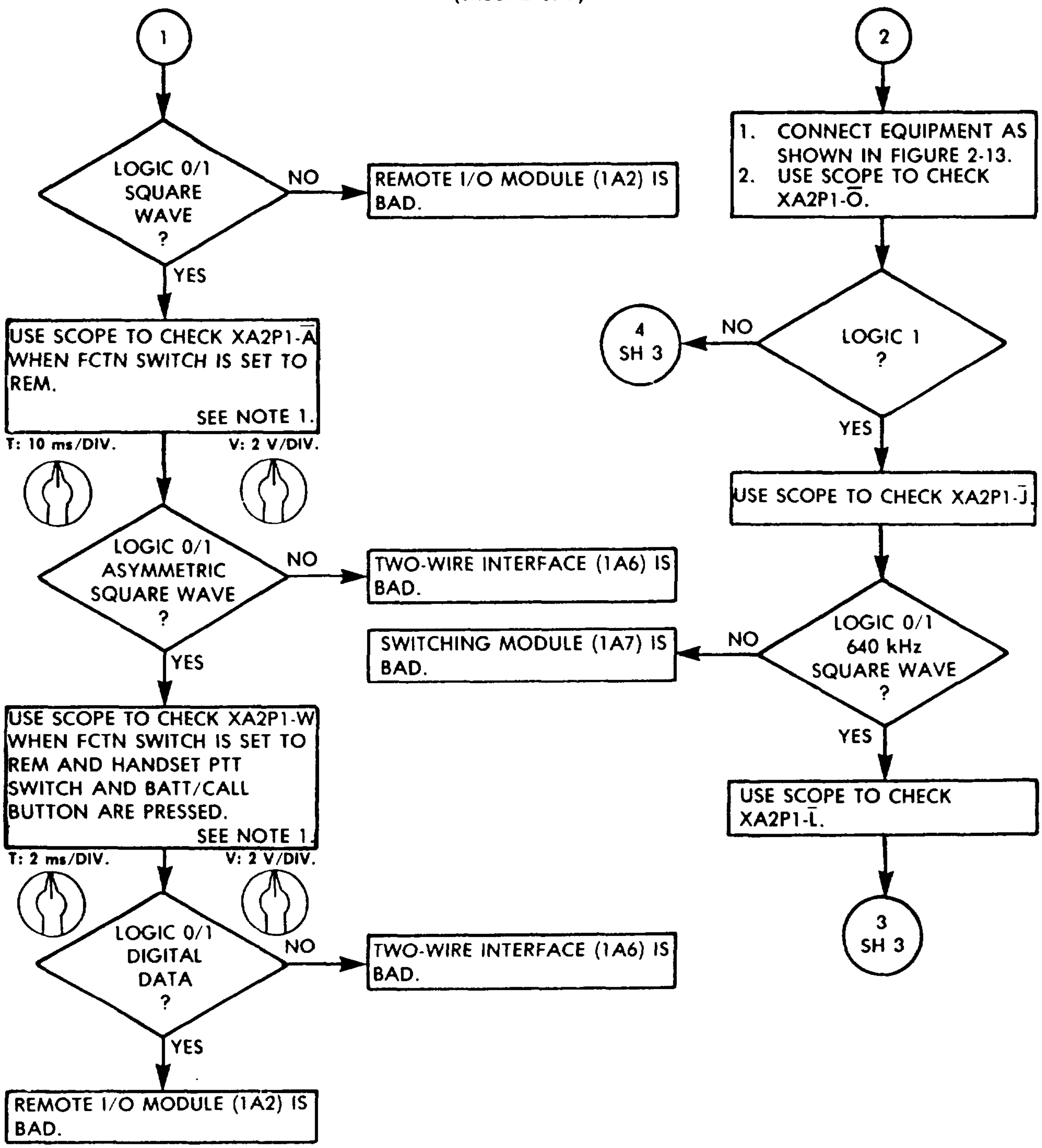
NOTES

1. Setting the FCTN switch to REM initiates a sequence of events. Where a reading is to be taken "WHEN FCTN SWITCH IS SET TO REM," move the FCTN switch out of REM then back to REM. Where required, PTT and BATT/CALL must be pressed and held at the same time.
2. See FO-10 for diagram of these circuit paths.
3. If you get logic 1, try turning the FCTN switch out of REM then back to REM.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 9

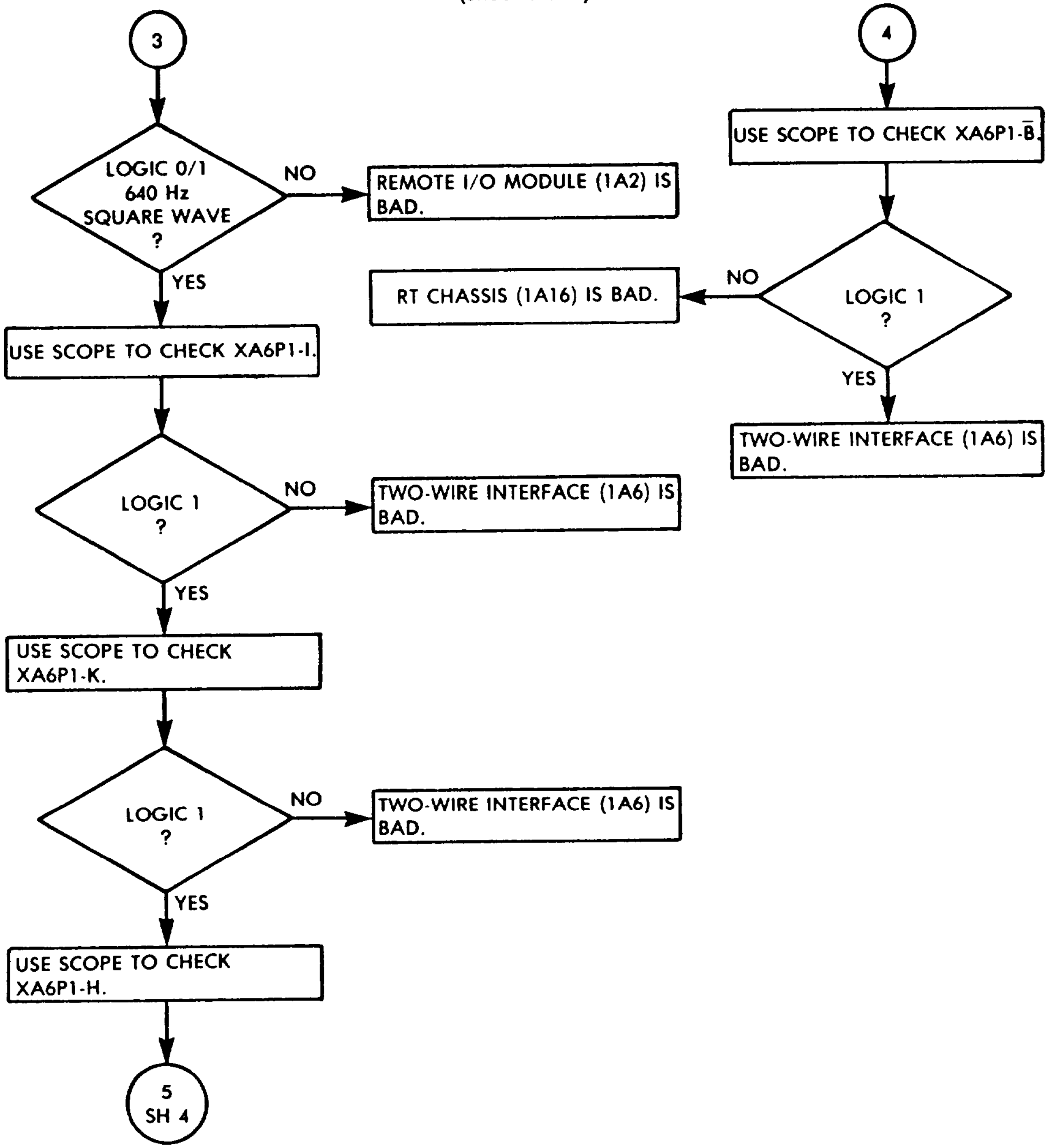
Troubleshooting Remote Control Circuits
(Sheet 2 of 7)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 9

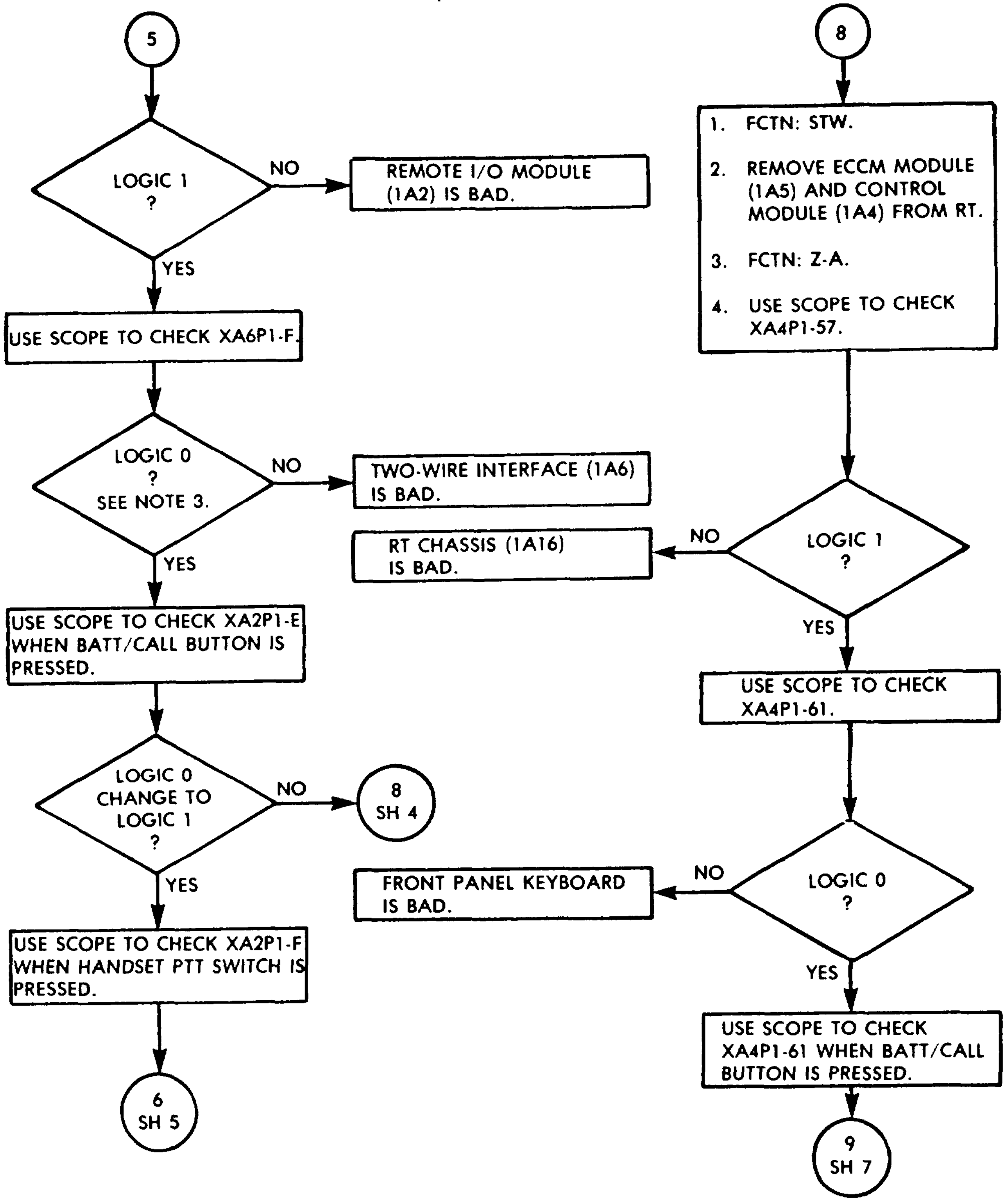
Troubleshooting Remote Control Circuits
(Sheet 3 of 7)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 9

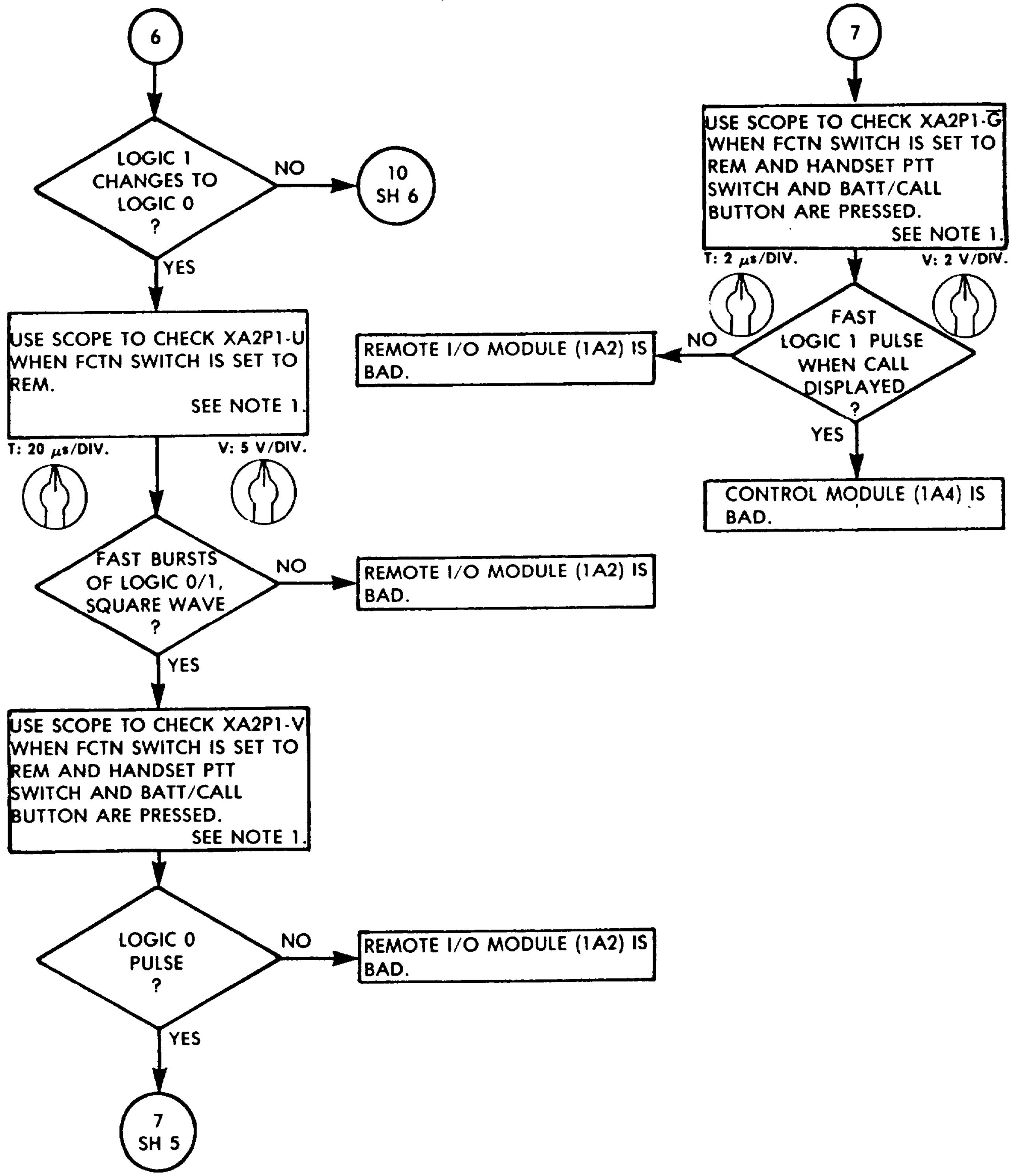
Troubleshooting Remote Control Circuits
(Sheet 4 of 7)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 9

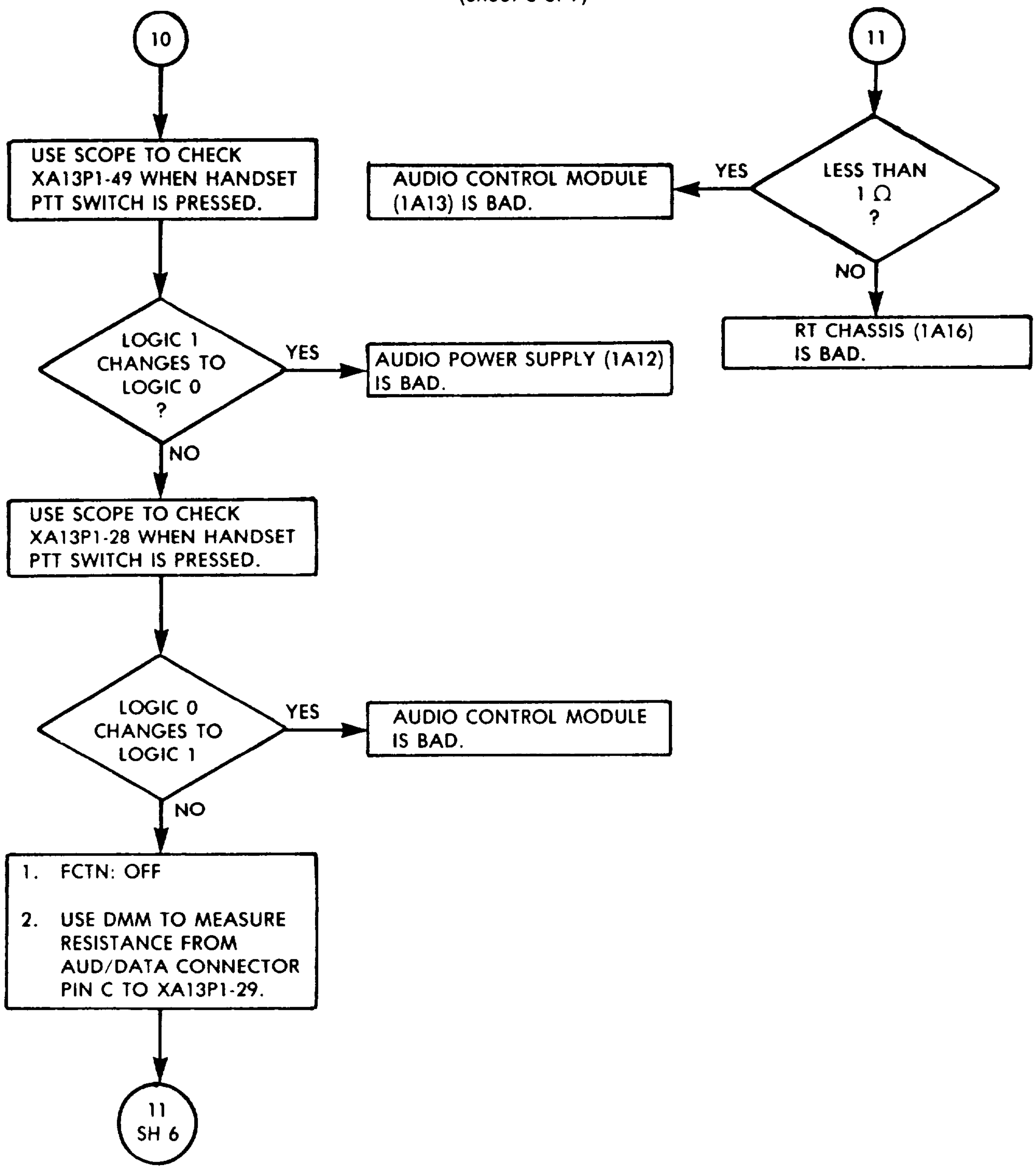
Troubleshooting Remote Control Circuits
(Sheet 5 of 7)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 9

Troubleshooting Remote Control Circuits
(Sheet 6 of 7)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 9

Troubleshooting Remote Control Circuits
(Sheet 7 of 7)

9

LOGIC 1 PULSE WHEN BUTTON PRESSED ?

YES → CONTROL MODULE (1A4) IS BAD.

NO ↓

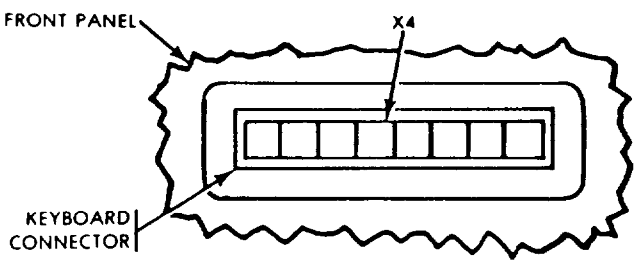
1. FCTN: STW.
2. REMOVE FRONT PANEL KEYBOARD.
3. USE DMM TO CHECK RESISTANCE FROM XA4P1-61 TO KEYBOARD CONNECTOR X4. (SEE BELOW.)

LESS THAN 5 Ω ?

YES → FRONT PANEL KEYBOARD IS BAD.

NO ↓

RT CHASSIS (1A16) IS BAD.



EL7XL166

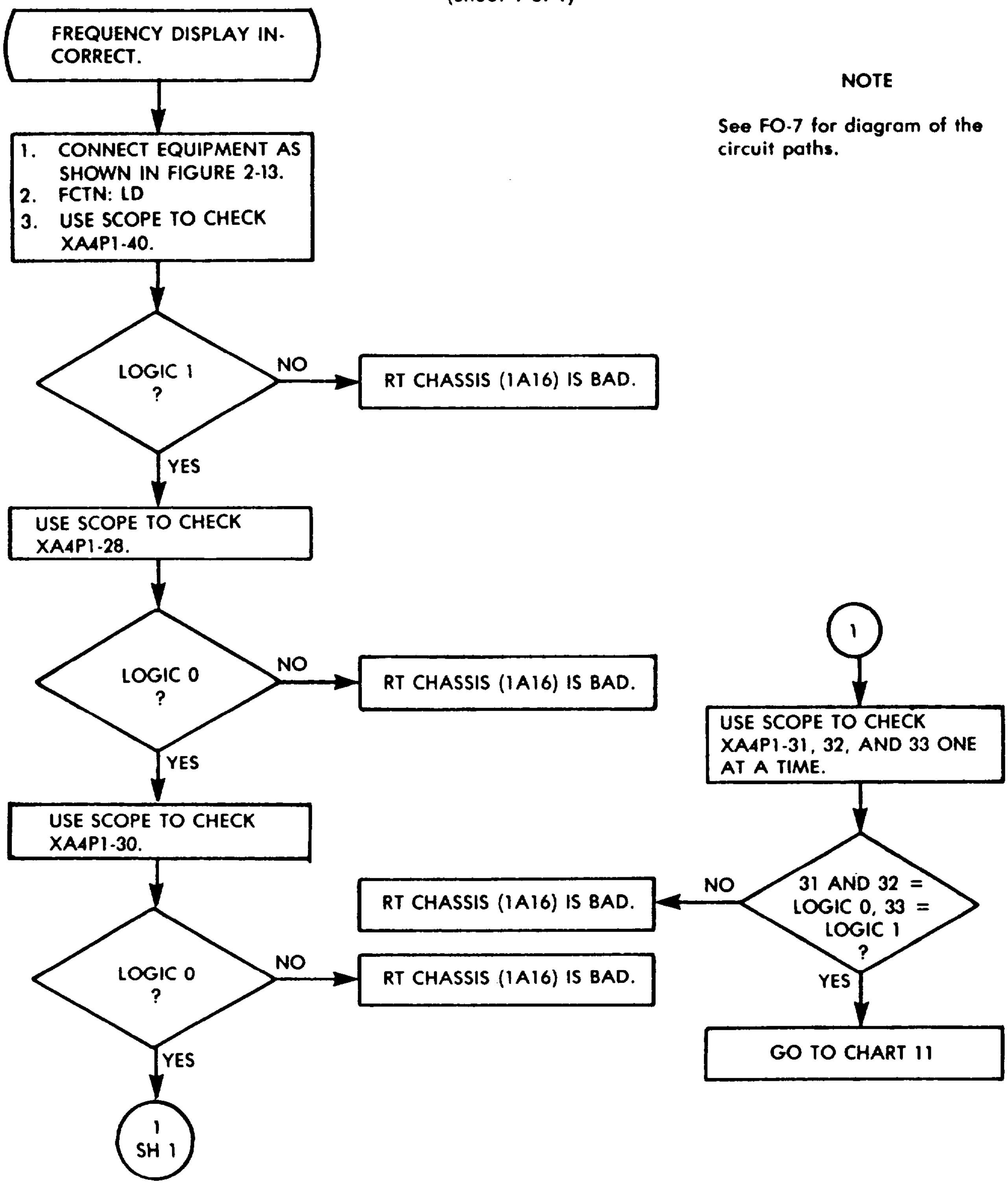
2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 10

Troubleshooting Display Circuitry
(Sheet 1 of 1)

NOTE

See FO-7 for diagram of the circuit paths.



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 11

Troubleshooting Keyboard Circuits
(Sheet 1 of 1)

ONE KEYBOARD BUTTON INOPERATIVE.

1. CONNECT EQUIPMENT AS SHOWN IN FIGURE 2-13.
2. USE SCOPE TO CHECK XA4P1 X-LINE PIN THAT CORRESPONDS TO INOPERATIVE BUTTON.
3. PRESS BUTTON.

BUTTON	XA4P1 X-LINE PIN
1,4,7,CLR	52
2,5,8,H•Ld/0	53
3,6,9,Sto/ENT	56
FREQ, SEnd/OFST, TIME, CALL/BATT	61

NOTES

1. See FO-7 for diagram of these circuit paths.

WAVEFORM 1 WHEN BUTTON PRESSED ?

YES → FRONT PANEL KEYBOARD IS BAD.

NO ↓

LOGIC 0 ?

YES → CONTROL MODULE (1A4) IS BAD.

NO ↓

USE SCOPE TO CHECK XA4P1-60, 59, 55, AND 57 ONE AT A TIME.

LOGIC 1 FOR ALL FOUR ?

YES → FRONT PANEL KEYBOARD IS BAD.

NO ↓

CONTROL MODULE (1A4) IS BAD.

2.

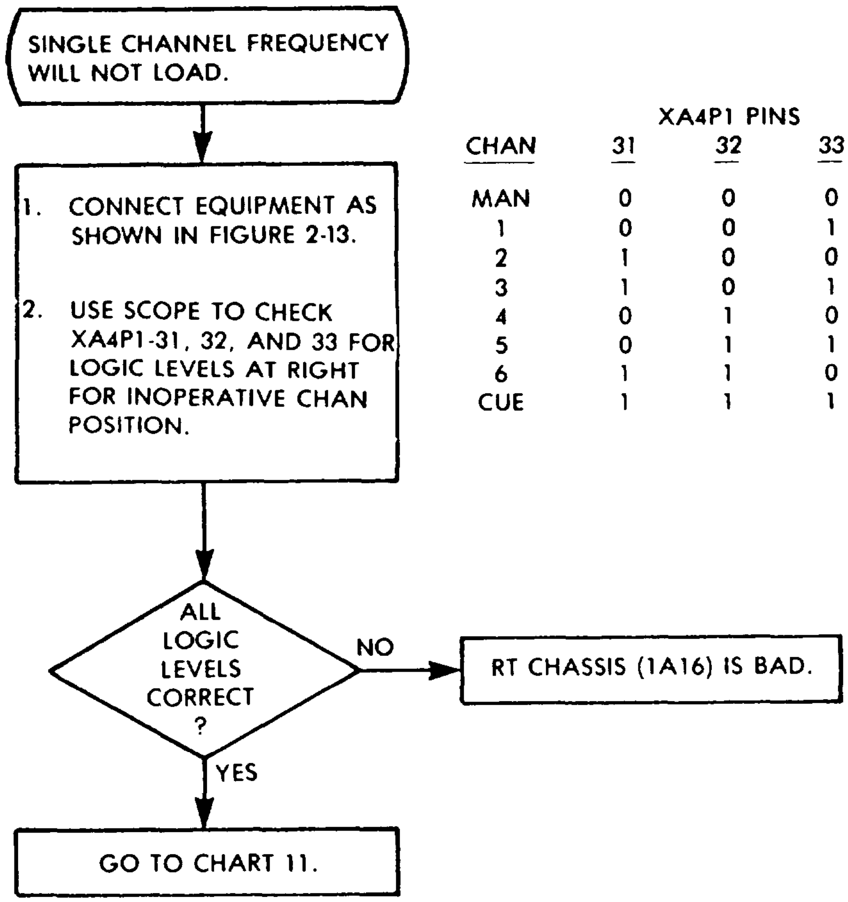
WAVEFORM 1: LOGIC 1 PULSE, VARYING WIDTH

EL7XL135

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 12

Troubleshooting CHAN Switch
(Sheet 1 of 1)



	XA4P1 PINS		
CHAN	31	32	33
MAN	0	0	0
1	0	0	1
2	1	0	0
3	1	0	1
4	0	1	0
5	0	1	1
6	1	1	0
CUE	1	1	1

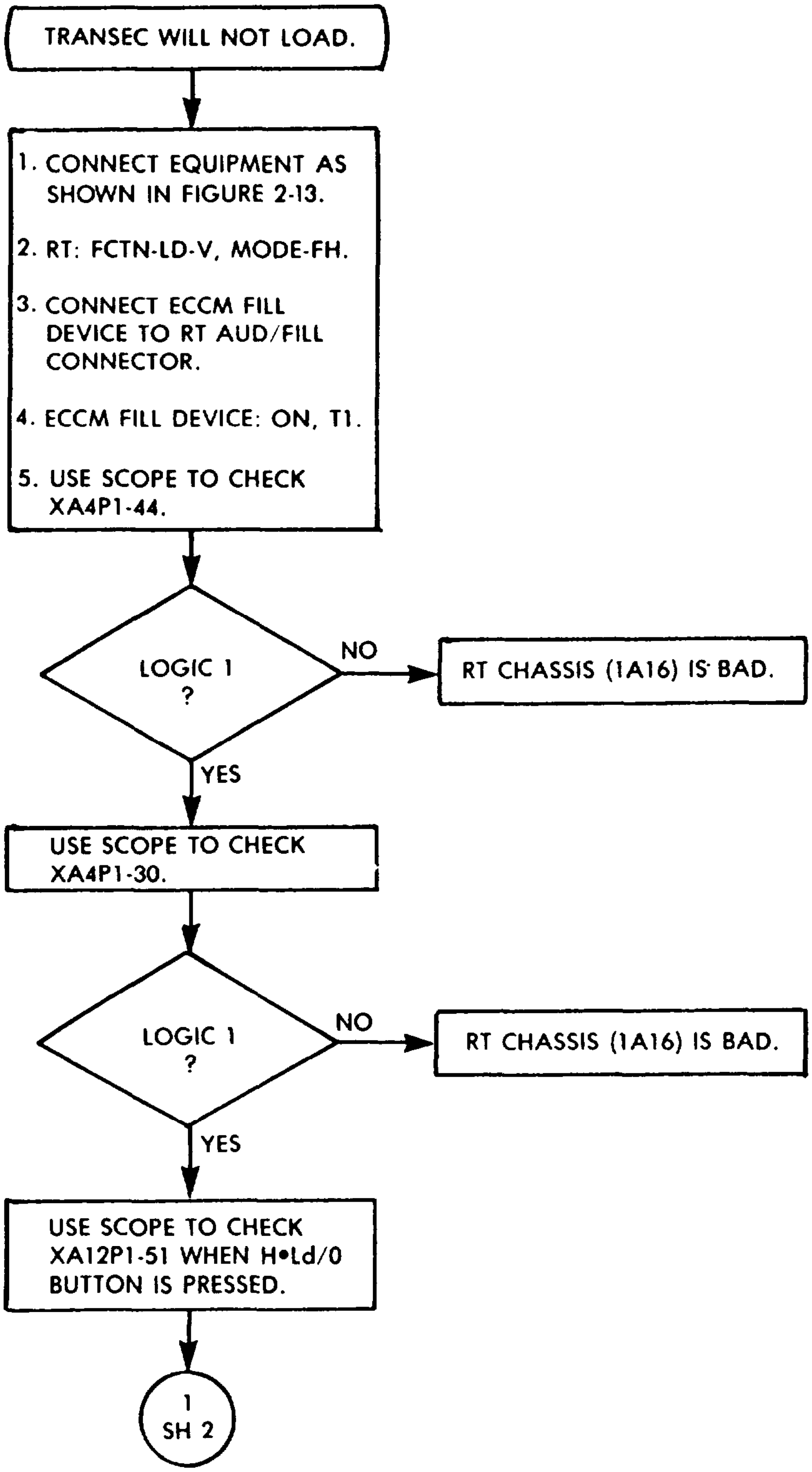
NOTE

See FO-7 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 13

Troubleshooting Fill Circuitry
(Sheet 1 of 4)



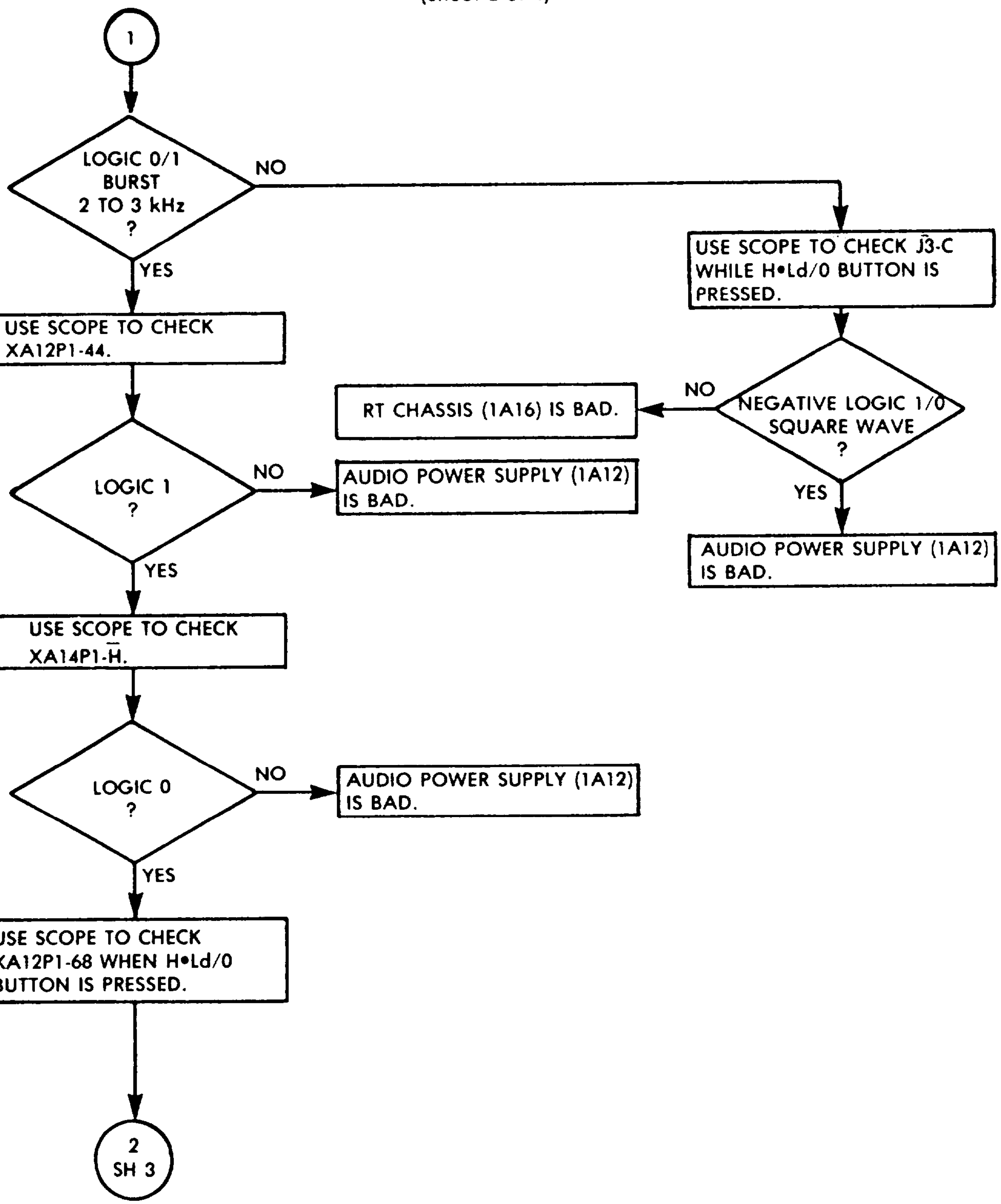
NOTE

See figure 2-11 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 13

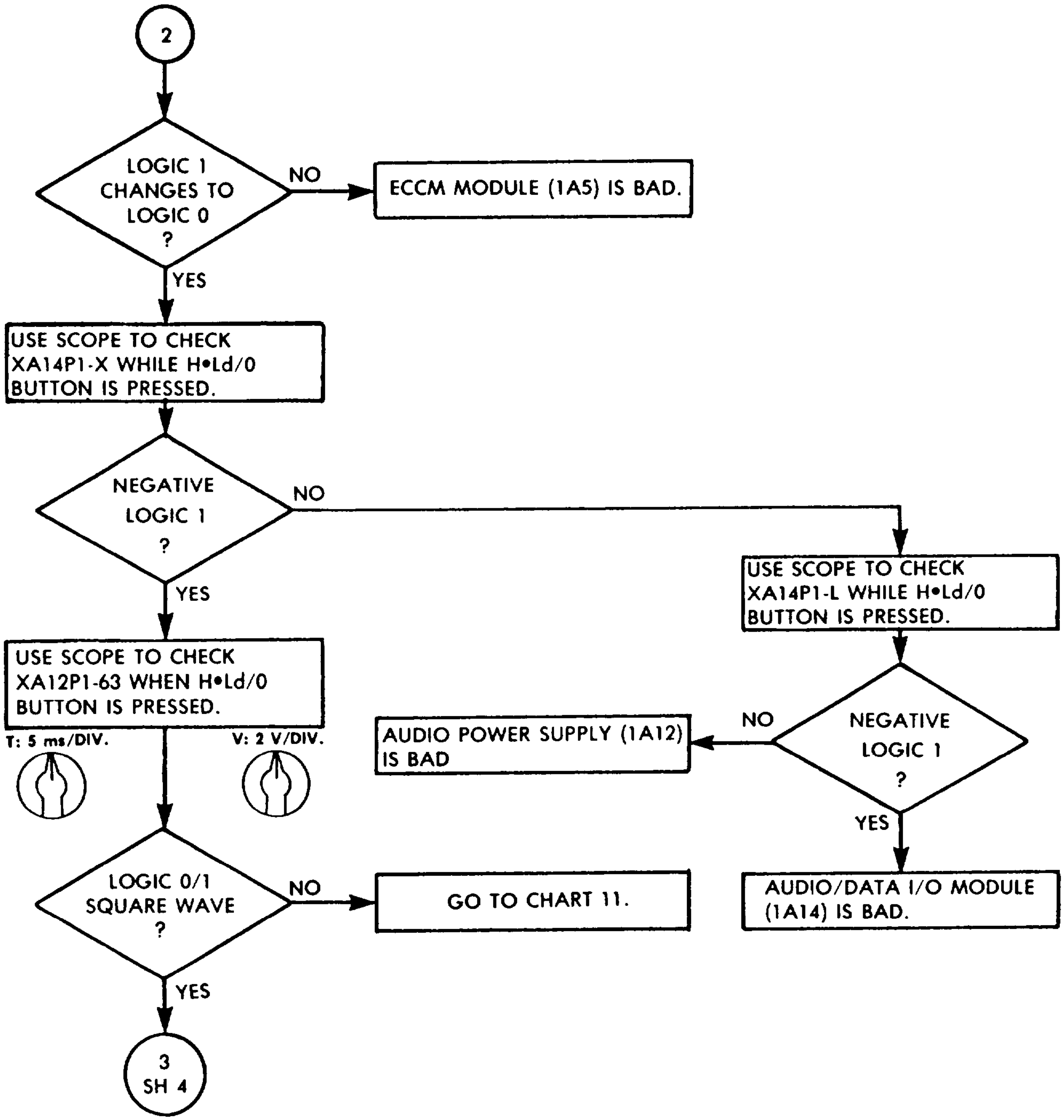
Troubleshooting Fill Circuitry
(Sheet 2 of 4)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 13

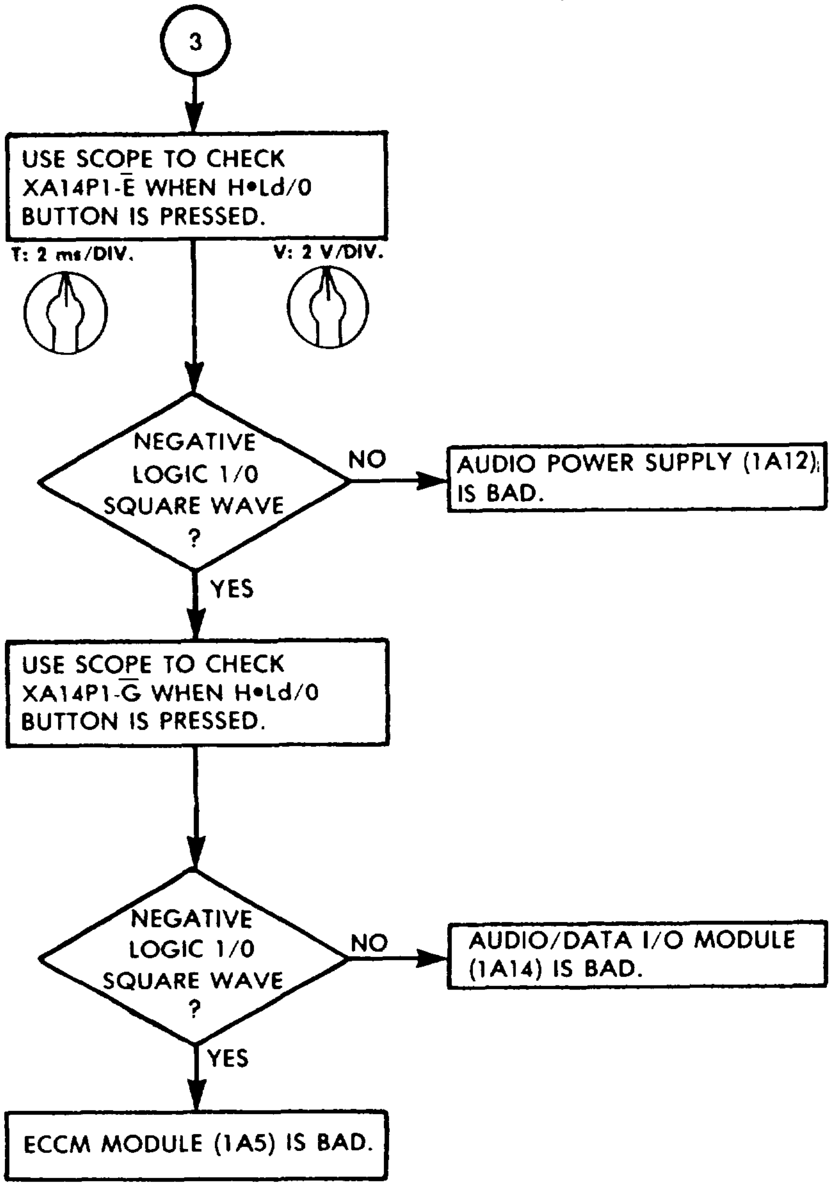
Troubleshooting Fill Circuitry
(Sheet 3 of 4)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 13

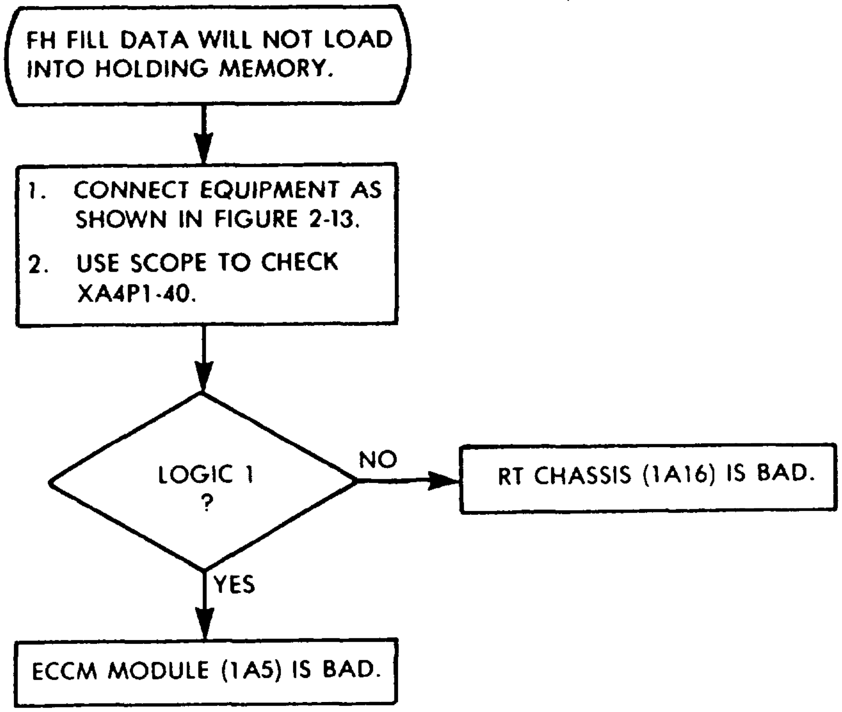
Troubleshooting Fill Circuitry
(Sheet 4 of 4)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 14

Troubleshooting Fill Circuitry
(Sheet 1 of 1)



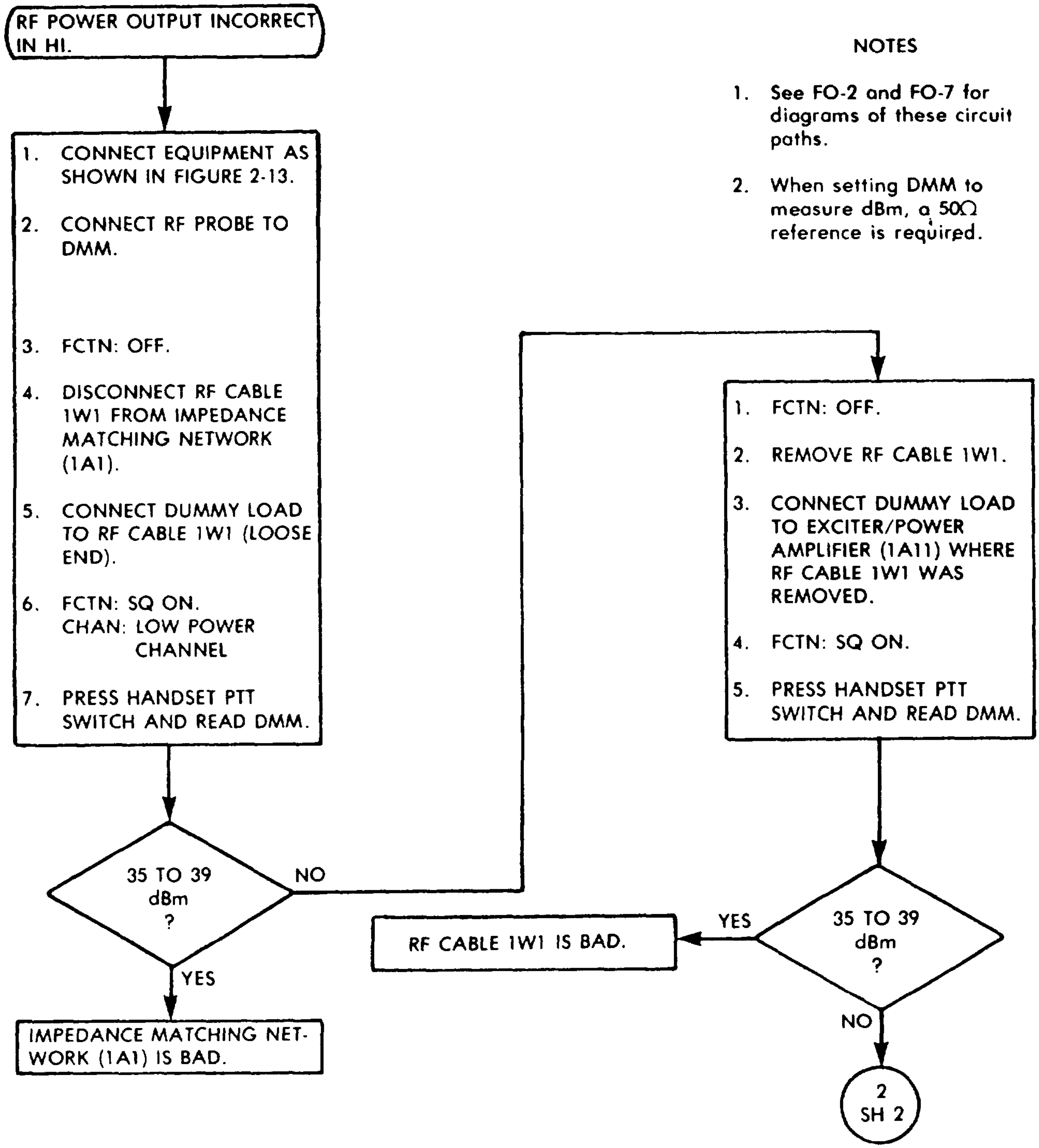
NOTE

See figure 2-11 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 15

Troubleshooting Transmit Circuit
(Sheet 1 of 5)



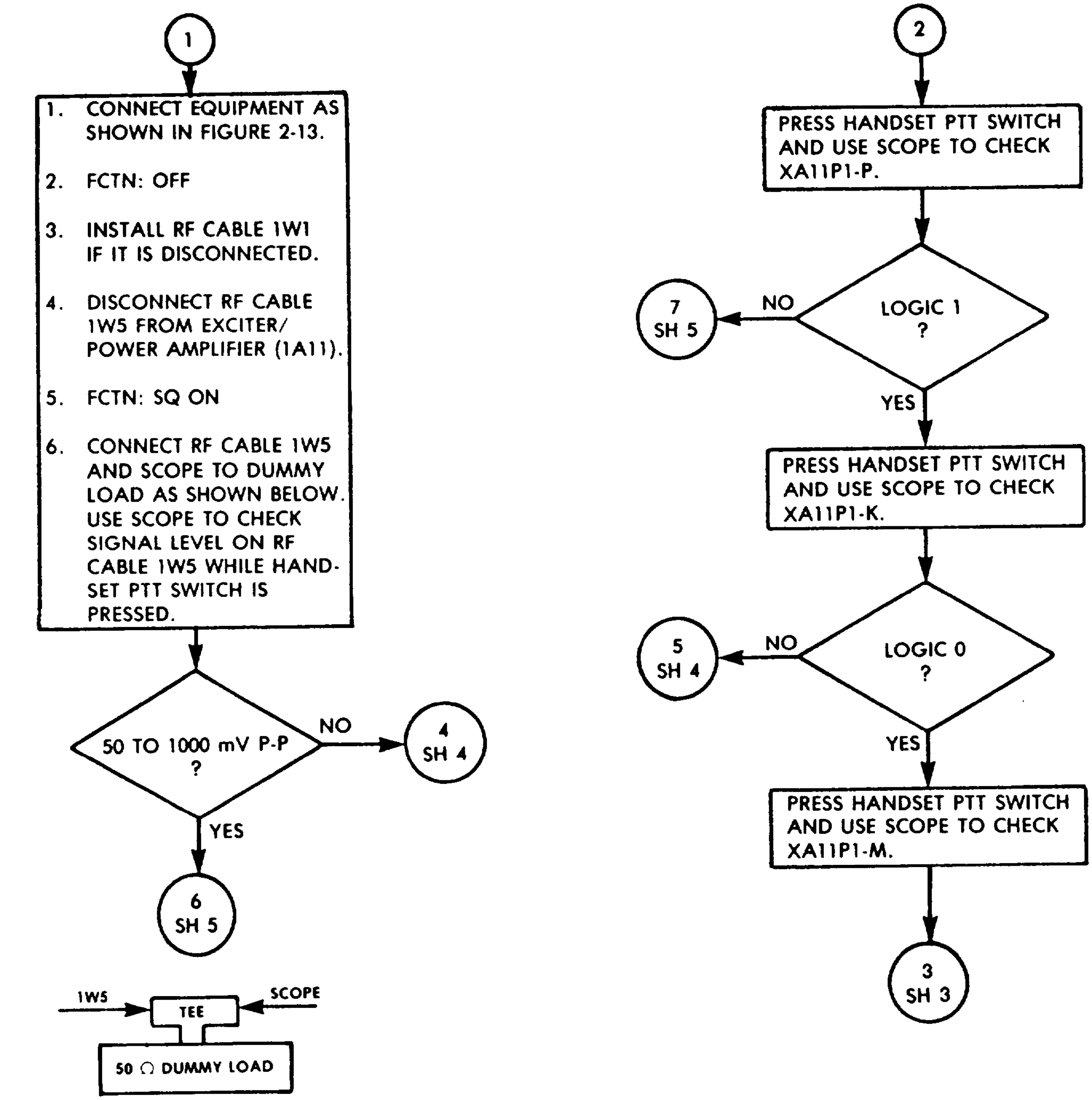
NOTES

1. See FO-2 and FO-7 for diagrams of these circuit paths.
2. When setting DMM to measure dBm, a 50Ω reference is required.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 15

Troubleshooting Transmit Circuit
(Sheet 2 of 5)

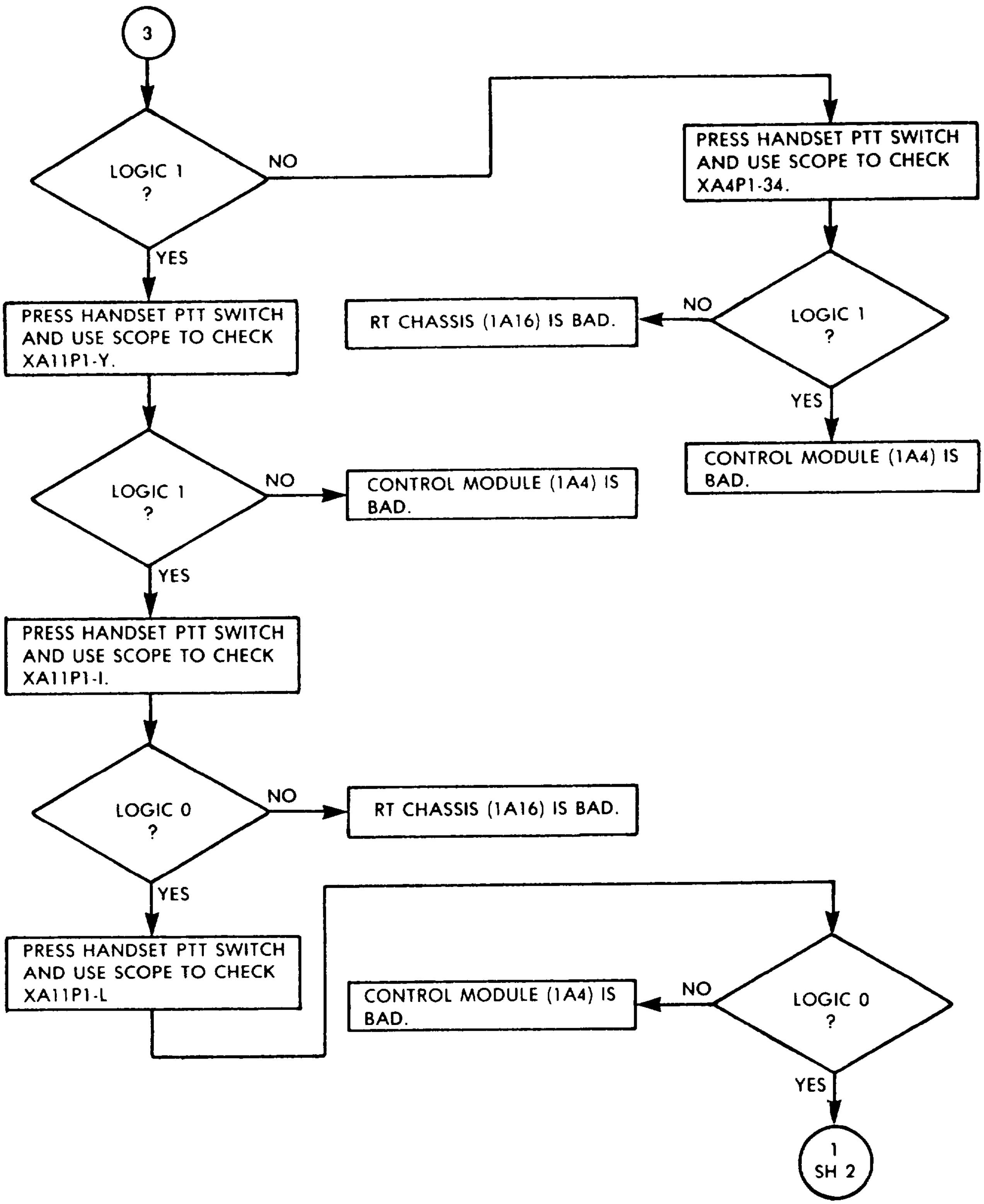


EL7XL165

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 15

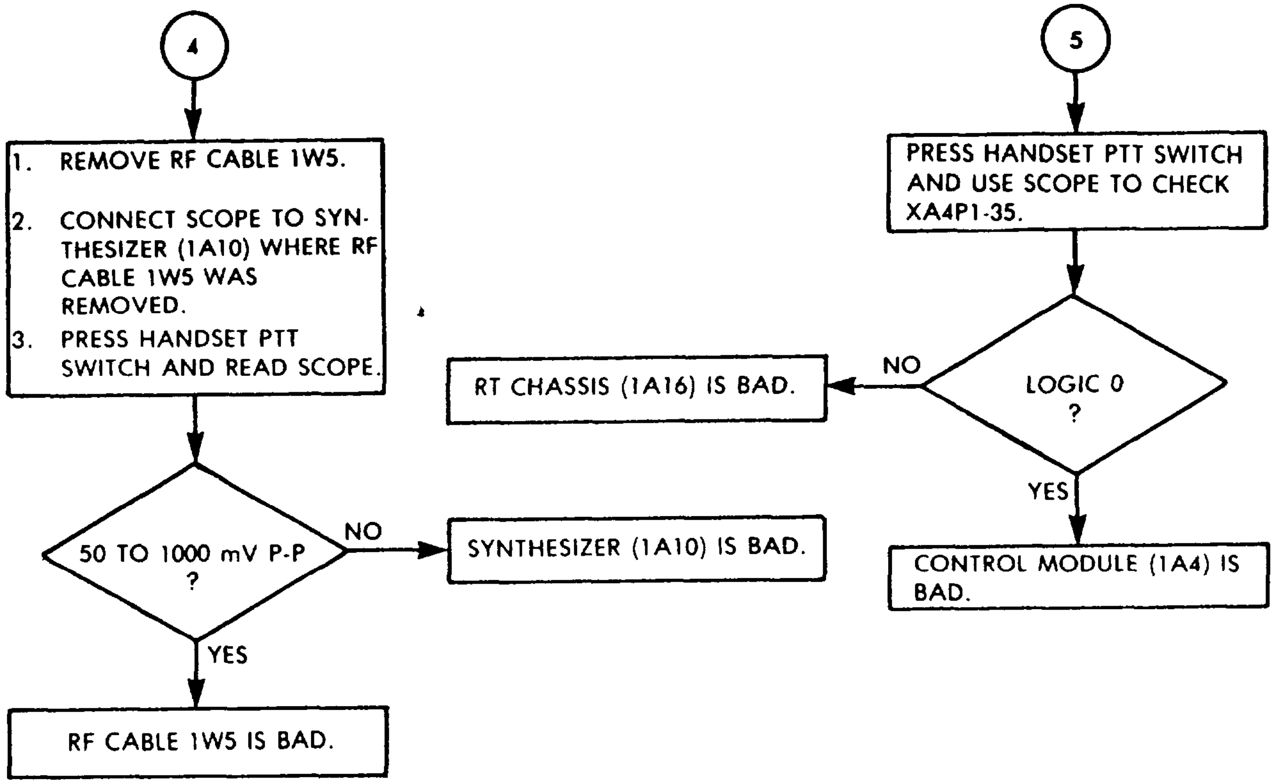
Troubleshooting Transmit Circuit
(Sheet 3 of 5)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 15

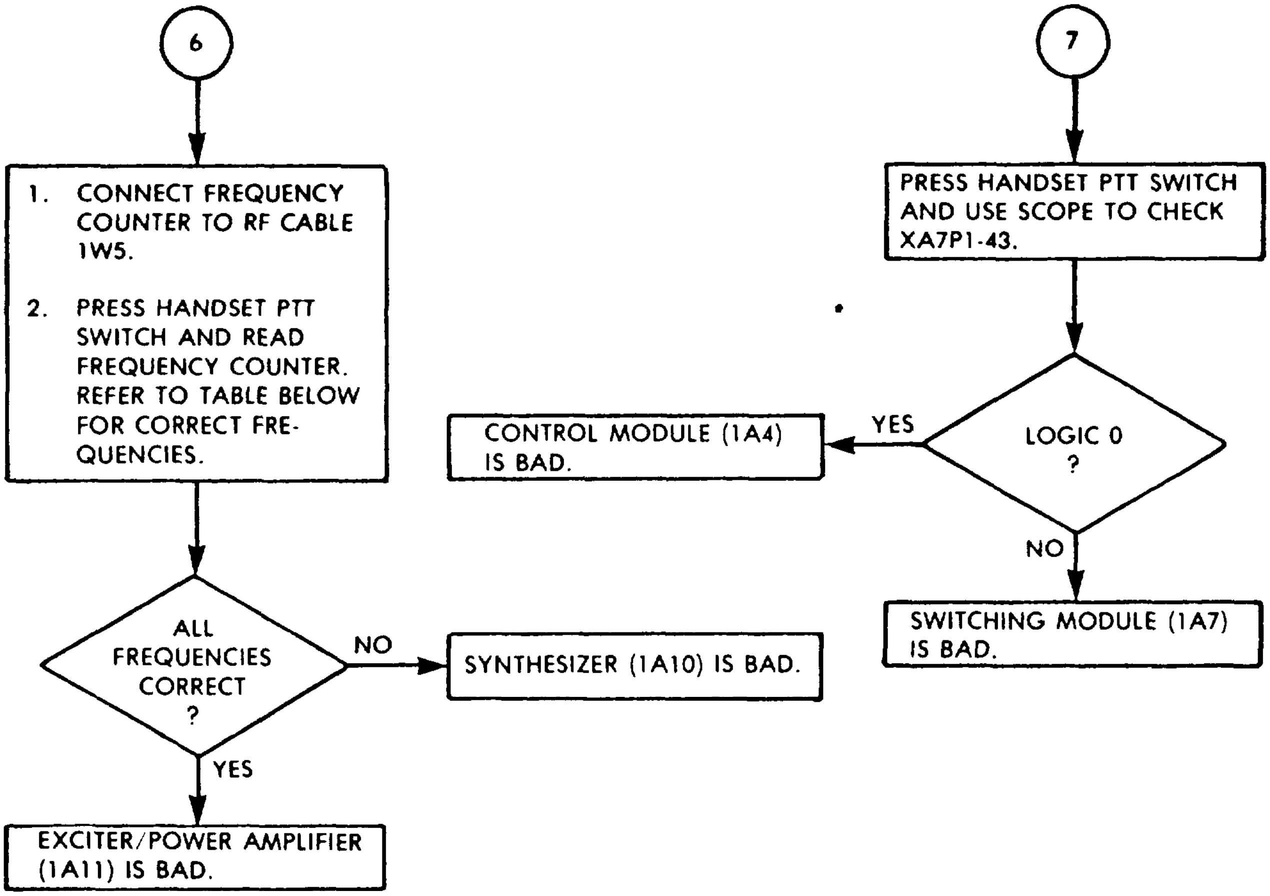
Troubleshooting Transmit Circuit
(Sheet 4 of 5)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 15

Troubleshooting Transmit Circuit
(Sheet 5 of 5)

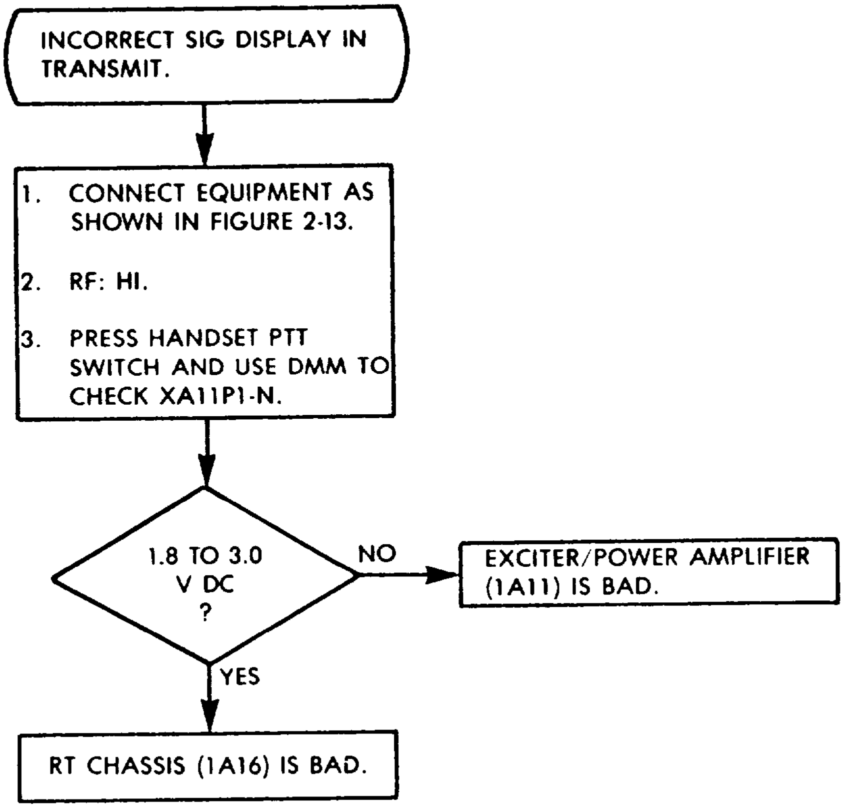


CHAN	FREQUENCY (MHz)
MAN	36.999800 TO 37.000200
1	44.874750 TO 44.875250
2	49.974750 TO 49.975250
3	50.374750 TO 50.375250
4	56.074700 TO 56.075300
5	63.199700 TO 63.200300
6	75.774600 TO 75.775400
CUE	94.974500 TO 94.975500

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 16

Troubleshooting SIG Display
(Sheet 1 of 1)



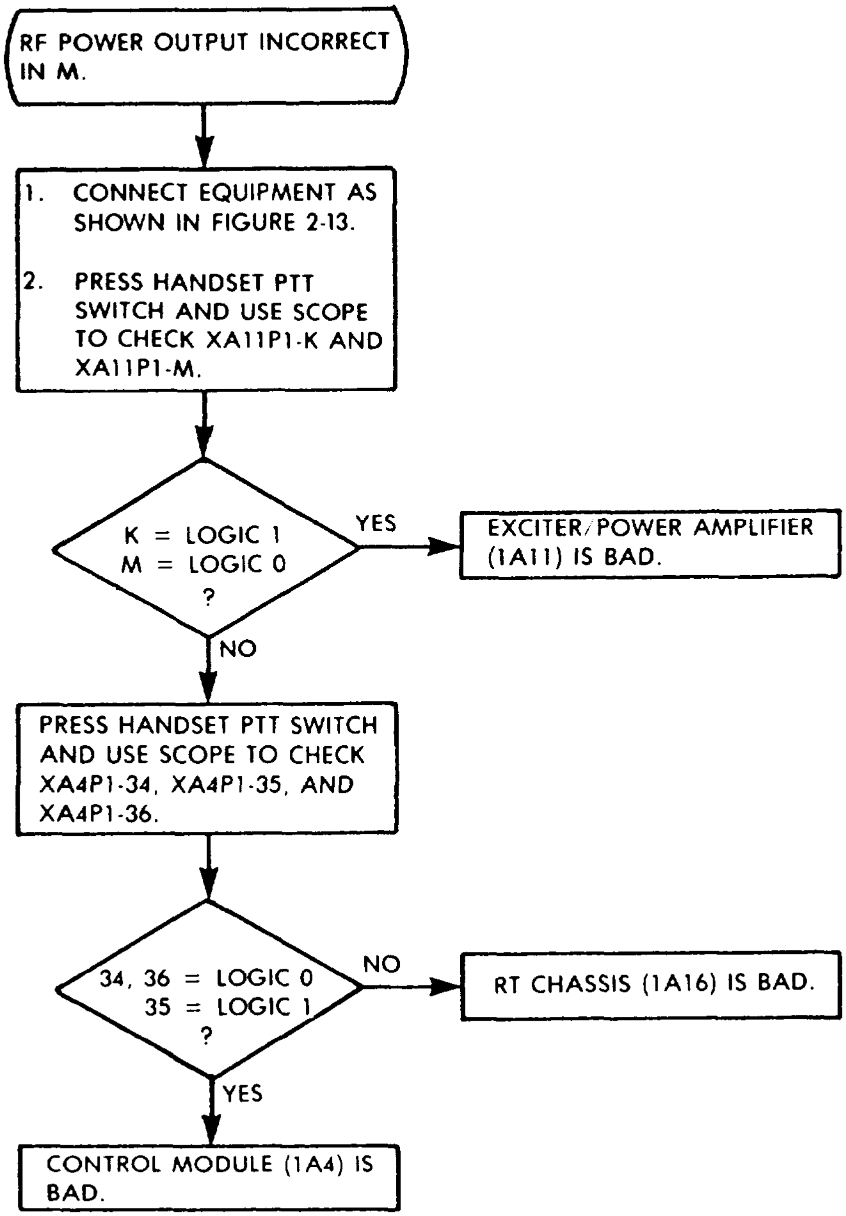
NOTE

See FO-2 for diagram of this circuit path.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 17

Troubleshooting Medium Power Transmit Path
(Sheet 1 of 1)



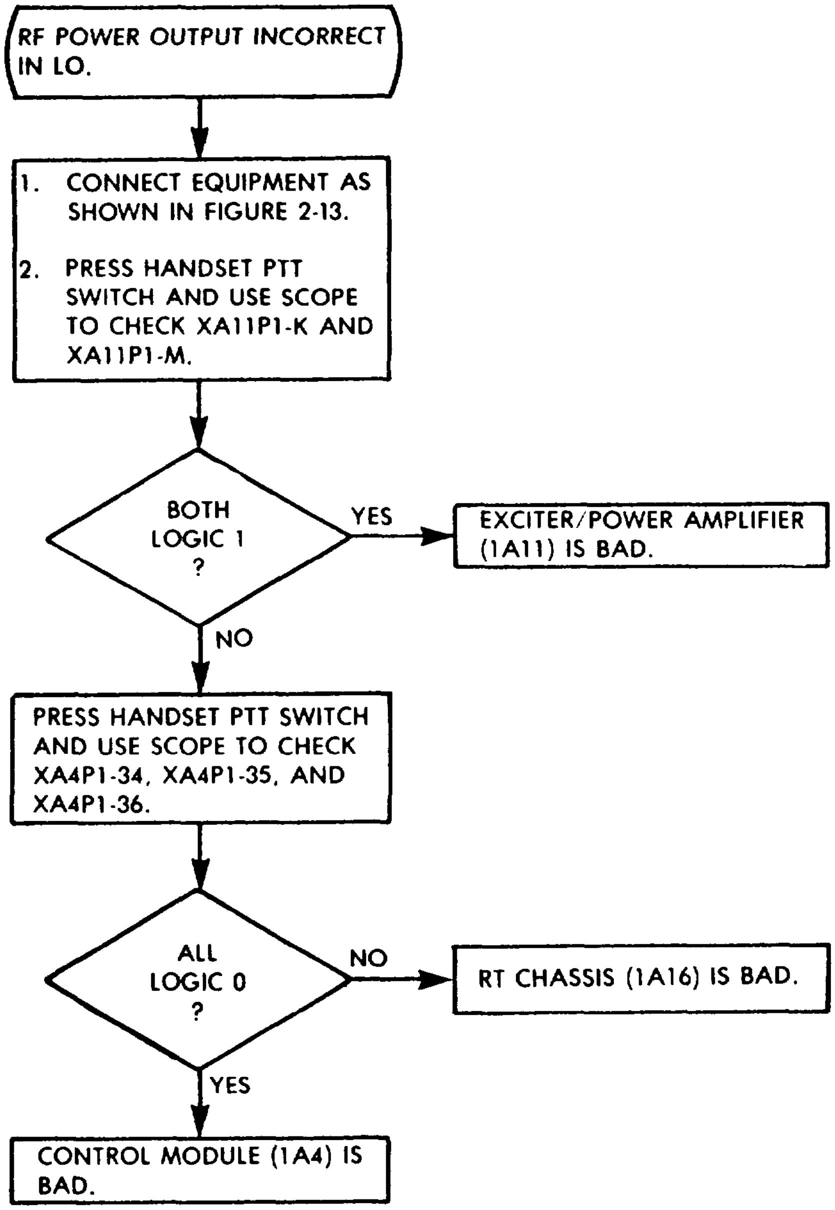
NOTE

See FO-7 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 18

Troubleshooting Low Power Transmit Path
(Sheet 1 of 1)



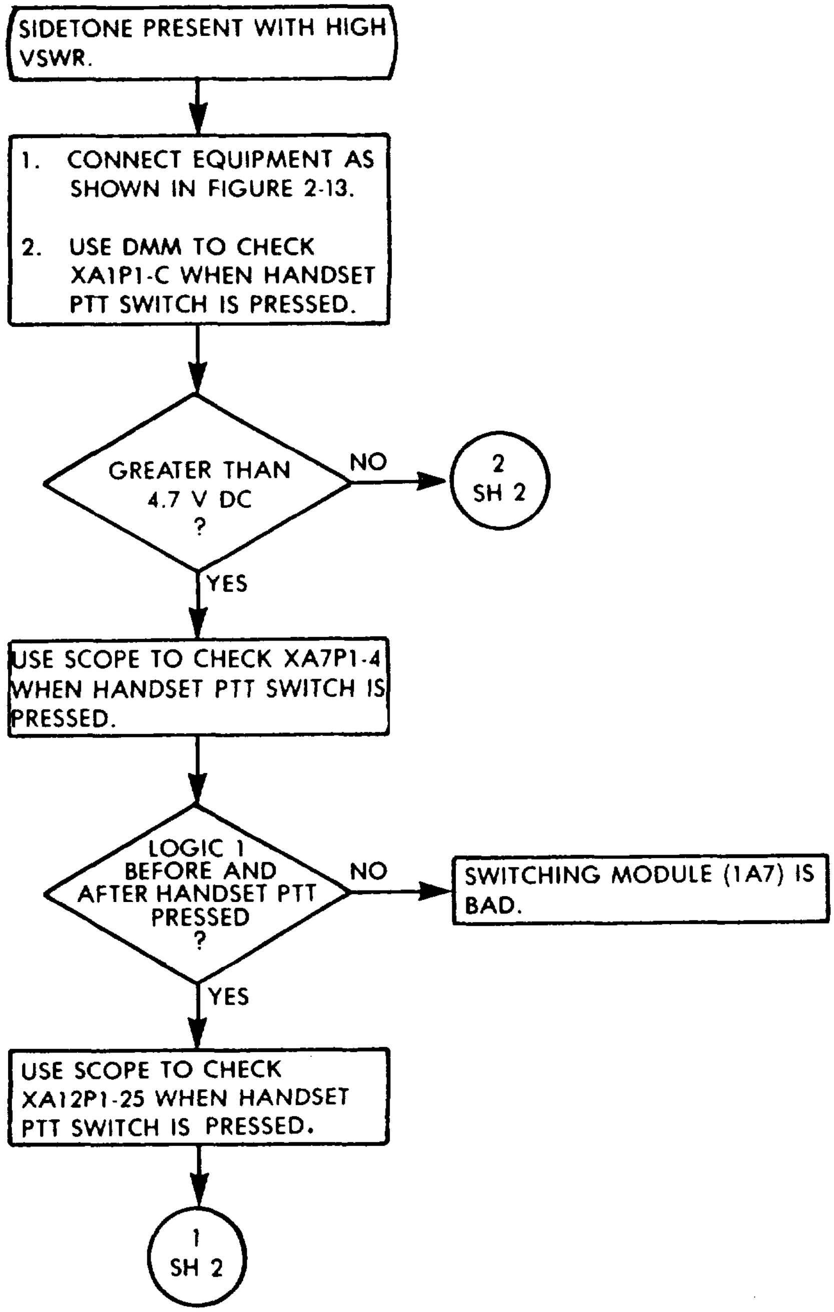
NOTE

See FO-7 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 19

Troubleshooting Sidetone Circuit
(Sheet 1 of 2)



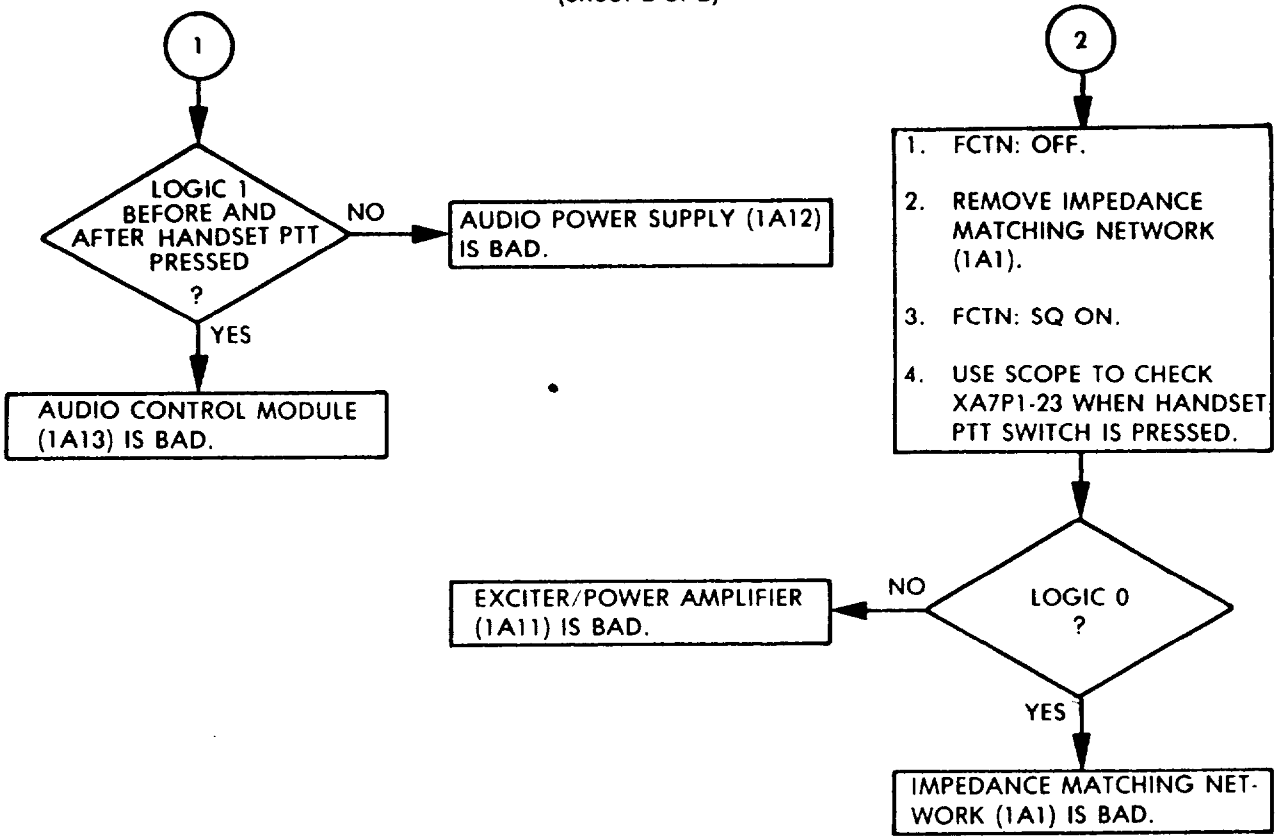
NOTE

See FO-2 for diagram of this circuit path.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 19

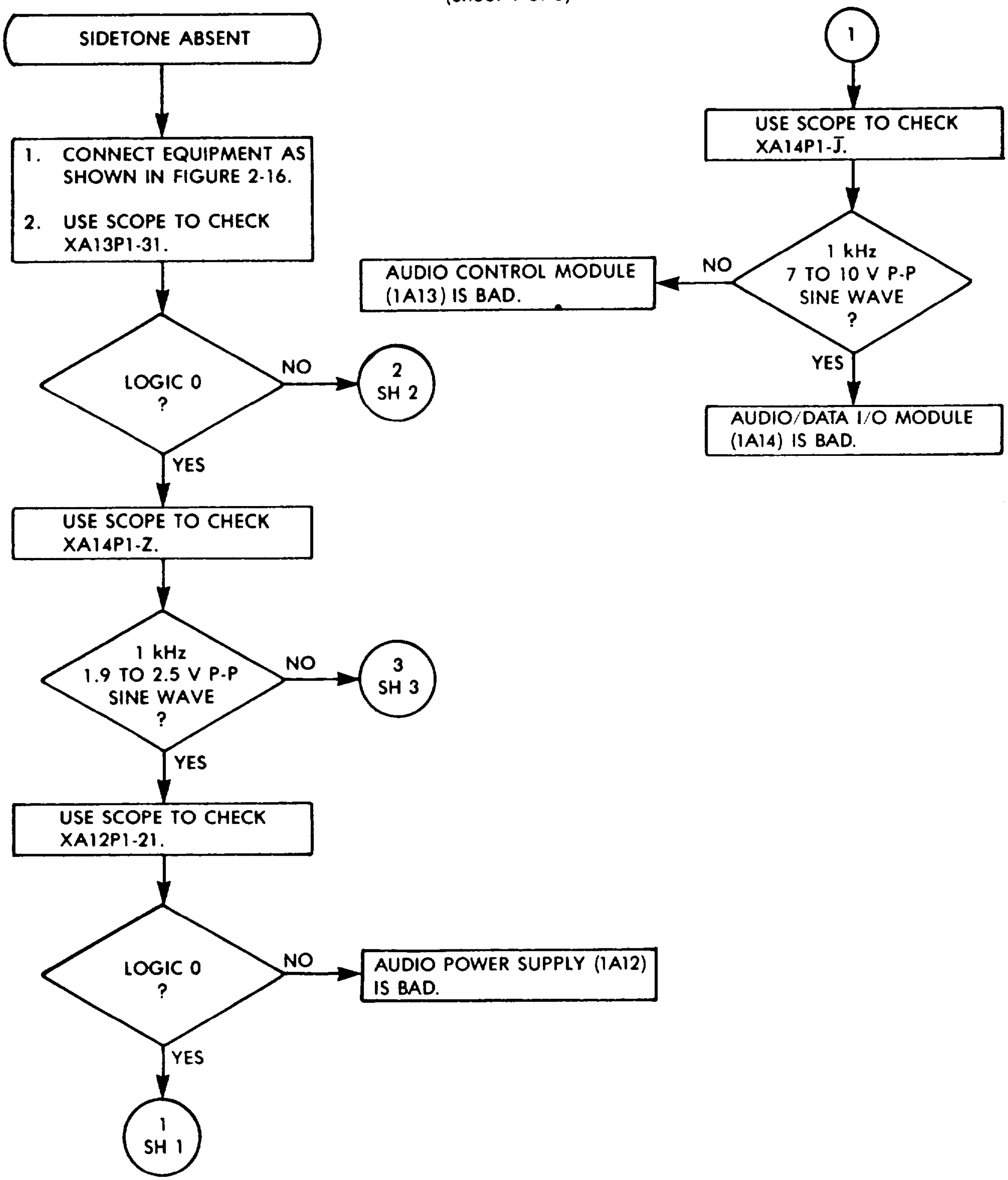
Troubleshooting Sidetone Circuit
(Sheet 2 of 2)

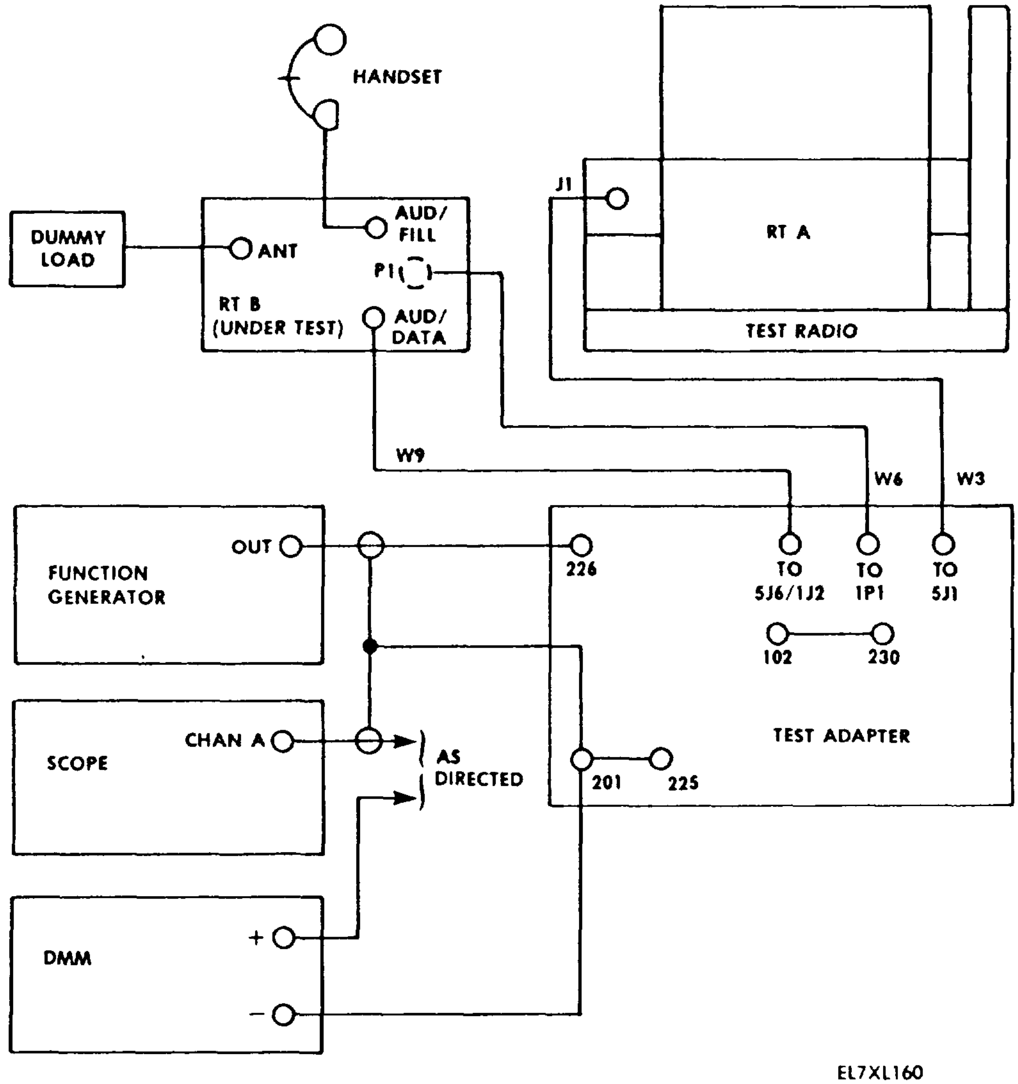


2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 20

Troubleshooting Faulty Sidetone
(Sheet 1 of 3)





EQUIPMENT PRESETS

RT (UNDER TEST):
TOP AND BOTTOM COVERS REMOVED.

DO NOT CHANGE SWITCH POSITIONS.

FUNCTION GENERATOR:
- FREQ: 1000 Hz (900 TO 1100 Hz)
- LEVEL: 300 mV P-P (250 TO 350 mV P-P)
- FUNCTION: SINE

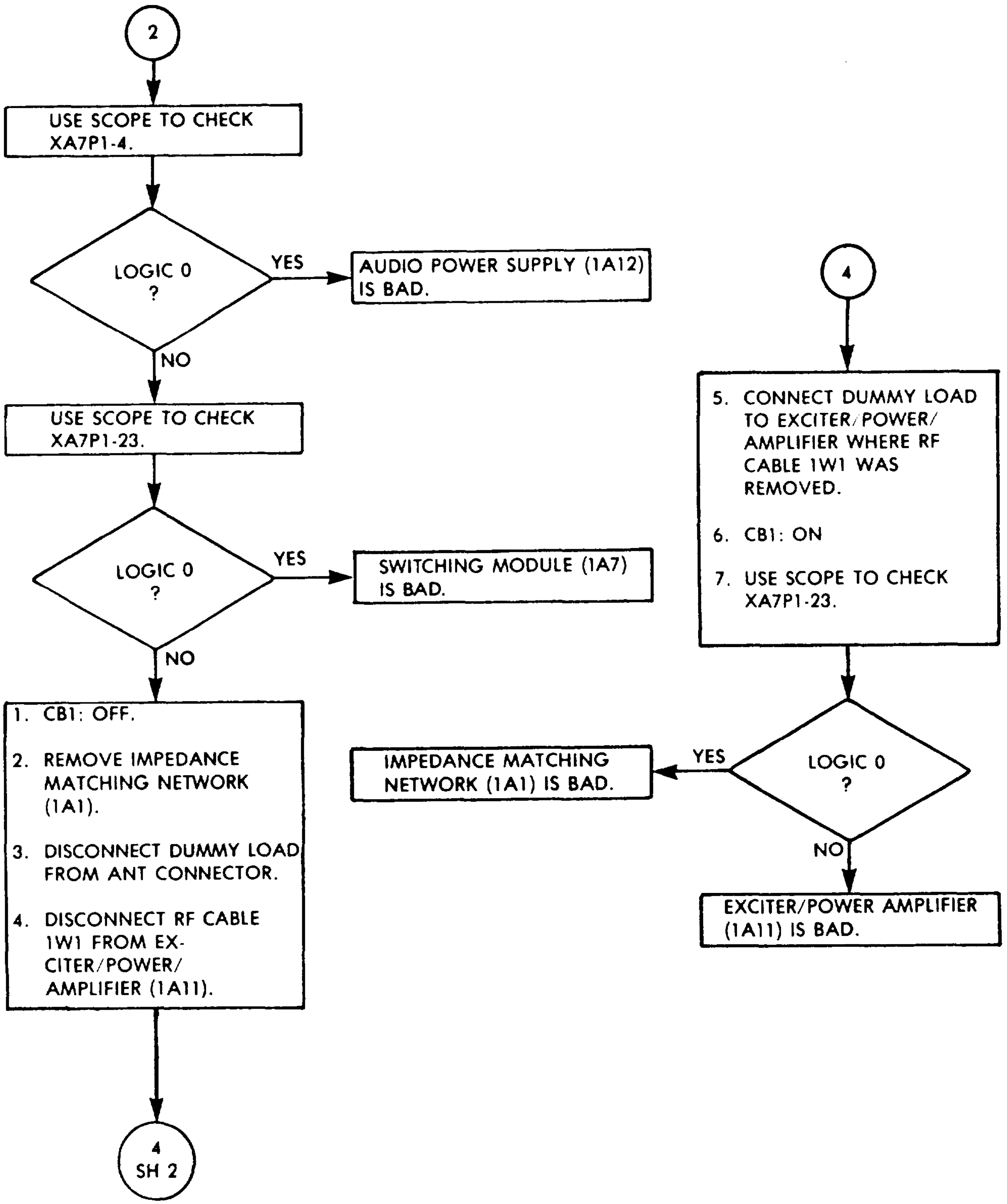
TEST RADIO:
- CB1: ON
- RT A FCTN: OFF

Figure 2-16. Absent Sidetone Troubleshooting Test Setup

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 20

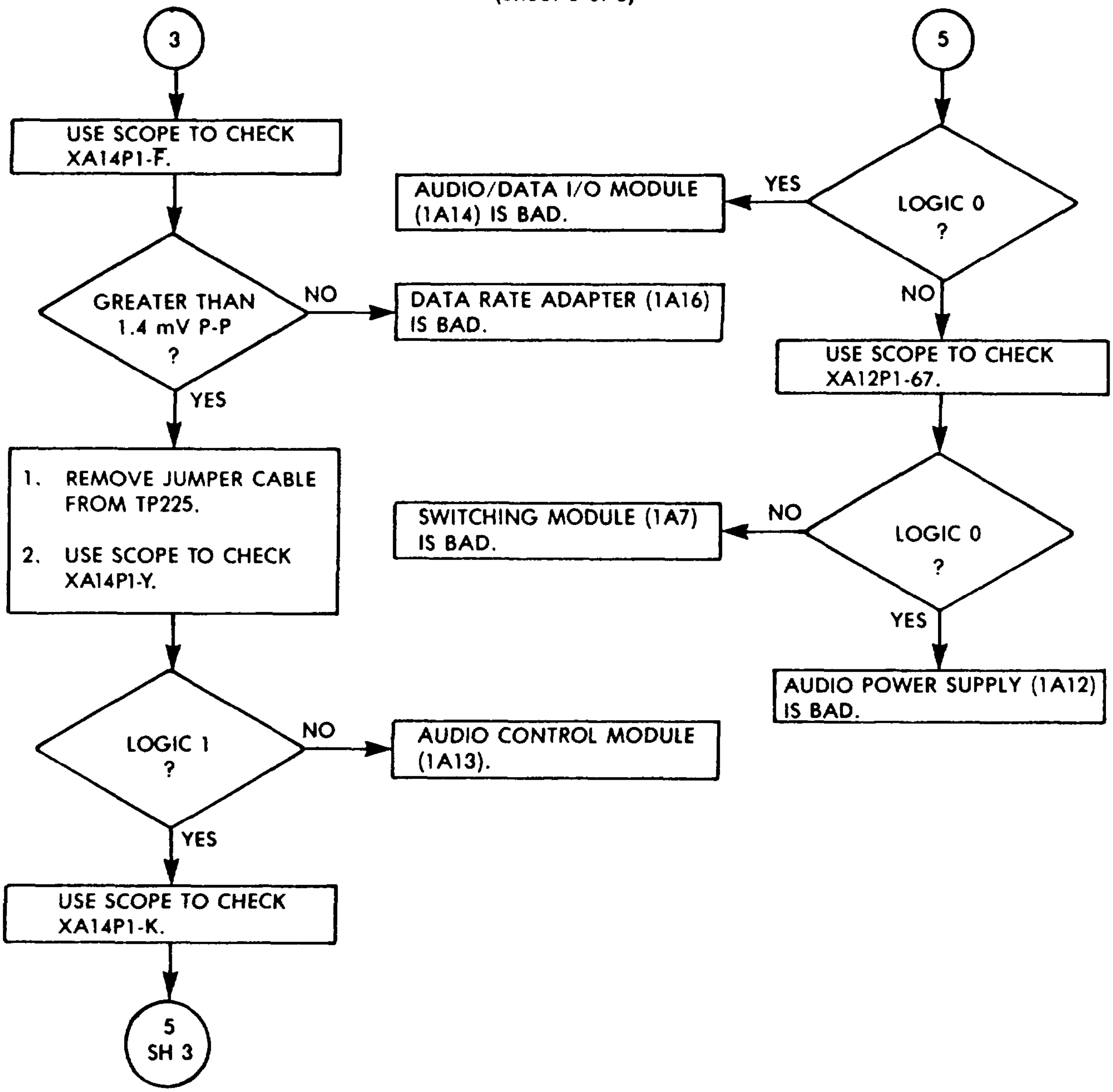
Troubleshooting Faulty Sidetone
(Sheet 2 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 20

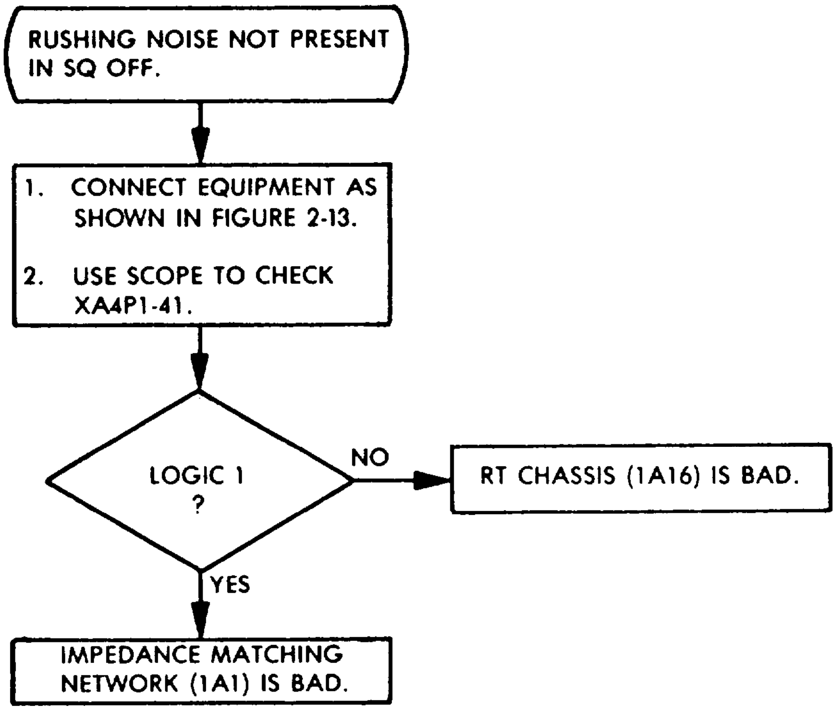
Troubleshooting Faulty Sidetone
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 21

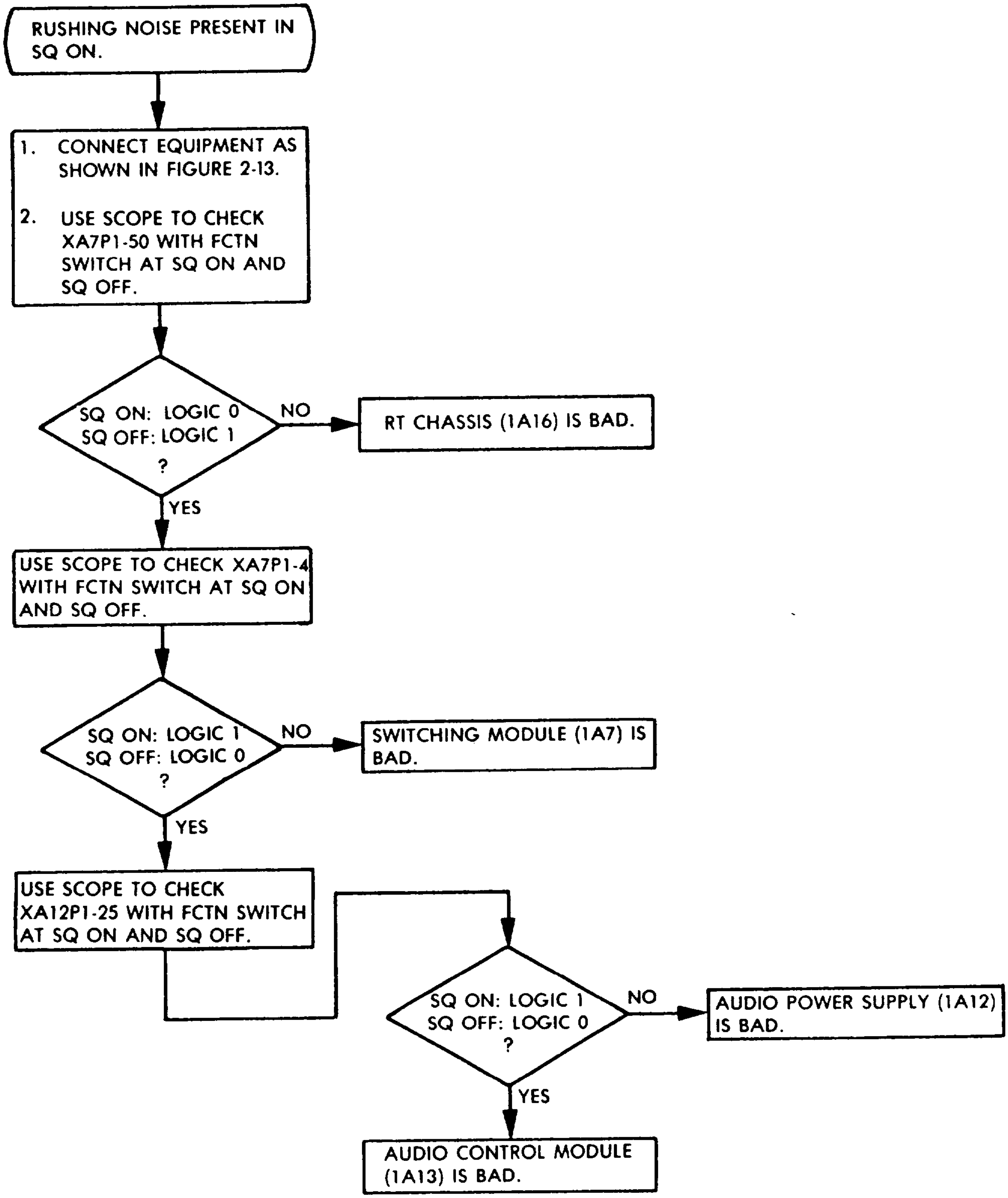
Troubleshooting Squelch Off Circuit
(Sheet 1 of 1)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 22

Troubleshooting Squelch On Circuit
(Sheet 1 of 1)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 23

Troubleshooting SC Transmit Path
(Sheet 1 of 3)

WILL NOT TRANSMIT (SC, AUDIO, PT).

1. CONNECT EQUIPMENT AS SHOWN IN FIGURE 2-15.
2. CONNECT W8 TO 5J6/1J2 AND W9 TO 5J4/5 ON THE TEST ADAPTER.
3. USE SCOPE TO CHECK XA7P1-26 FOR 3.6 TO 4.2 V P-P SINE WAVE MADE OF: 900 TO 1100 Hz SINE WAVE, 140 TO 160 Hz SINE WAVE.

SIGNAL PRESENT ?

YES → EXCITER/POWER AMPLIFIER (1A11) IS BAD.

NO → USE SCOPE TO CHECK XA7P1-29 FOR 5 TO 8 V P-P SINE WAVE MADE OF: 4.2 TO 5.7 V P-P, 900 TO 1100 Hz SINE WAVE, 1.5 TO 2.5 V P-P, 140 TO 160 Hz SINE WAVE (SQUELCH TONE).

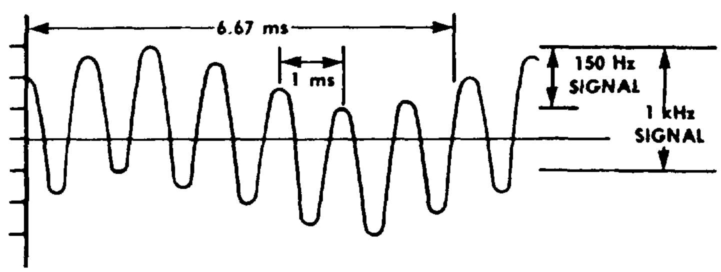
SIGNAL PRESENT ?

YES → 3 SH 3

NO → 1 SH 2

NOTE

See FO-4 and FO-5 for diagram of these circuit paths.

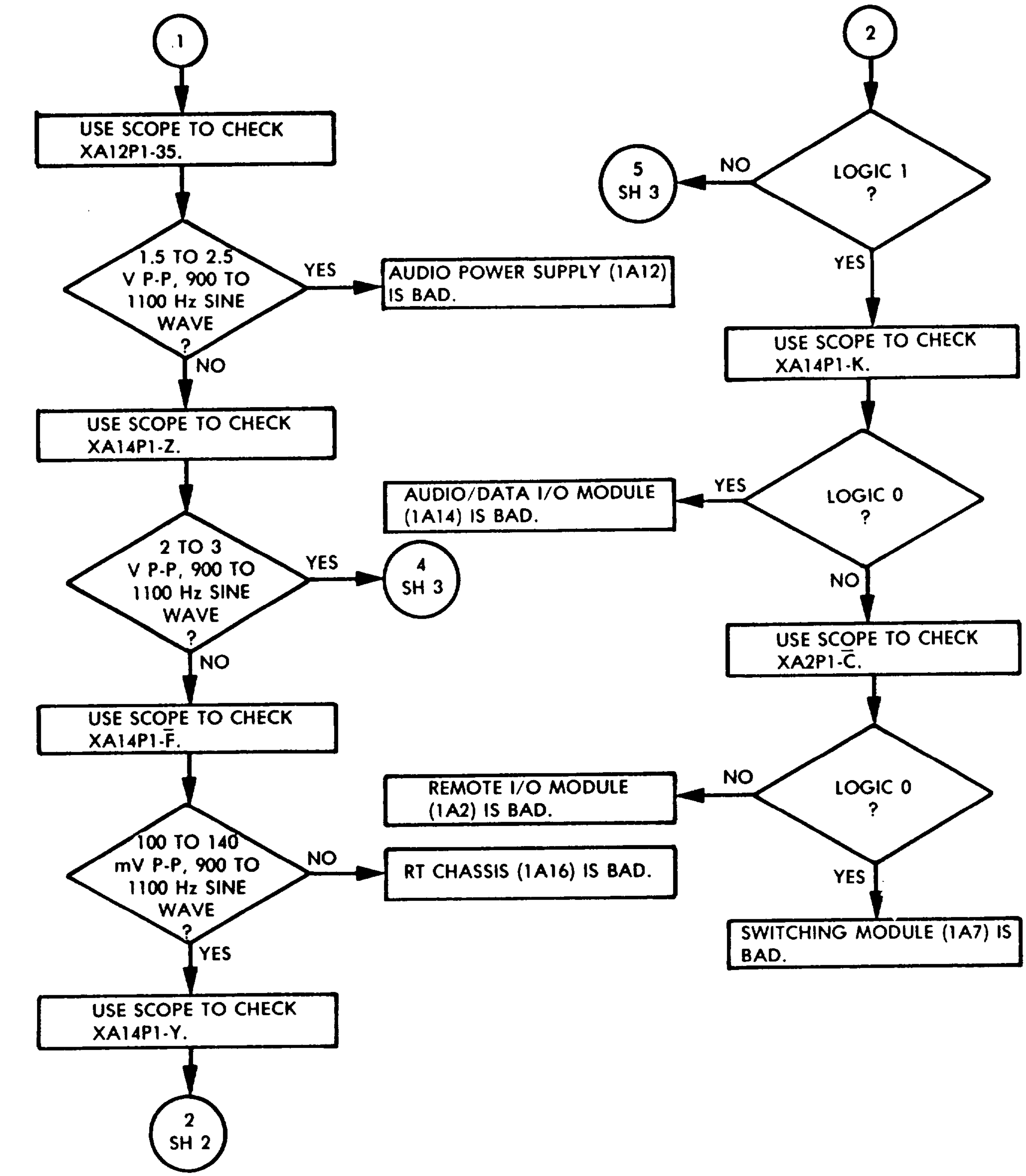


EL7XL162

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 23

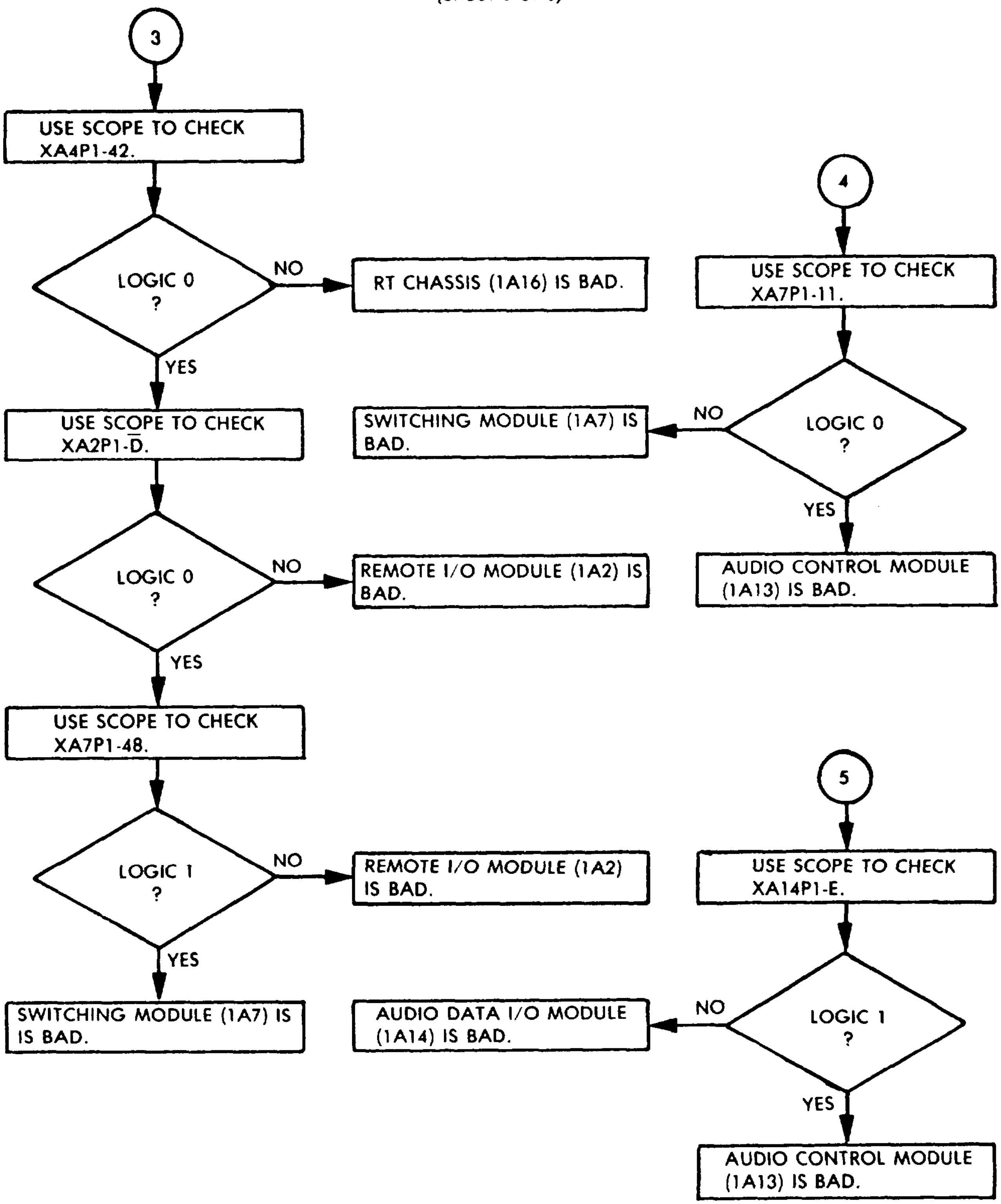
Troubleshooting SC Transmit Path
(Sheet 2 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 23

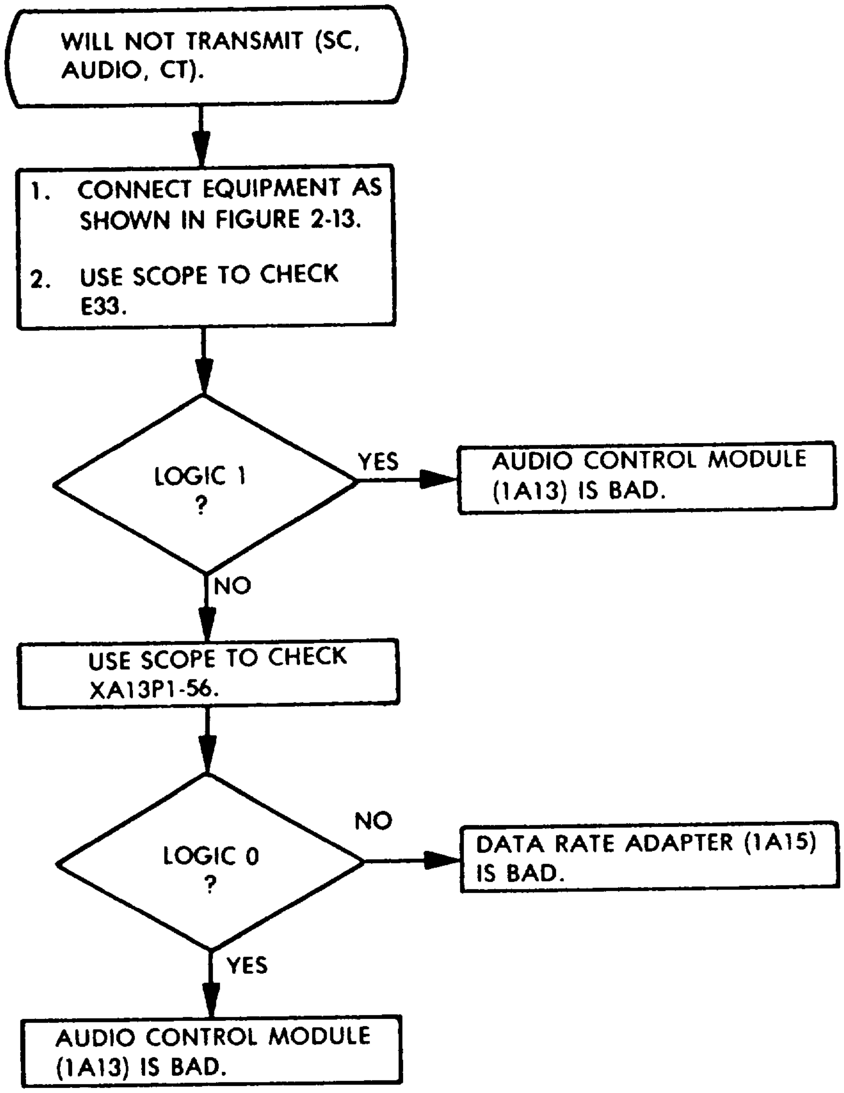
Troubleshooting SC Transmit Path
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 24

Troubleshooting CT Transmit Path (VIN AT/DDCO)
(Sheet 1 of 1)



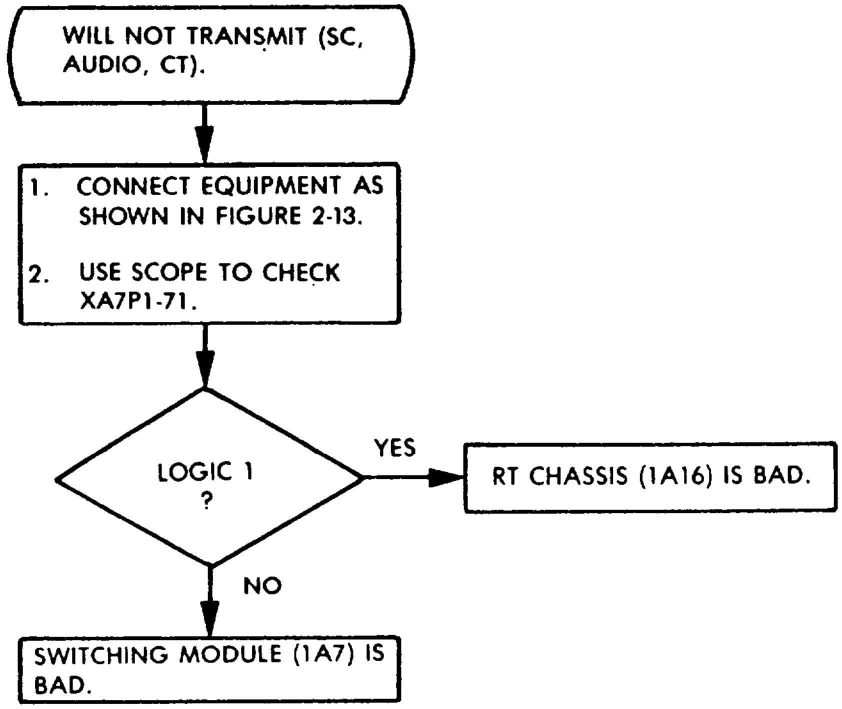
NOTE

See FO-11 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 25

Troubleshooting CT Transmit Path
(Sheet 1 of 1)



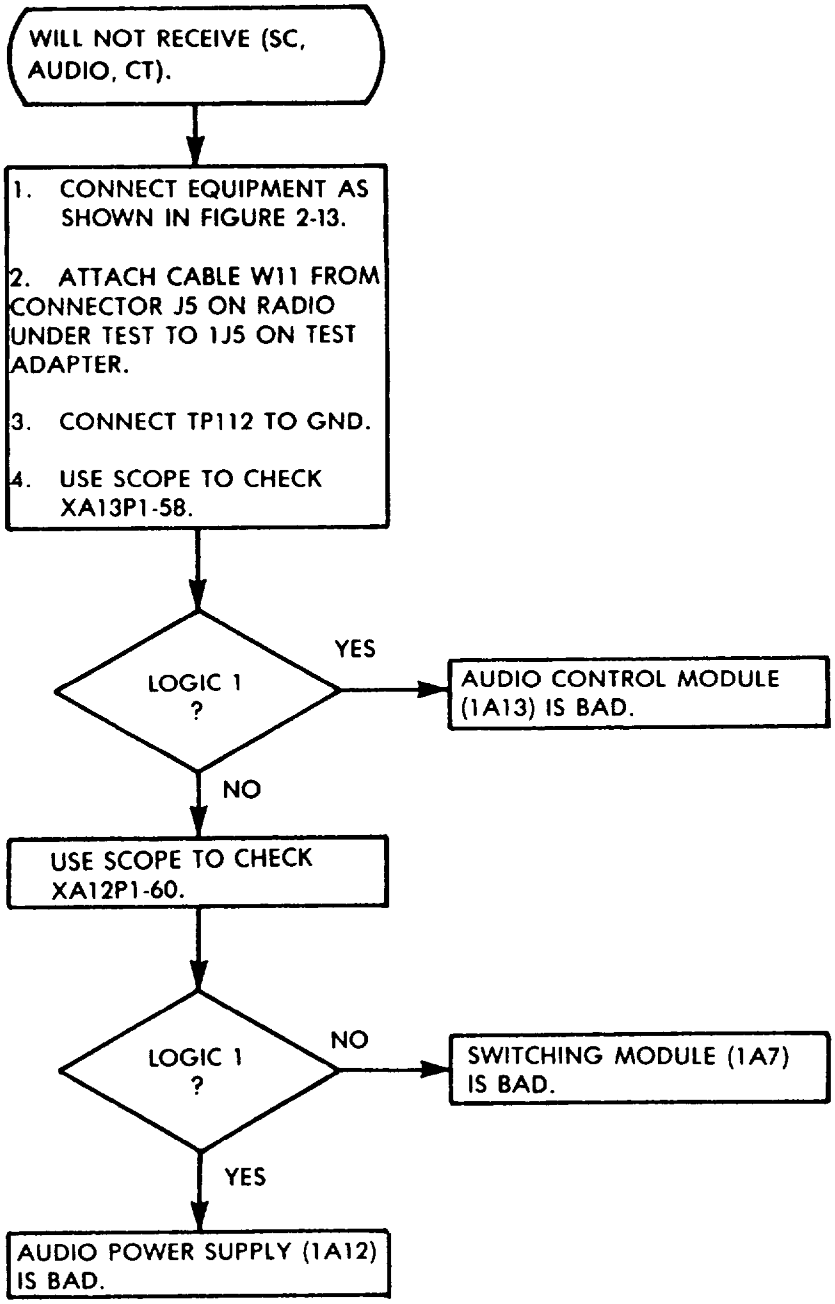
NOTE

See FO-11 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 26

Troubleshooting CT Receive Path
(Sheet 1 of 1)



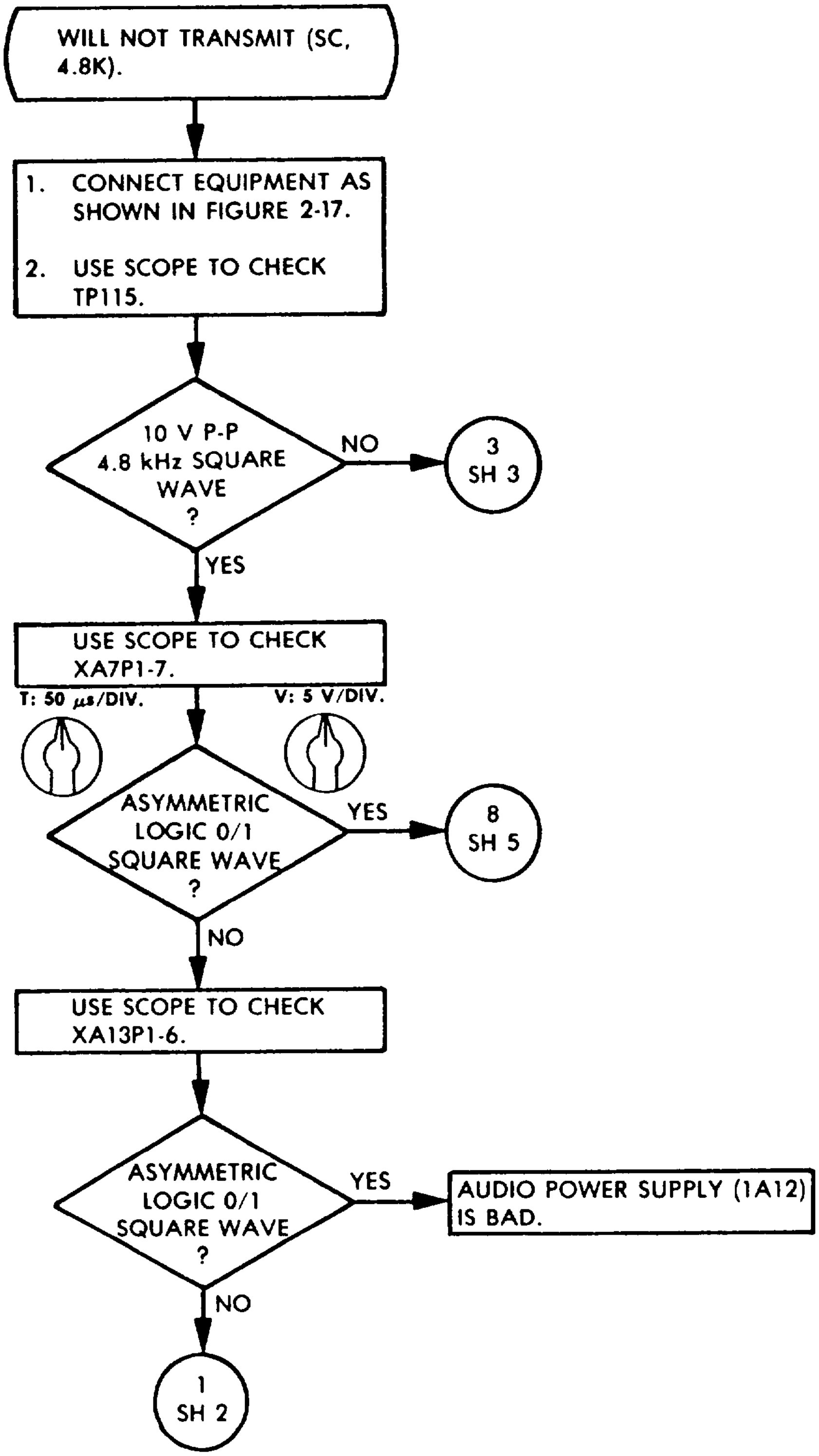
NOTE

See FO-11 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

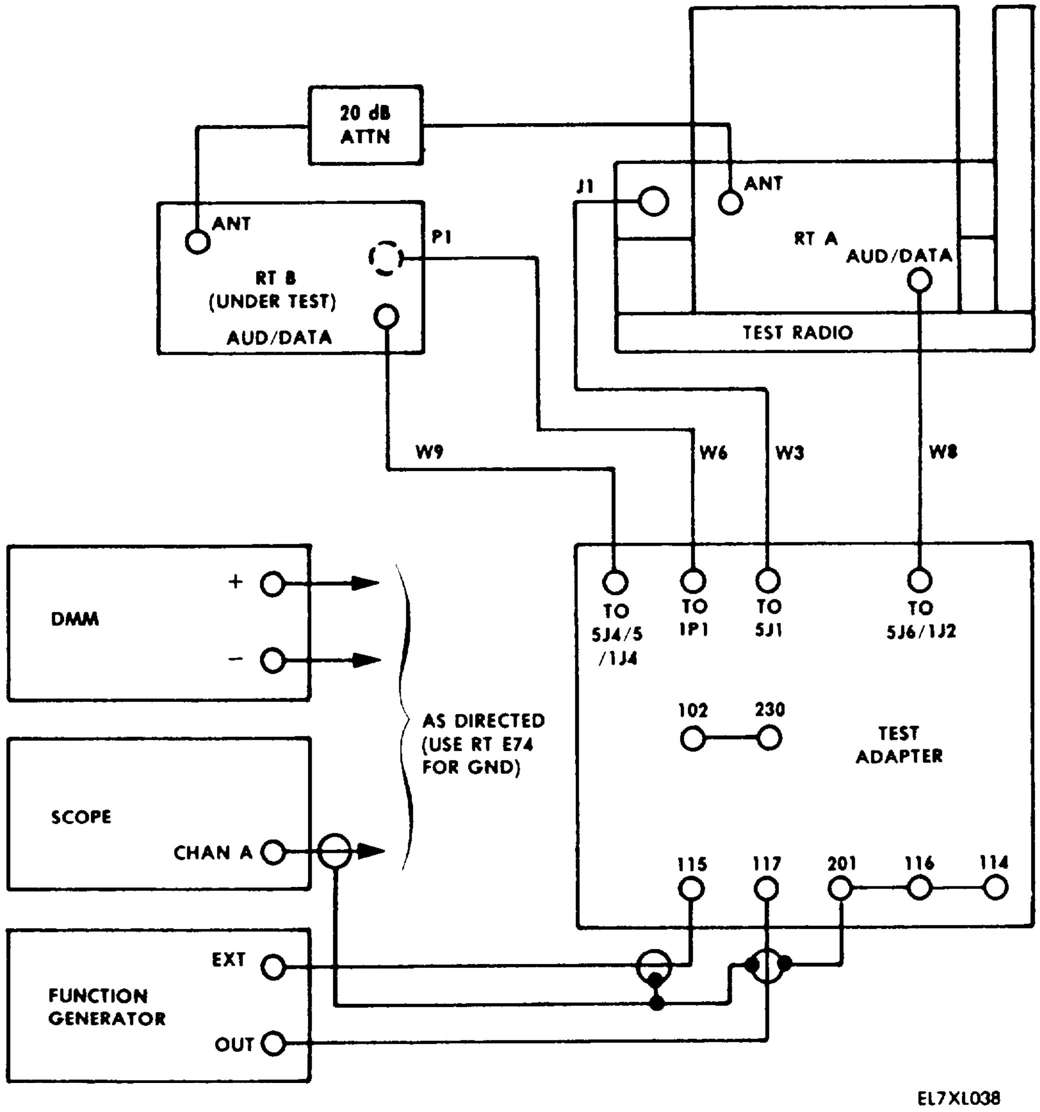
CHART 27

Troubleshooting Low Speed Data Transmit Path
(Sheet 1 of 6)



NOTE

See FO-6 for diagram of these circuit paths.



EQUIPMENT PRESETS

RT (UNDER TEST)
TOP AND BOTTOM COVERS REMOVED.

RT A AND RT B:
RF: LO
FCTN: SQ ON
MODE: SC
DATA: 4.8K
CHAN: 1

FUNCTION GENERATOR:
FREQ: 2400 Hz (2390 TO 2410 Hz)
LEVEL: 10 V P-P (9.5 TO 10.5 V P-P)
FUNCTION: SQUARE
TRIGGER: EXT TRIG
TRIG LEVEL: MID-RANGE

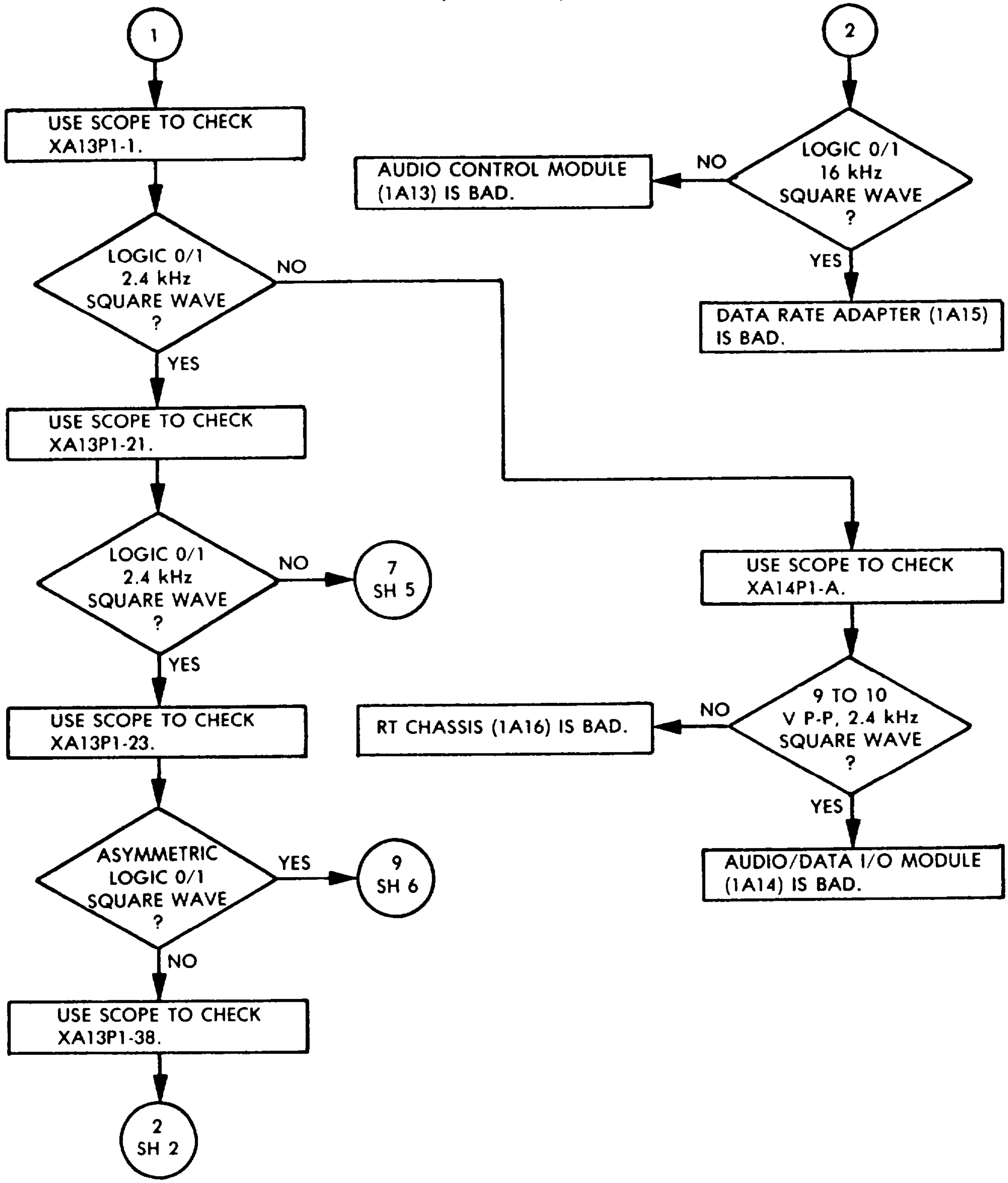
TEST RADIO:
CB1: ON

Figure 2-17. Transmit Test Setup (SC, 4.8K, PT).

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 27

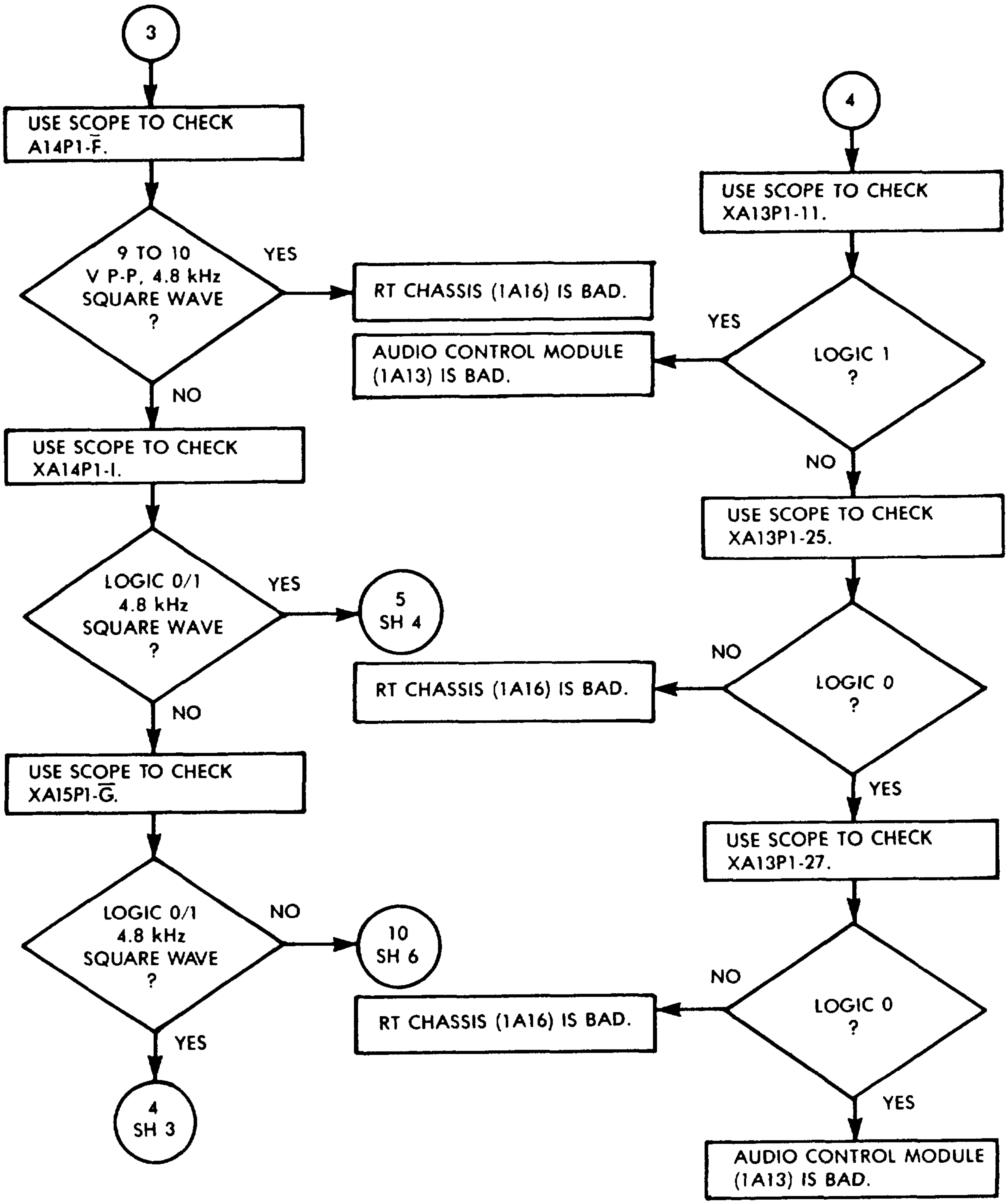
Troubleshooting Low Speed Data Transmit Path
(Sheet 2 of 6)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 27

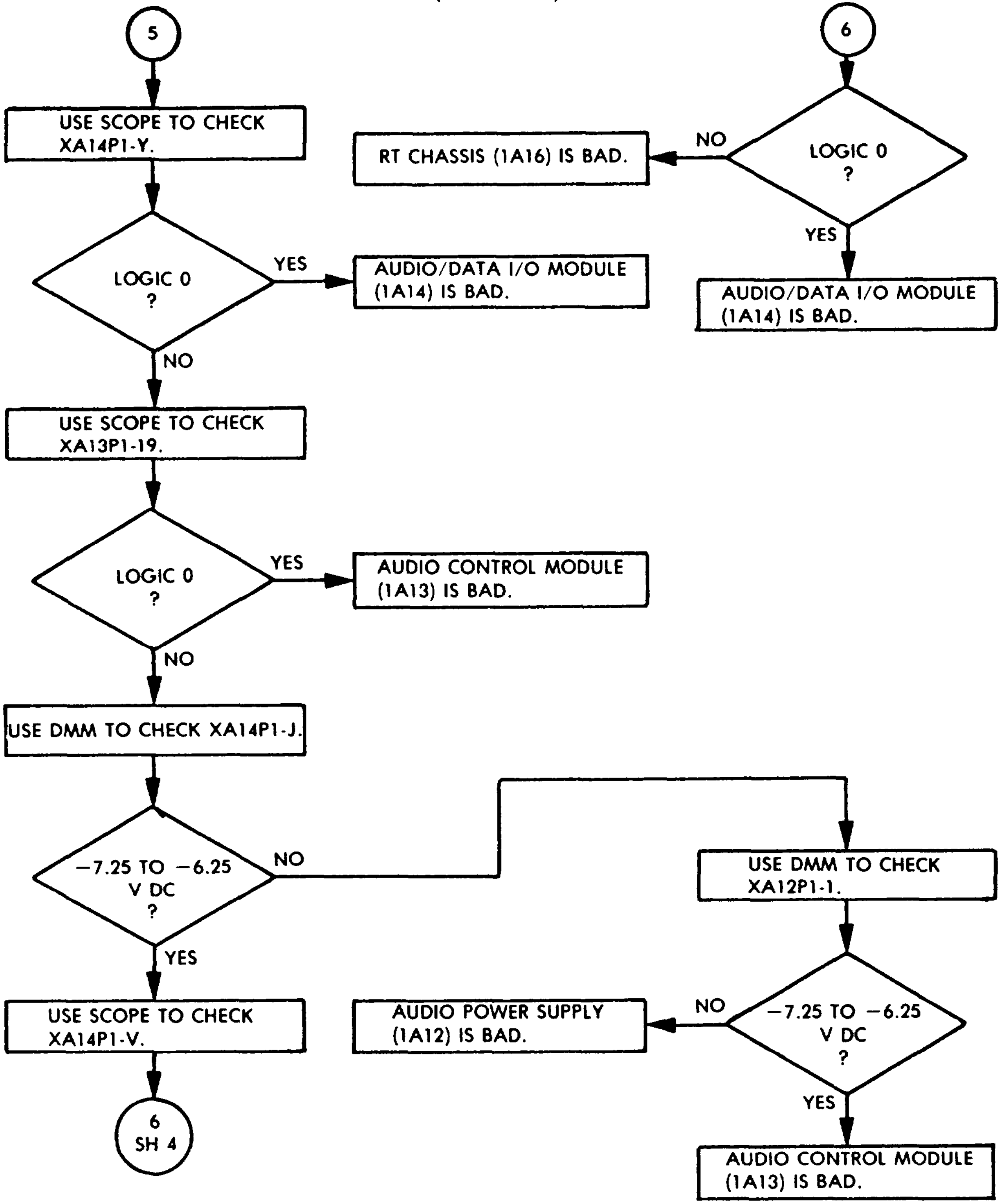
Troubleshooting Low Speed Data Transmit Path
(Sheet 3 of 6)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 27

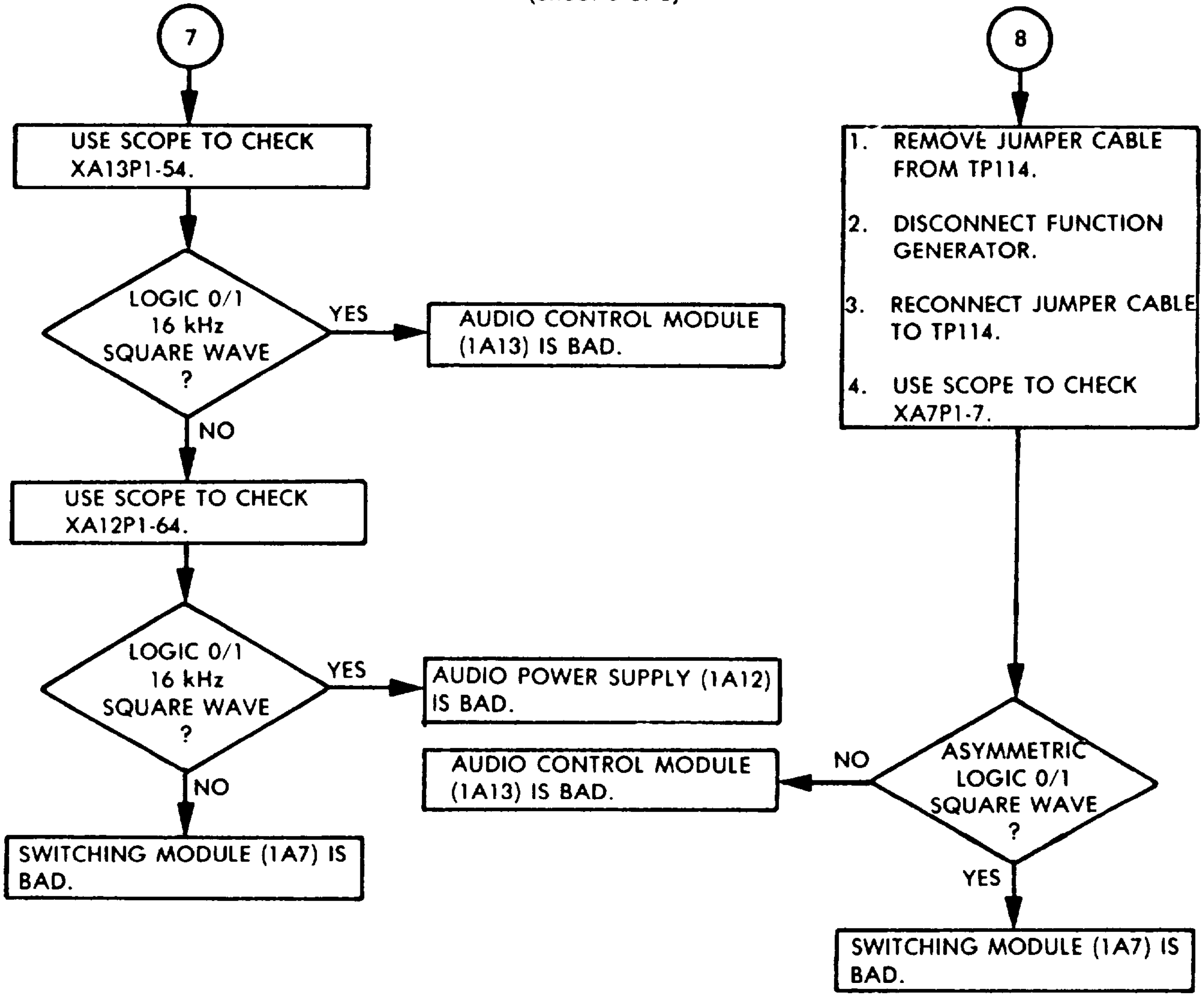
Troubleshooting Low Speed Data Transmit Path
(Sheet 4 of 6)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 27

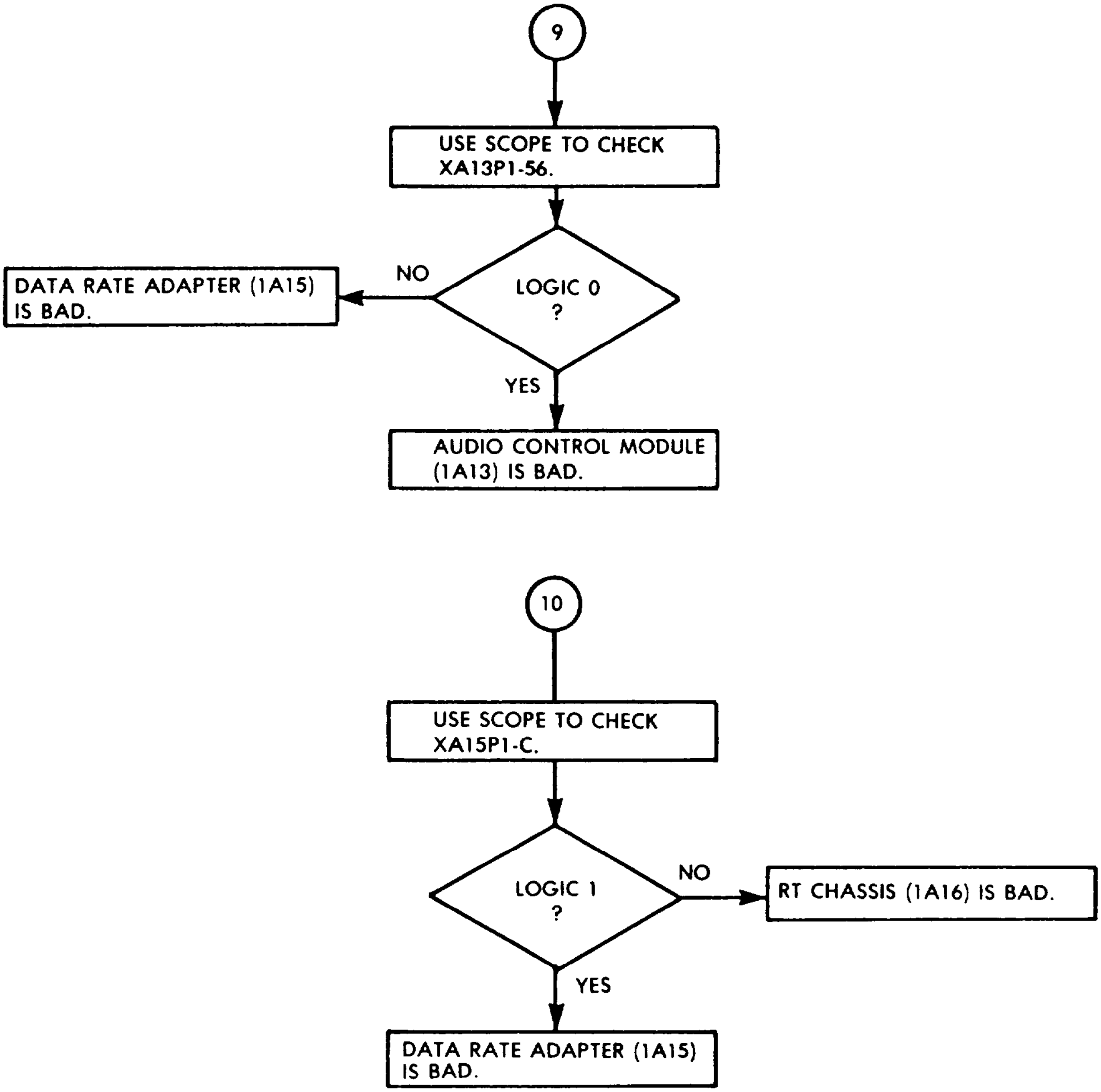
Troubleshooting Low Speed Data Transmit Path
(Sheet 5 of 6)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 27

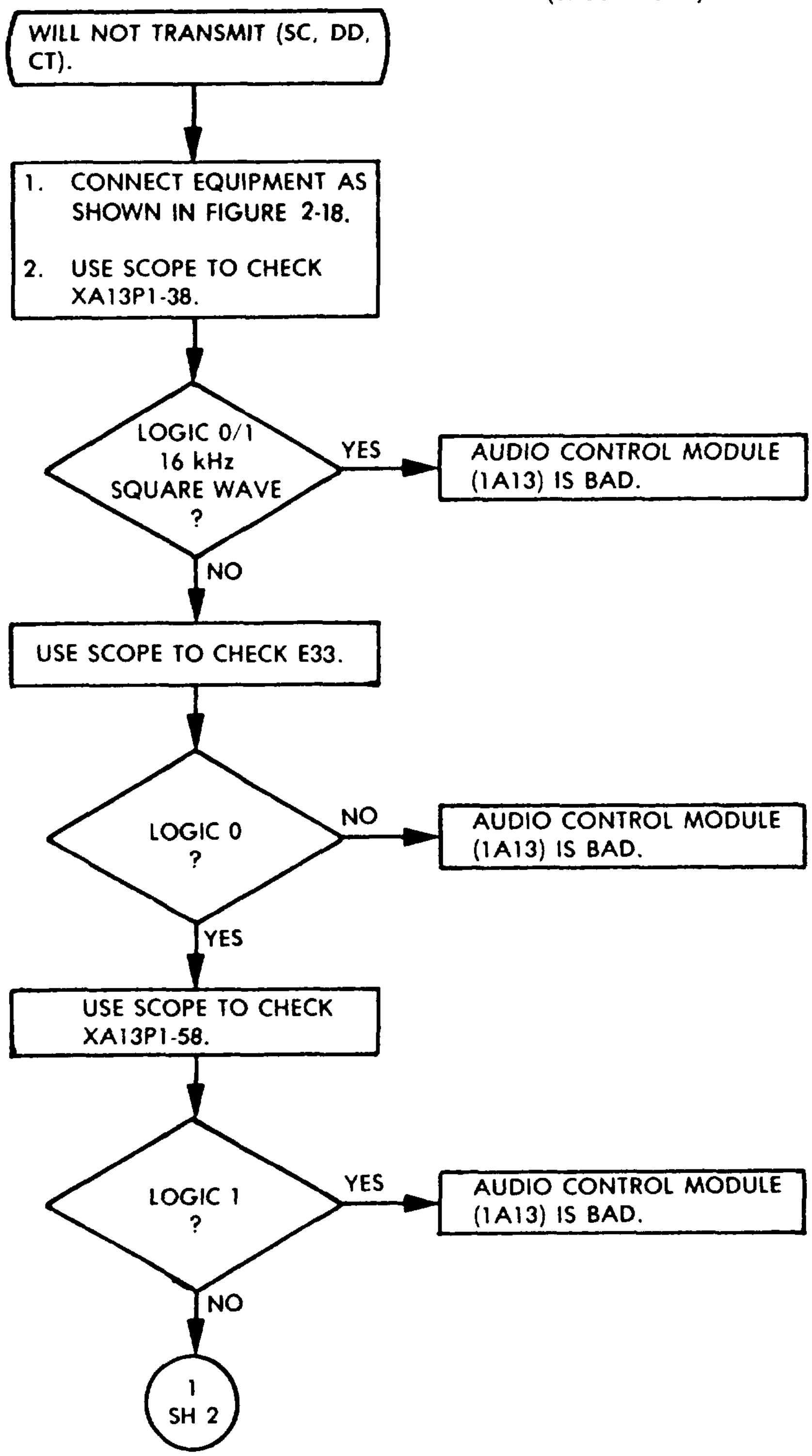
Troubleshooting Low Speed Data Transmit Path
(Sheet 6 of 6)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

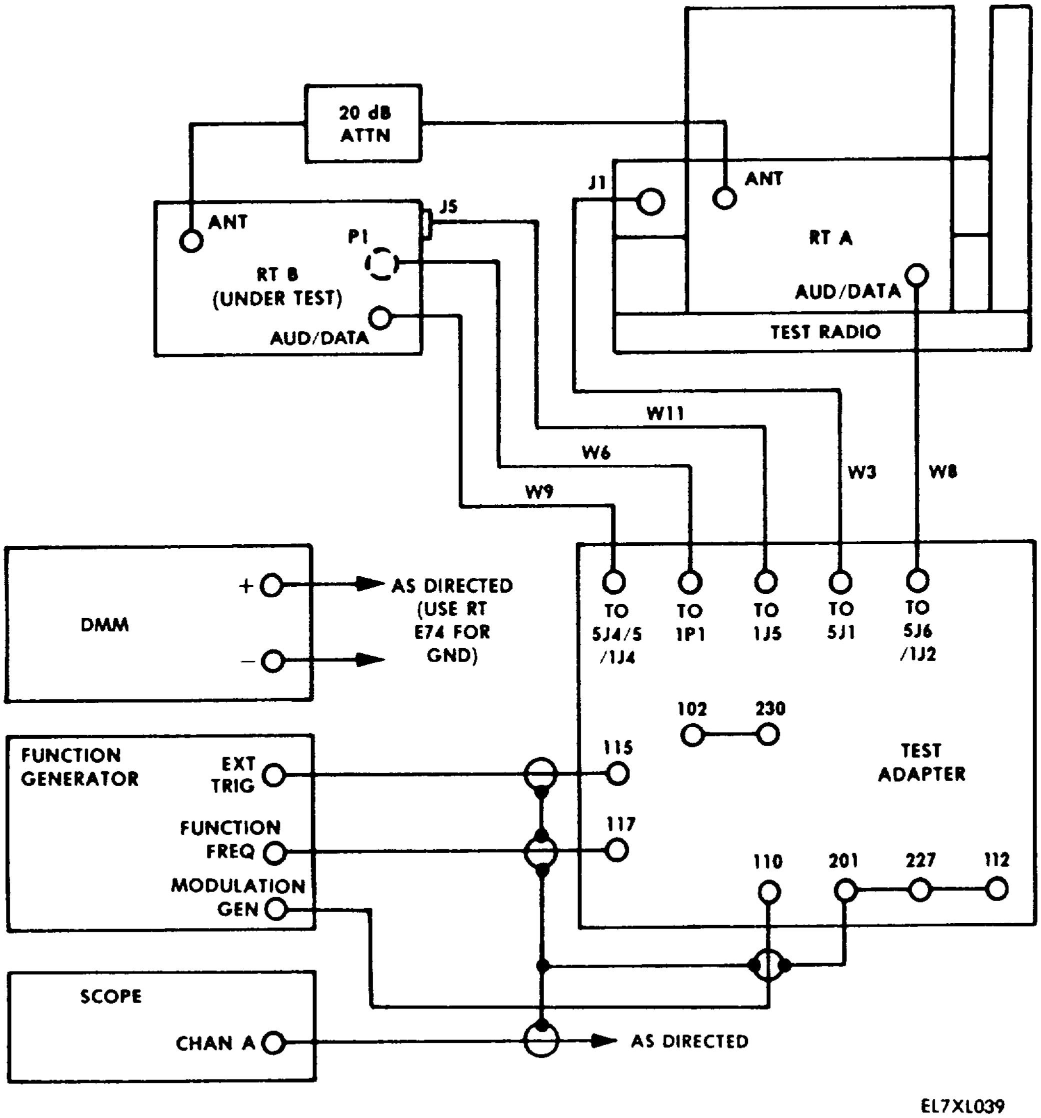
CHART 28

Troubleshooting COMSEC Digital Data Transmit Path
(Sheet 1 of 2)



NOTE

See FO-11 for diagram of these circuit paths.



EQUIPMENT PRESETS

RT (UNDER TEST):
TOP AND BOTTOM COVERS REMOVED

RT A AND RT B:

RF:	LO
FCTN:	SQ ON
MODE:	SC
DATA:	4.8K
CHAN:	1

FUNCTION GENERATORS:

FUNCTION FREQ:	2400 Hz (2390 TO 2410 Hz)
MODULATION GEN:	16000 Hz (15990 TO 16010 Hz)
LEVEL:	10 V P-P (9.5 TO 10.5 V P-P) (BOTH)
FUNCTION:	SQUARE (BOTH)
TRIGGER:	EXT
TRIG LEVEL:	MID-RANGE

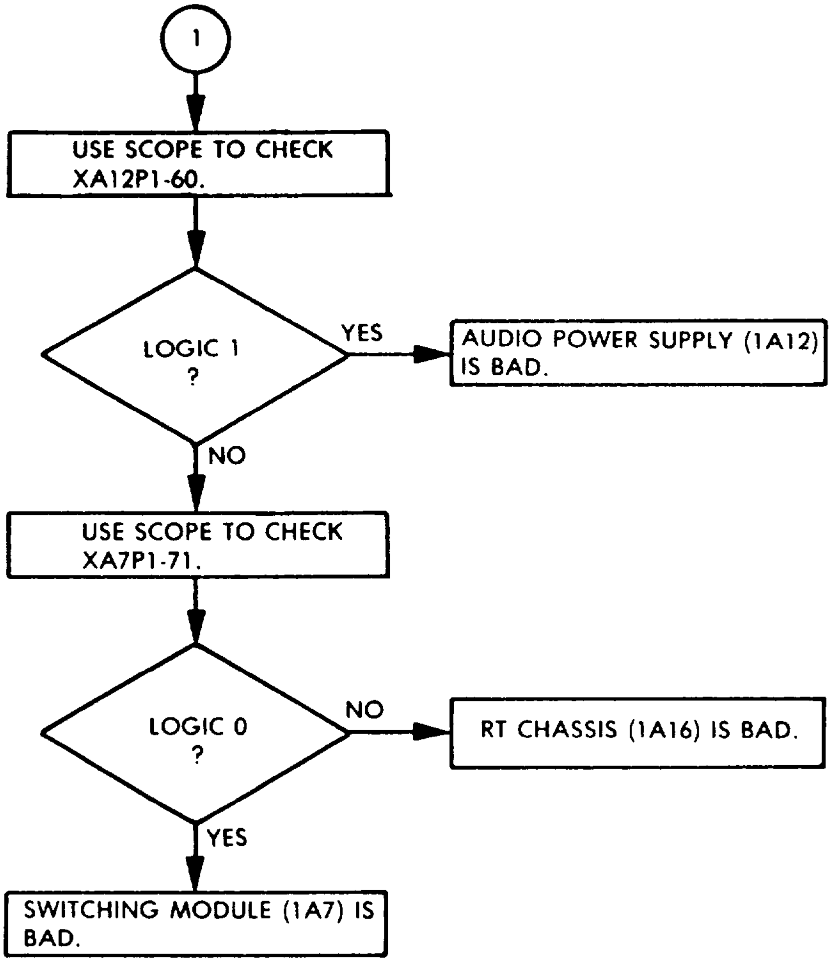
TEST RADIO:
CB1: ON

Figure 2-18. Transmit Test Setup (SC, DD, CT).

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 28

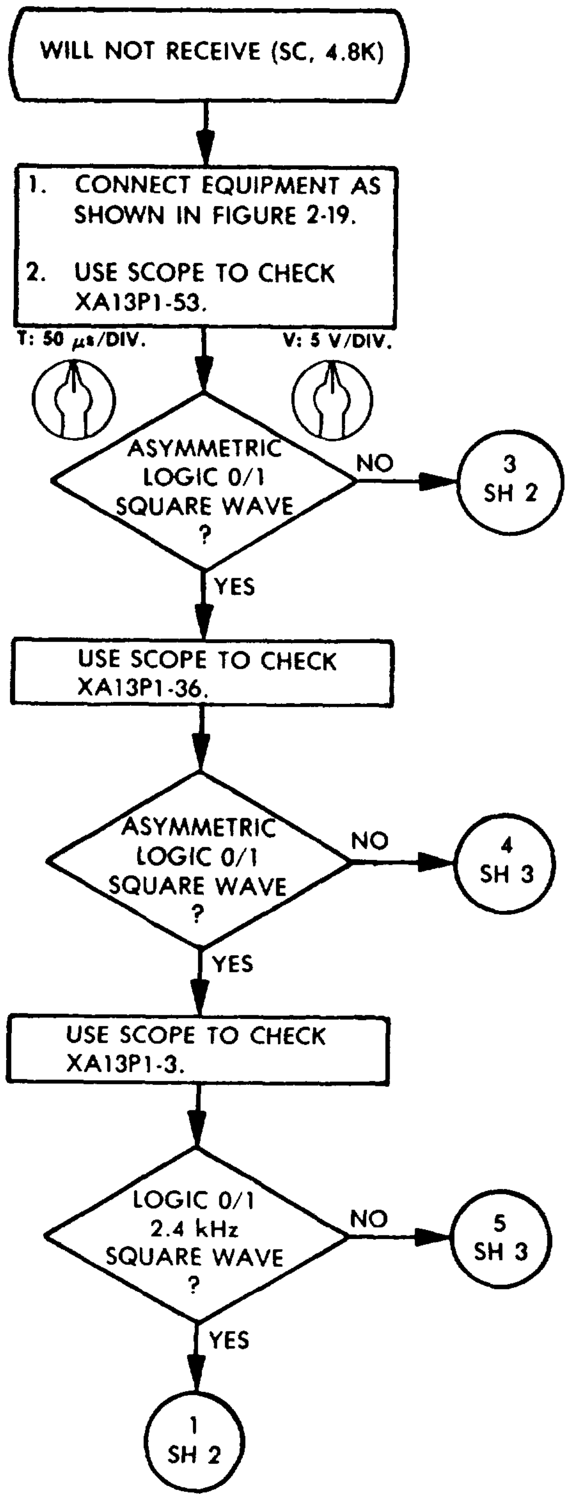
Troubleshooting COMSEC Digital Data Transmit Path
(Sheet 2 of 2)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

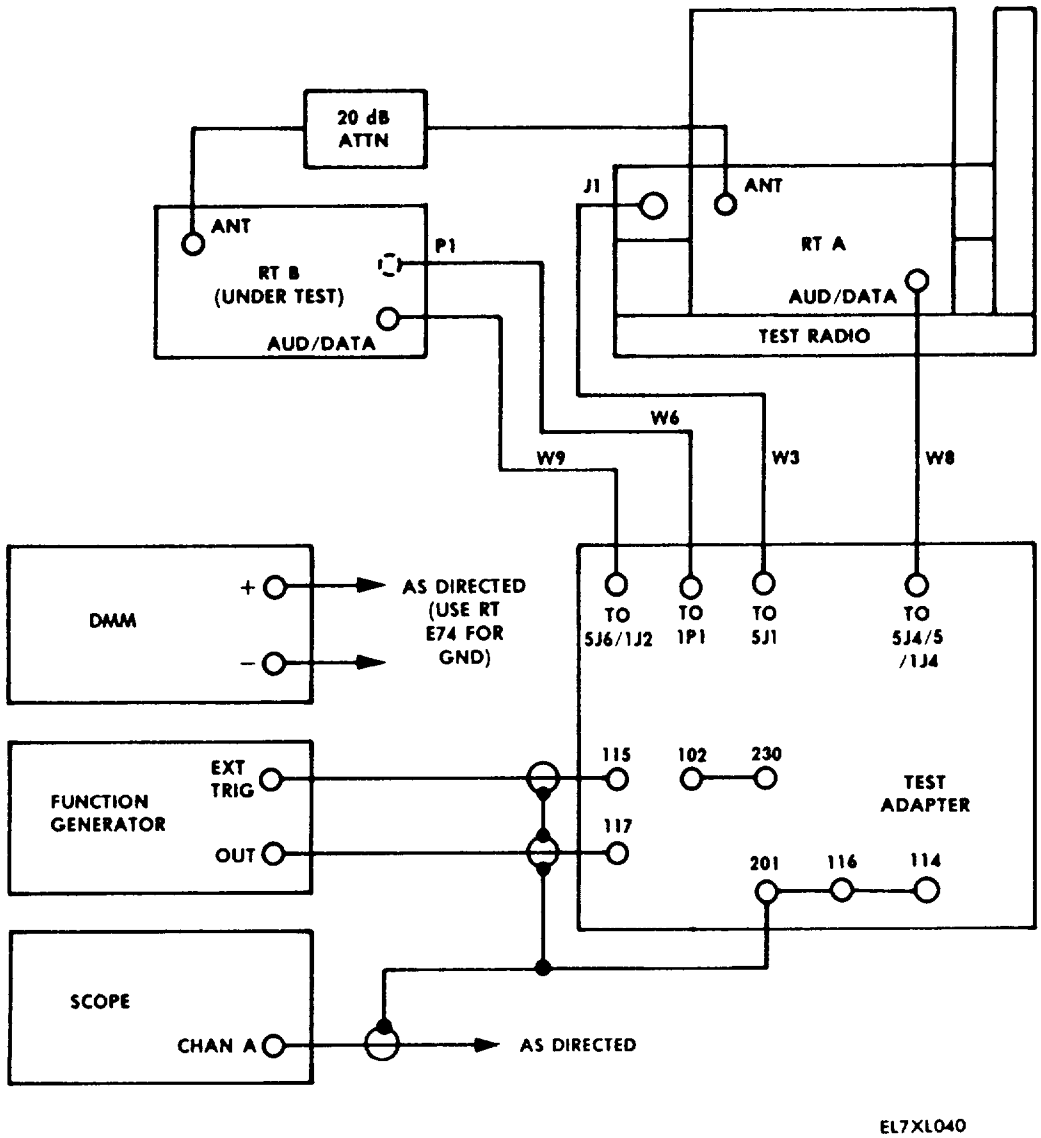
CHART 29

Troubleshooting Low Speed Data Receive Path
(Sheet 1 of 3)



NOTE

See FO-6 for diagram of these circuit paths.



EQUIPMENT PRESETS

RT (UNDER TEST)
TOP AND BOTTOM COVERS REMOVED.
DATA RATE ADAPTER (1A15) INSTALLED.

RT A AND RT B:

RF:	LO
FCTN:	SQ ON
MODE:	SC
DATA:	4.8K
CHAN:	1

FUNCTION GENERATOR:

FREQ:	2400 Hz (2390 TO 2410 Hz)
LEVEL:	10 V P-P (9.5 TO 10.5 V P-P)
FUNCTION:	SQUARE
TRIGGER:	EXT TRIG
TRIG LEVEL:	MID-RANGE

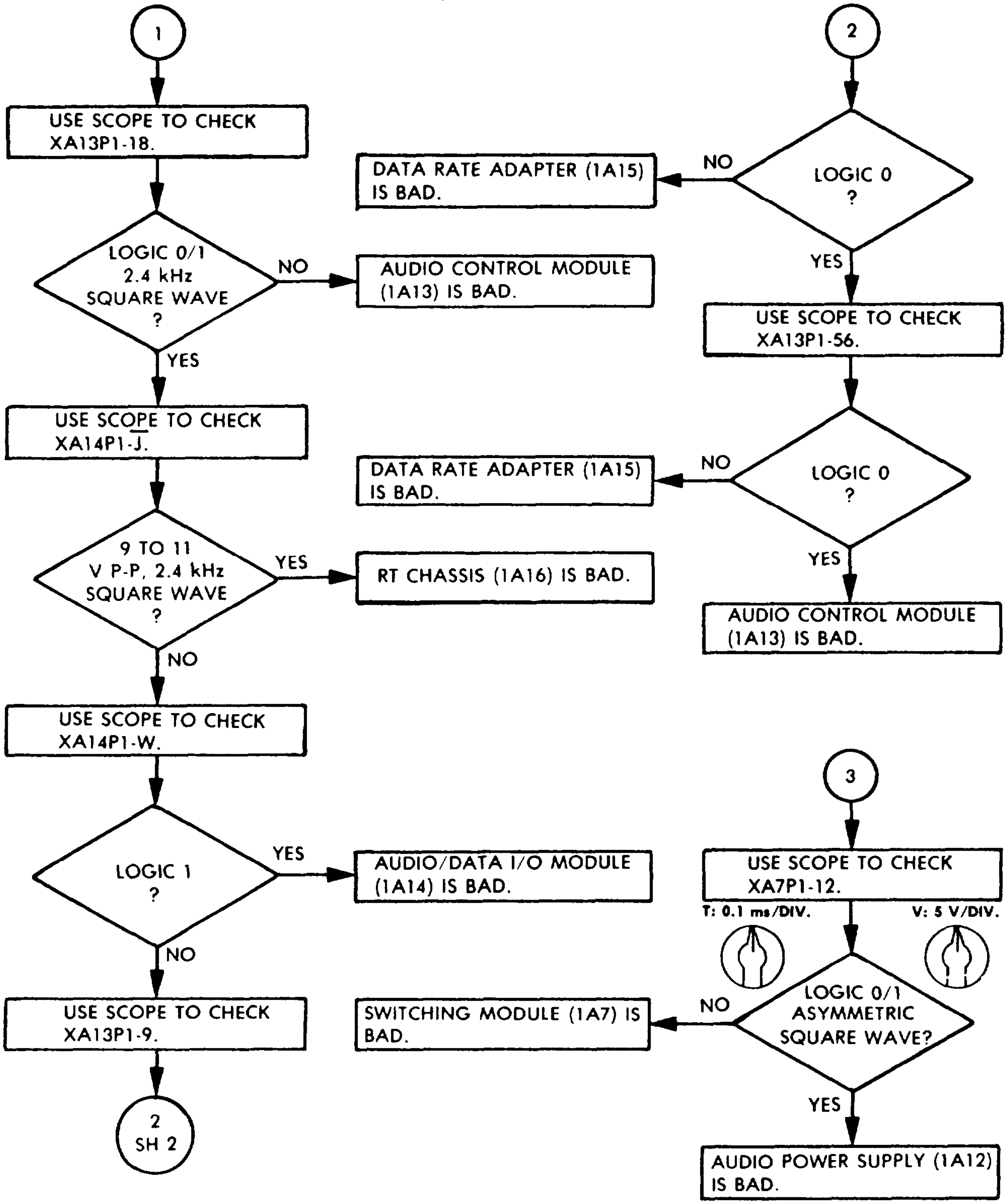
TEST RADIO:
CB1: ON

Figure 2-19. Receive Test Setup (SC, 4.8K DATA, PT).

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 29

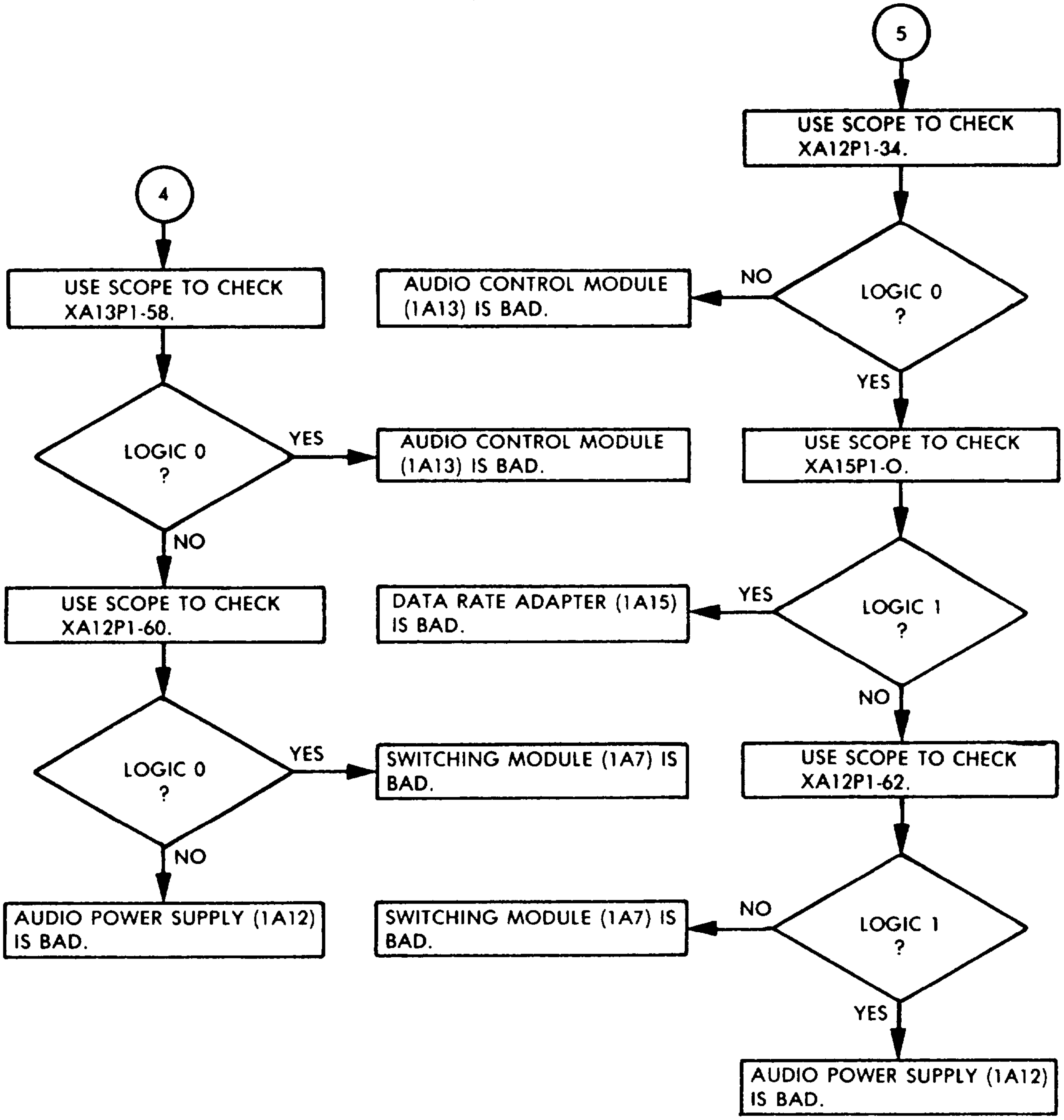
Troubleshooting Low Speed Data Receive Path
(Sheet 2 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 29

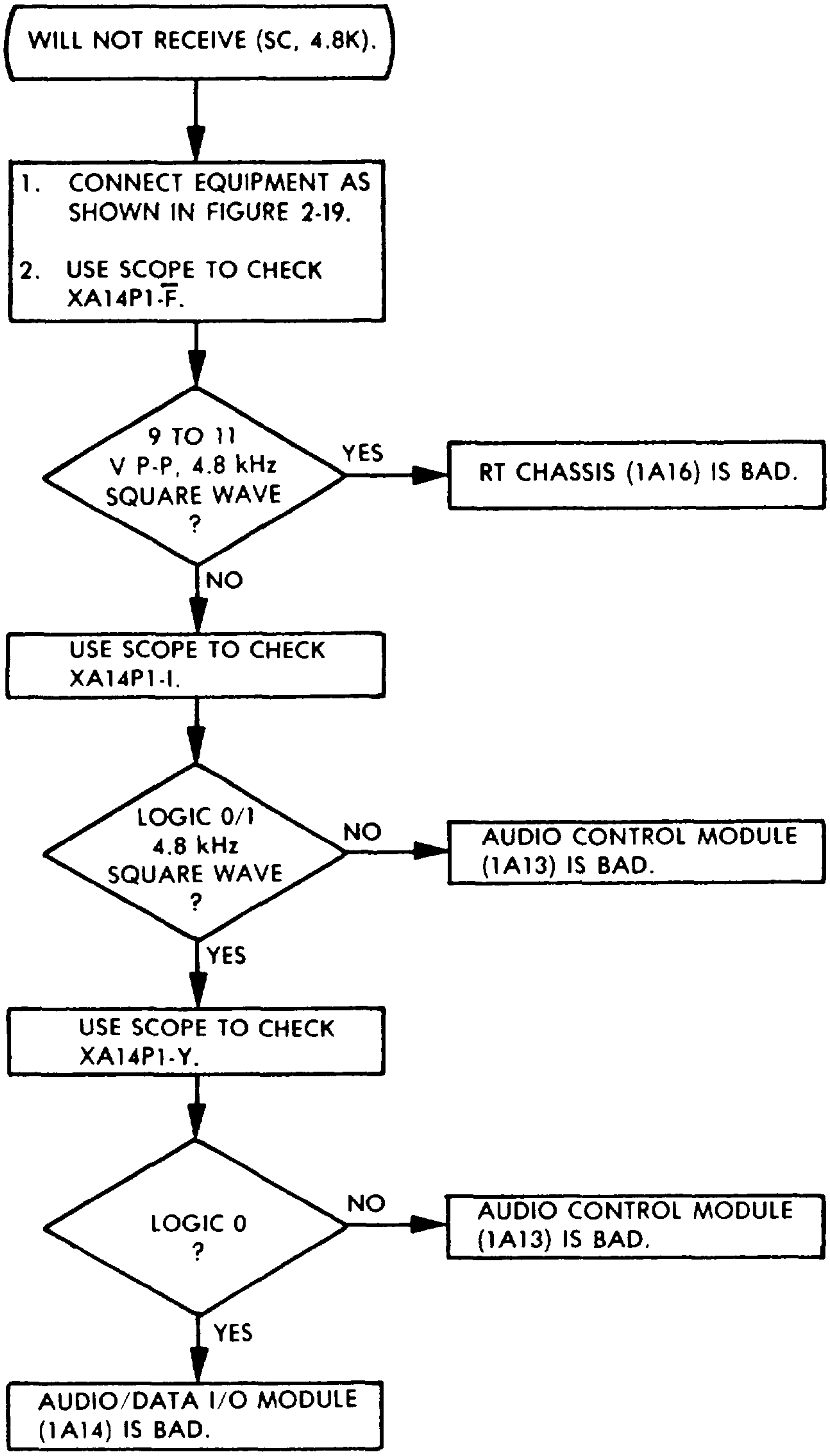
Troubleshooting Low Speed Data Receive Path
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 30

Troubleshooting Low Speed Data Receive Clock Path
(Sheet 1 of 1)



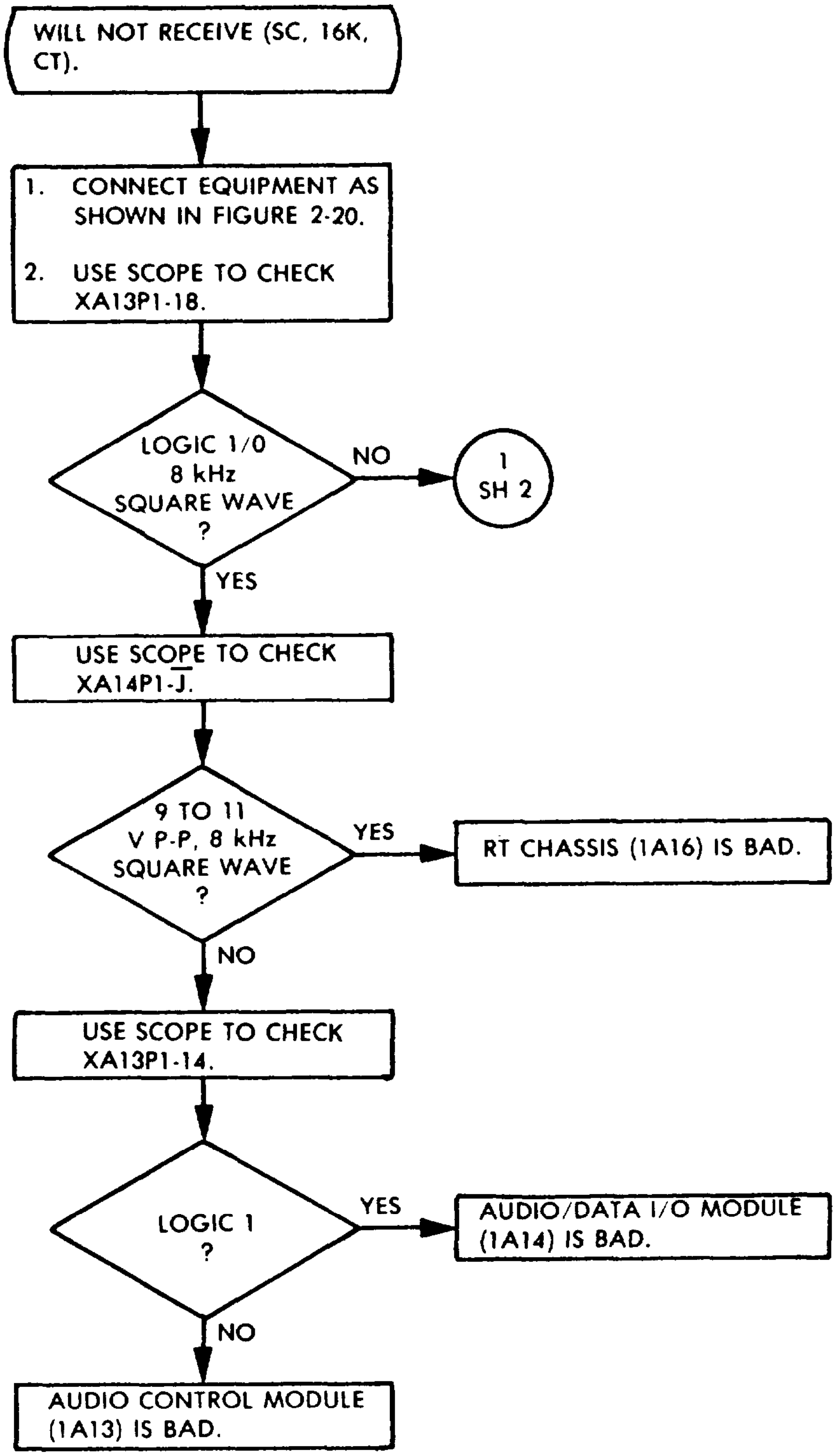
NOTES

1. See FO-6 for diagram of these circuit paths.
2. If any of these tests fail remove and reinsert the jumper cable to TP114, then test again.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

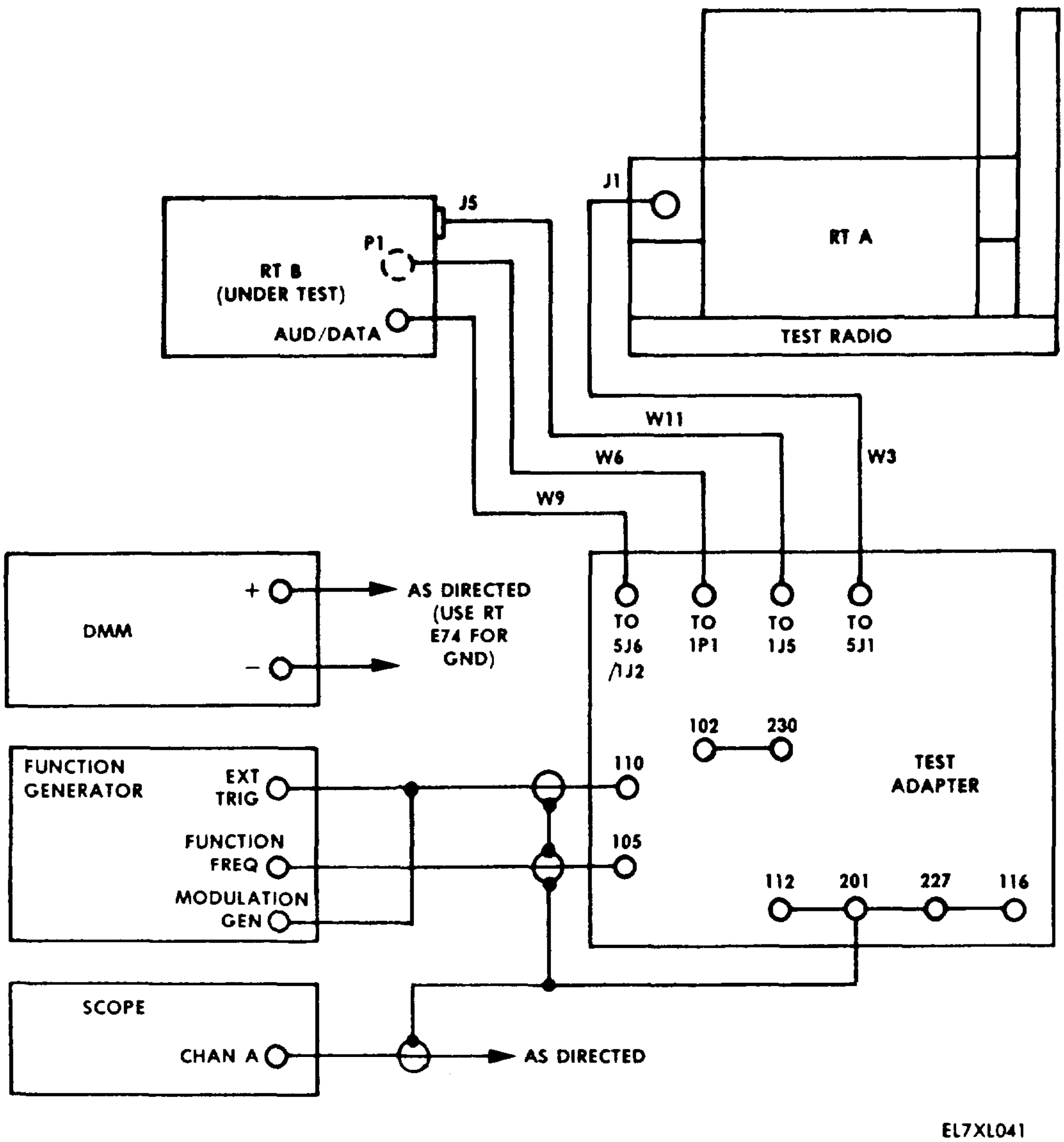
CHART 31

Troubleshooting COMSEC Digital Data Receive Path
(Sheet 1 of 3)



NOTE

See FO-5 and FO-11 for diagram of these circuit paths.



EQUIPMENT PRESETS

RT (UNDER TEST)
- TOP AND BOTTOM COVERS REMOVED.
- DATA RATE ADAPTER (1A15) REMOVED.

RT A AND RT B:

RF:	LO
FCTN:	SQ ON
MODE:	SC
DATA:	16K
CHAN:	1

FUNCTION GENERATORS:

FUNCTION FREQ:	8000 Hz (7990 TO 8010 Hz)
MODULATION GEN:	16000 Hz (15990 TO 16010 Hz)
LEVEL:	10 V P-P (9.5 TO 10.5 V P-P) (BOTH)
FUNCTION:	SQUARE (BOTH)
TRIGGER:	EXT TRIG
TRIG LEVEL:	MID-RANGE

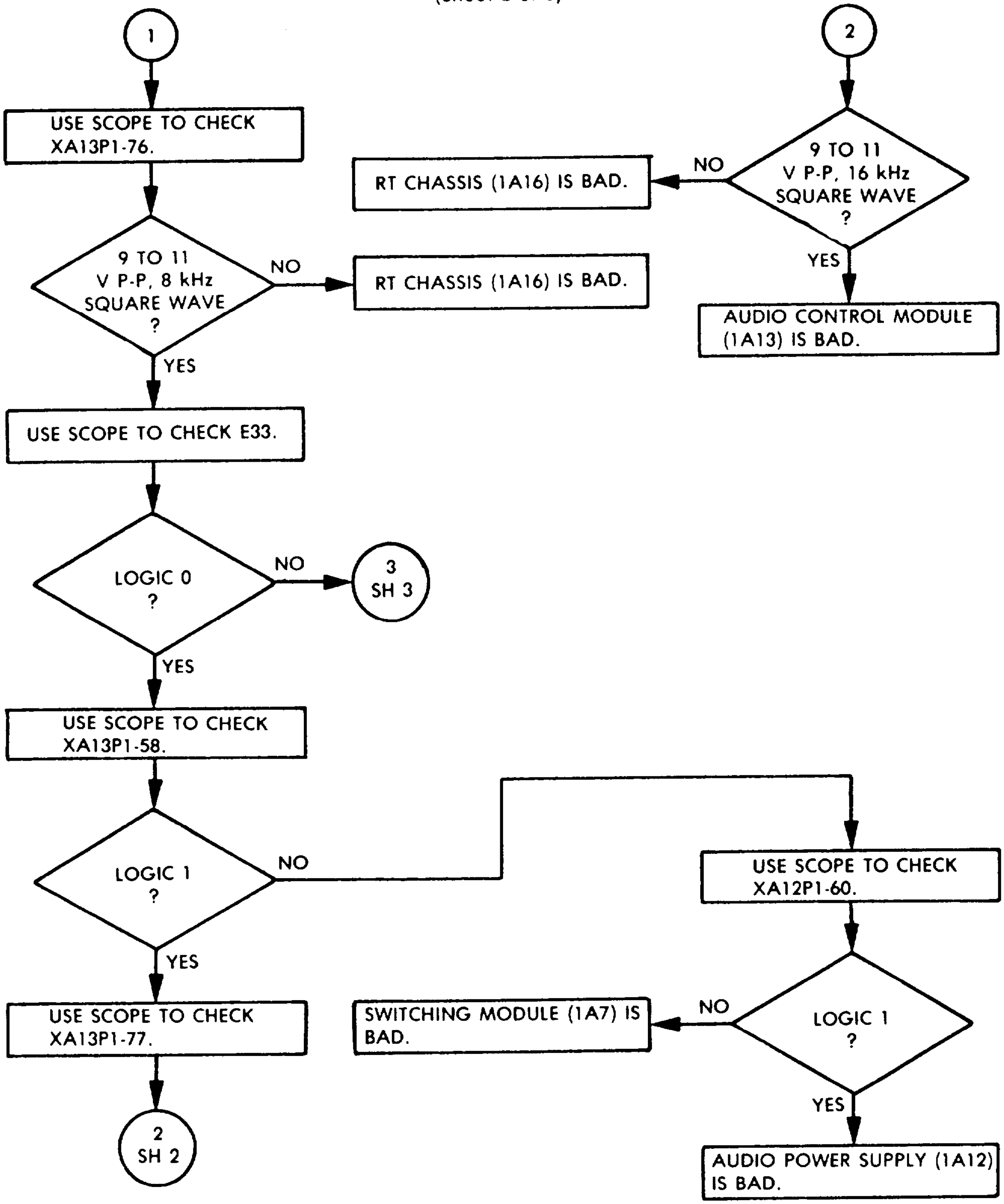
TEST RADIO:
- CB1: ON

Figure 2-20. Receive Test Setup (CT, DIGITAL DATA).

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 31

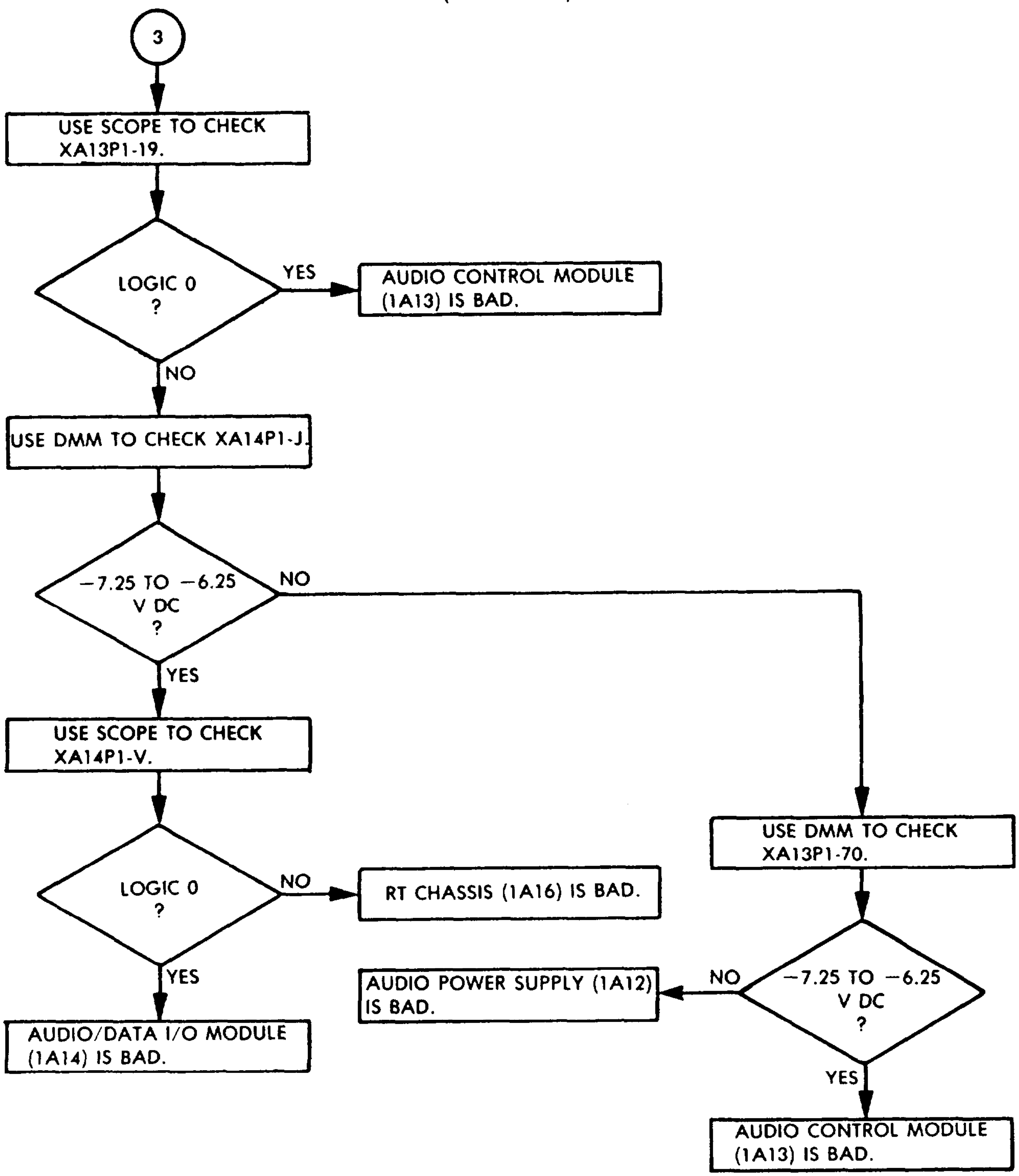
Troubleshooting COMSEC Digital Data Receive Path
(Sheet 2 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 31

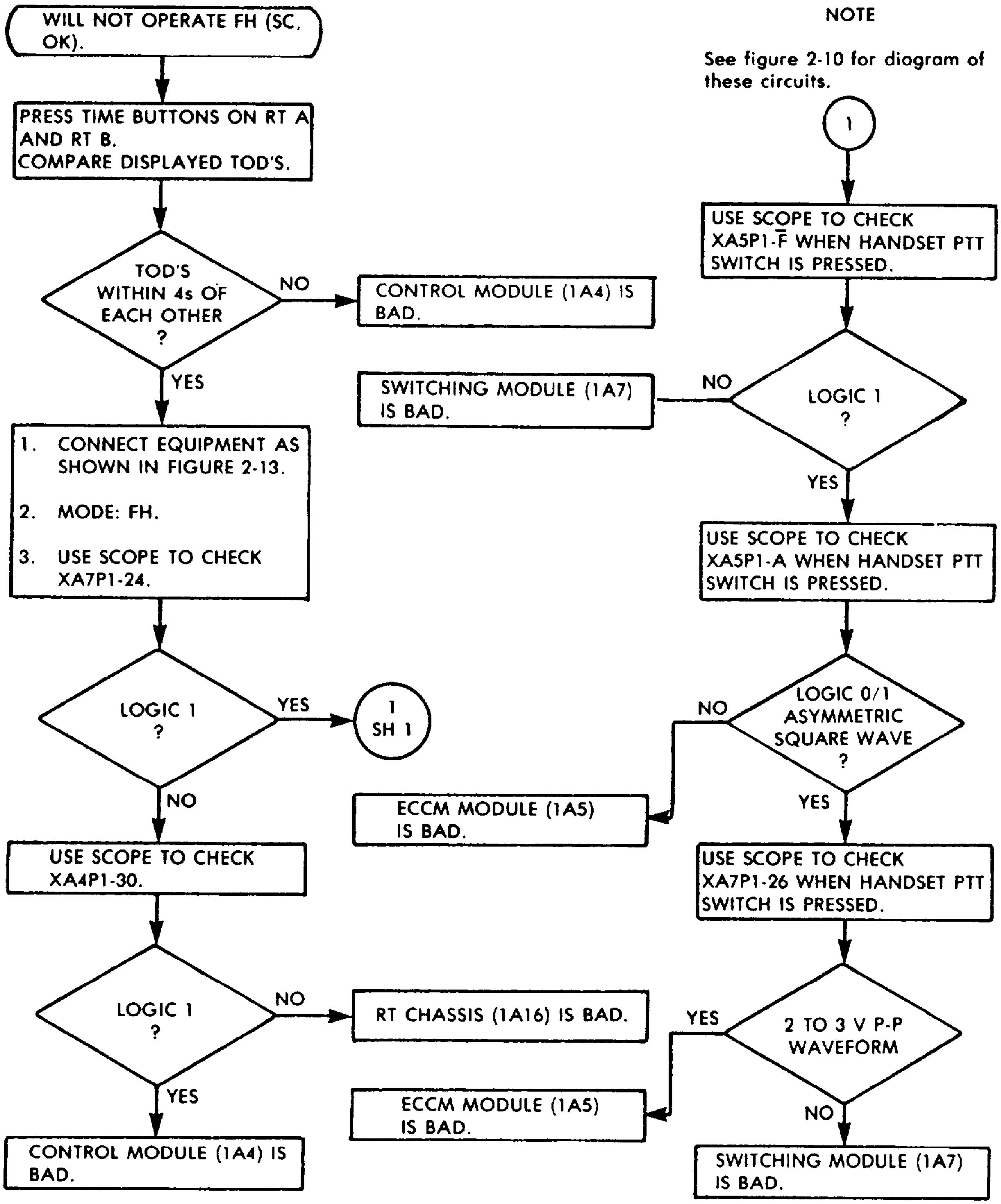
Troubleshooting COMSEC Digital Data Receive Path
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 32

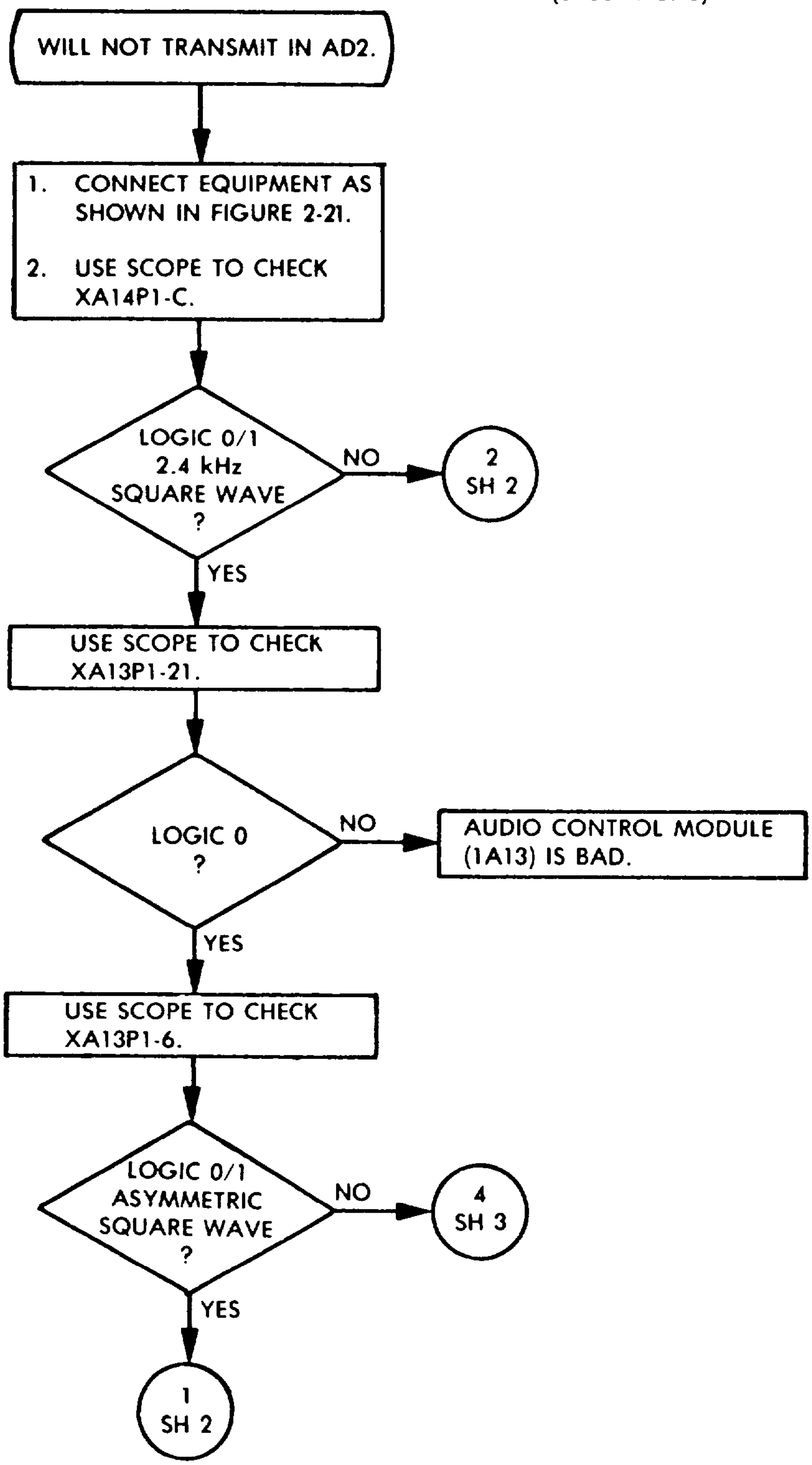
Troubleshooting FH Circuits
(Sheet 1 of 1)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

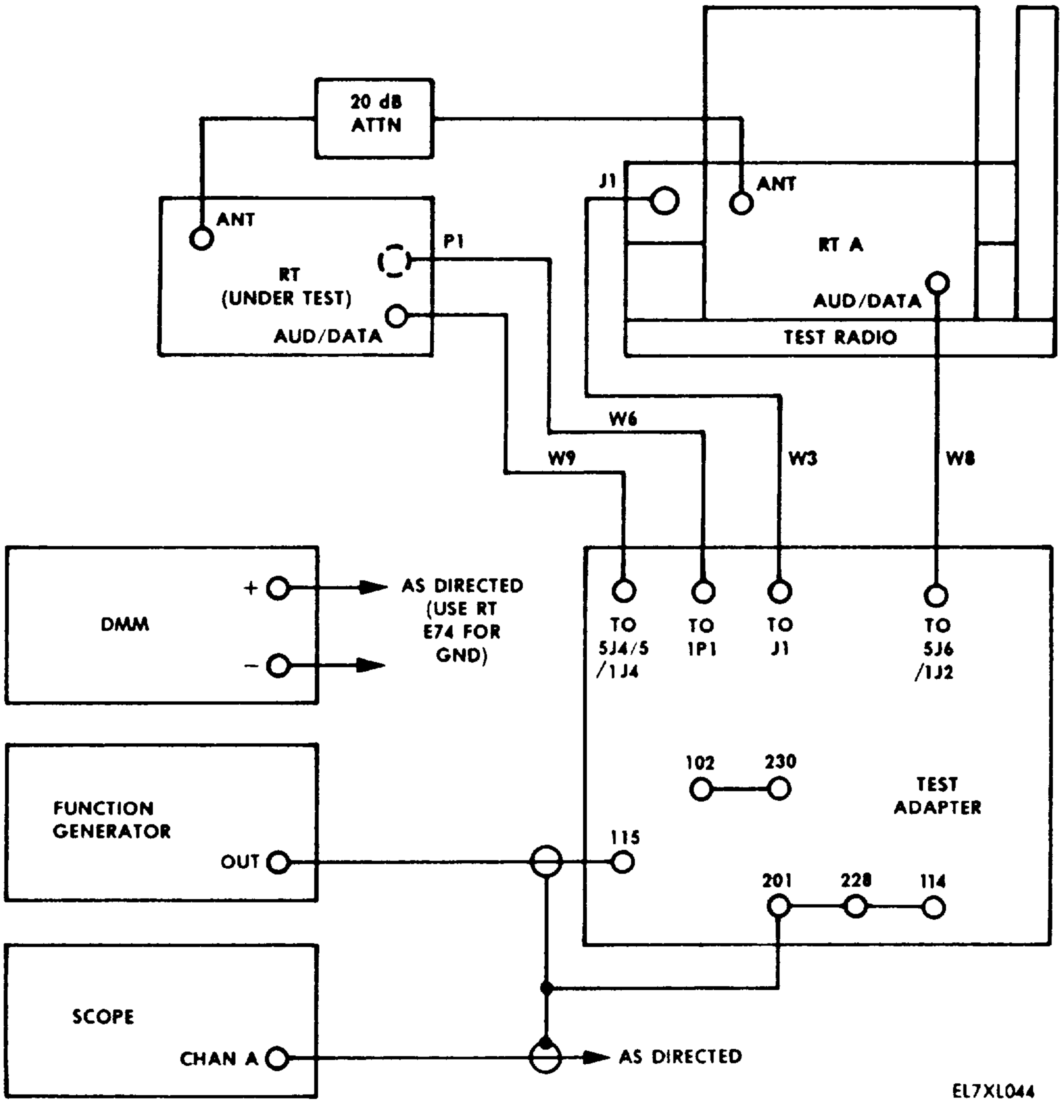
CHART 33

Troubleshooting AD2 Transmit Circuits
(Sheet 1 of 3)



NOTE

See FO-6 for diagram of these circuit paths.



EQUIPMENT PRESETS

RT (UNDER TEST)
TOP AND BOTTOM COVERS REMOVED.

RT A AND RT B:

RF:	LO
FCTN:	SQ ON
MODE:	SC
DATA:	AD2
CHAN:	1

FUNCTION GENERATOR:

FREQ:	2400 Hz (2390 TO 2410 Hz)
LEVEL:	350 mV P-P (300 TO 400 mV P-P)
FUNCTION:	SINE

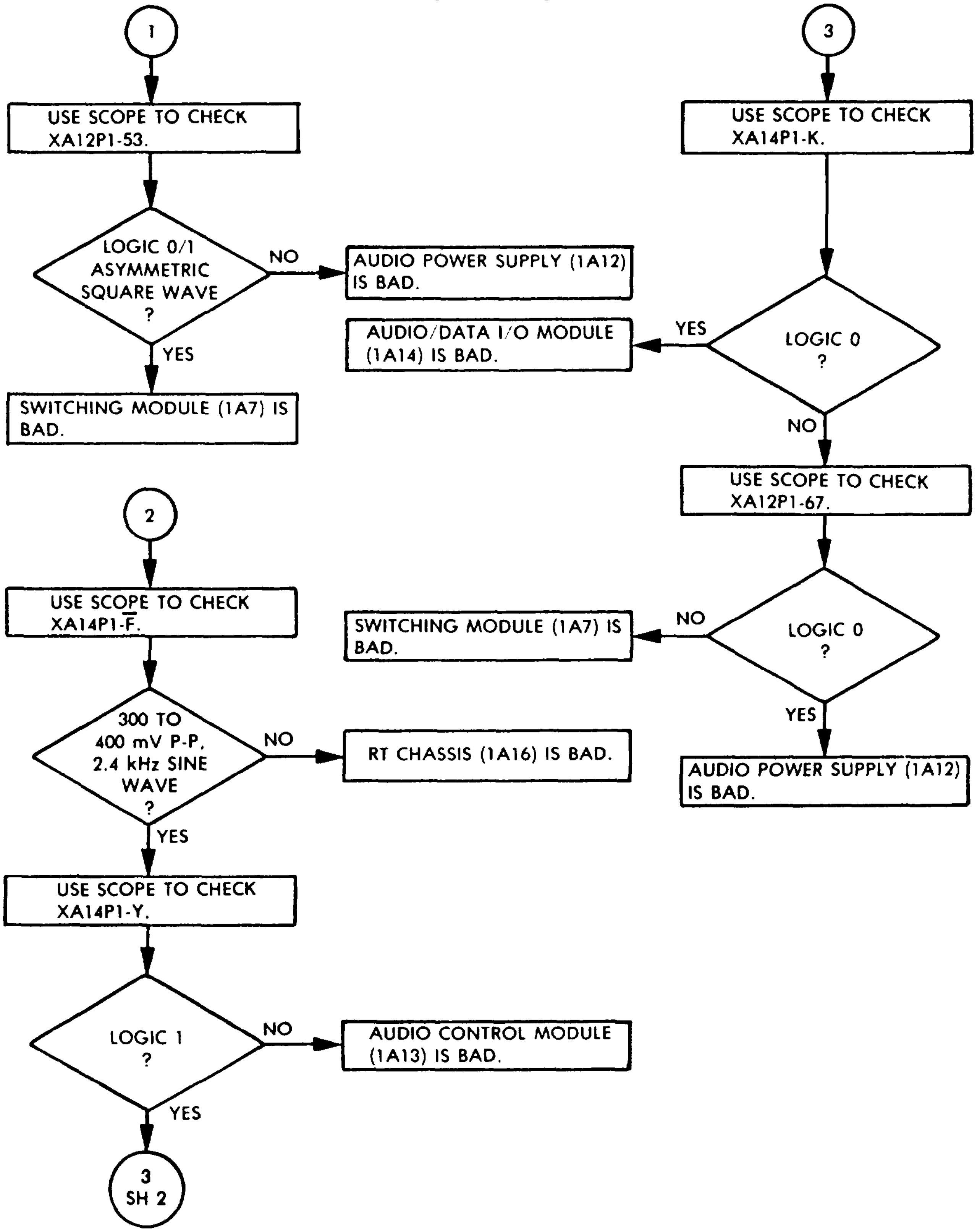
TEST RADIO:
CB1: ON

Figure 2-21. Transmit Test Set (SC, AD2, PT).

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 33

Troubleshooting AD2 Transmit Circuits
(Sheet 2 of 3)

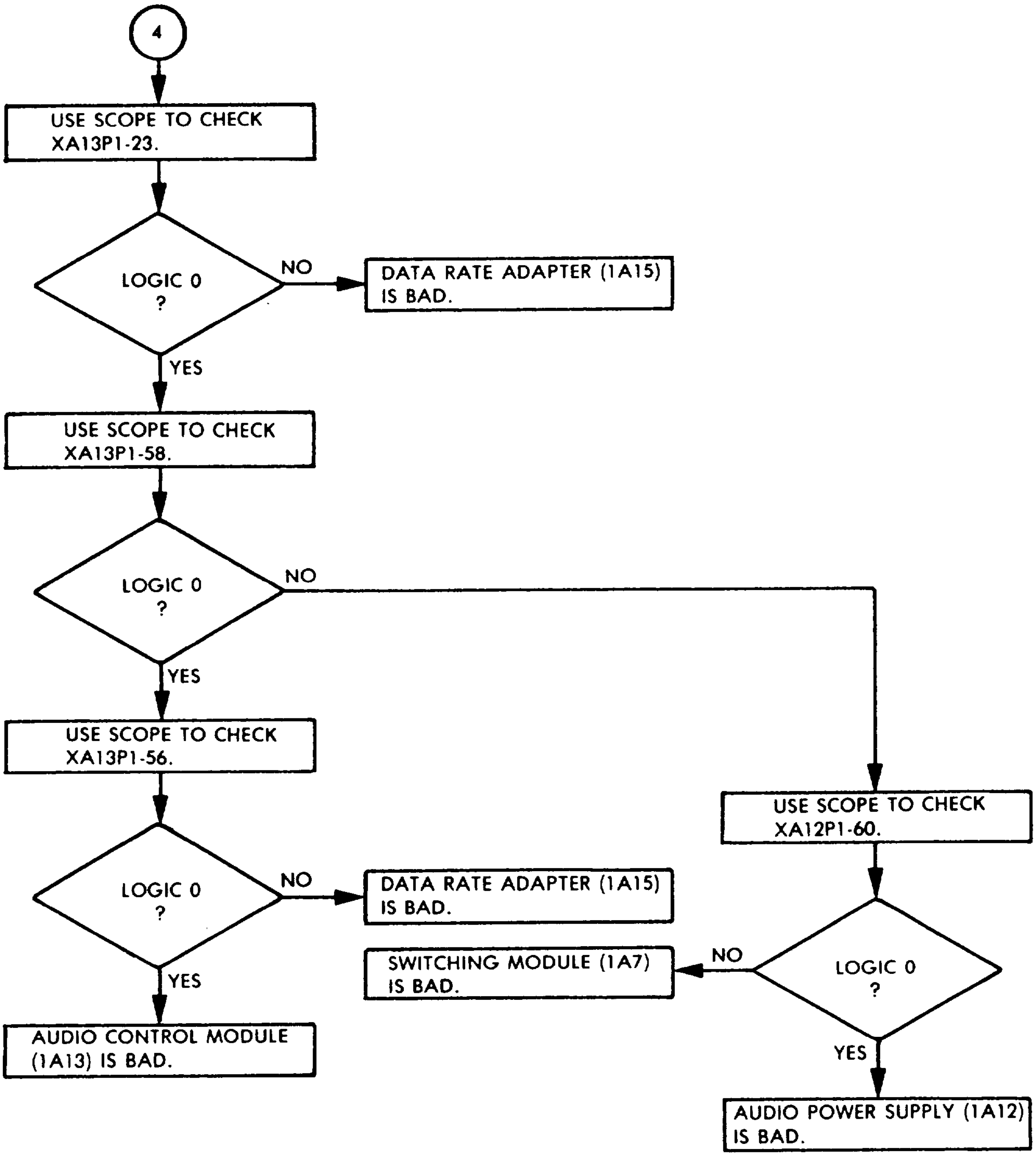


2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 33

Troubleshooting AD2 Transmit Circuits

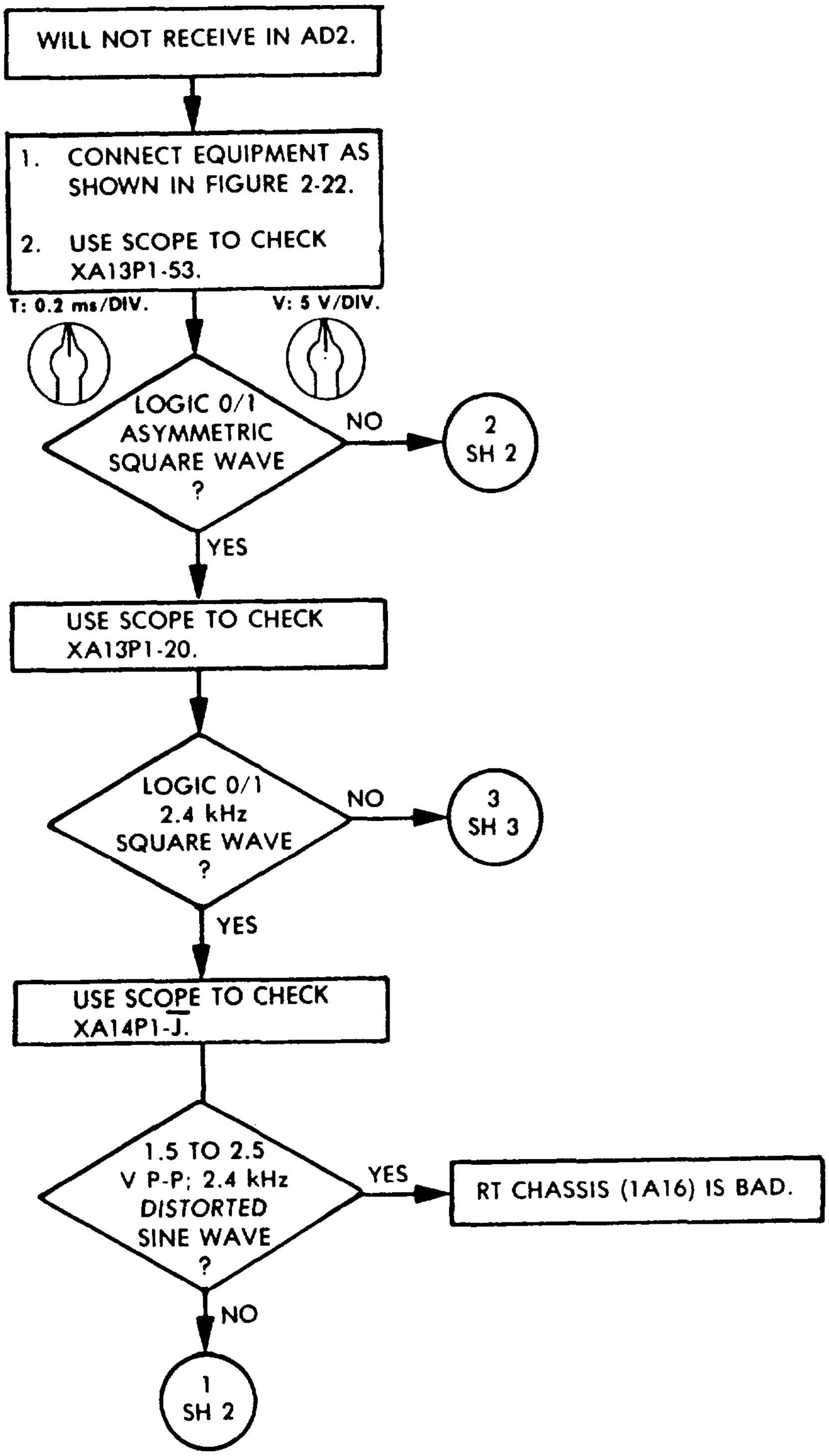
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

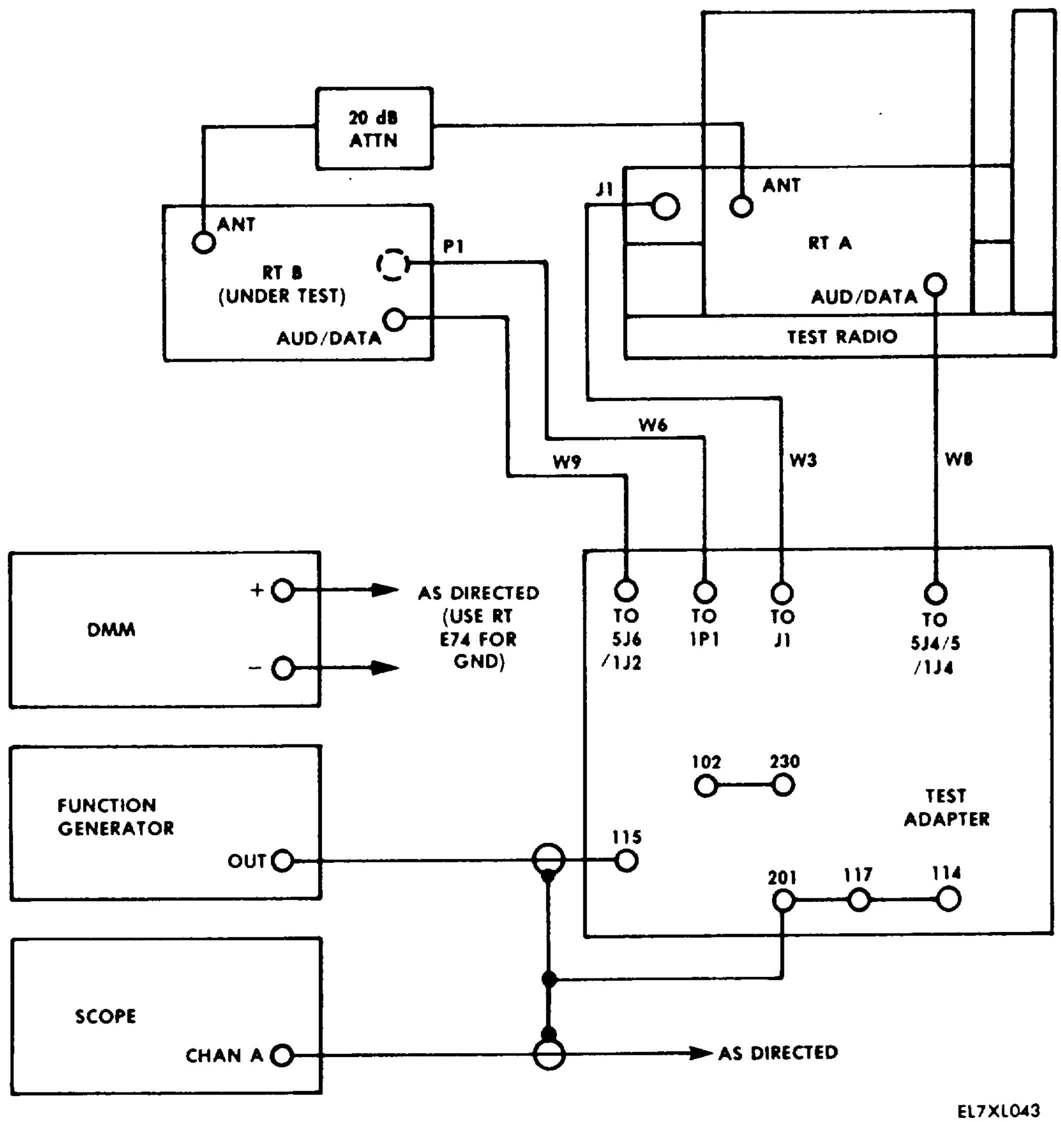
CHART 34

Troubleshooting AD2 Receive Circuits
(Sheet 1 of 3)



NOTES

1. See FO-5 for diagrom of these circuit paths.



EQUIPMENT PRESETS

RT (UNDER TEST)
TOP AND BOTTOM COVERS REMOVED.

RT A AND RT B:
RF: LO
FCTN: SQ ON
MODE: SC
DATA: AD2
CHAN: 1

FUNCTION GENERATOR:
FREQ: 2400 Hz (2390 TO 2410 Hz)
LEVEL: 350 mV P-P (300 TO 400 mV P-P)
FUNCTION: SINE

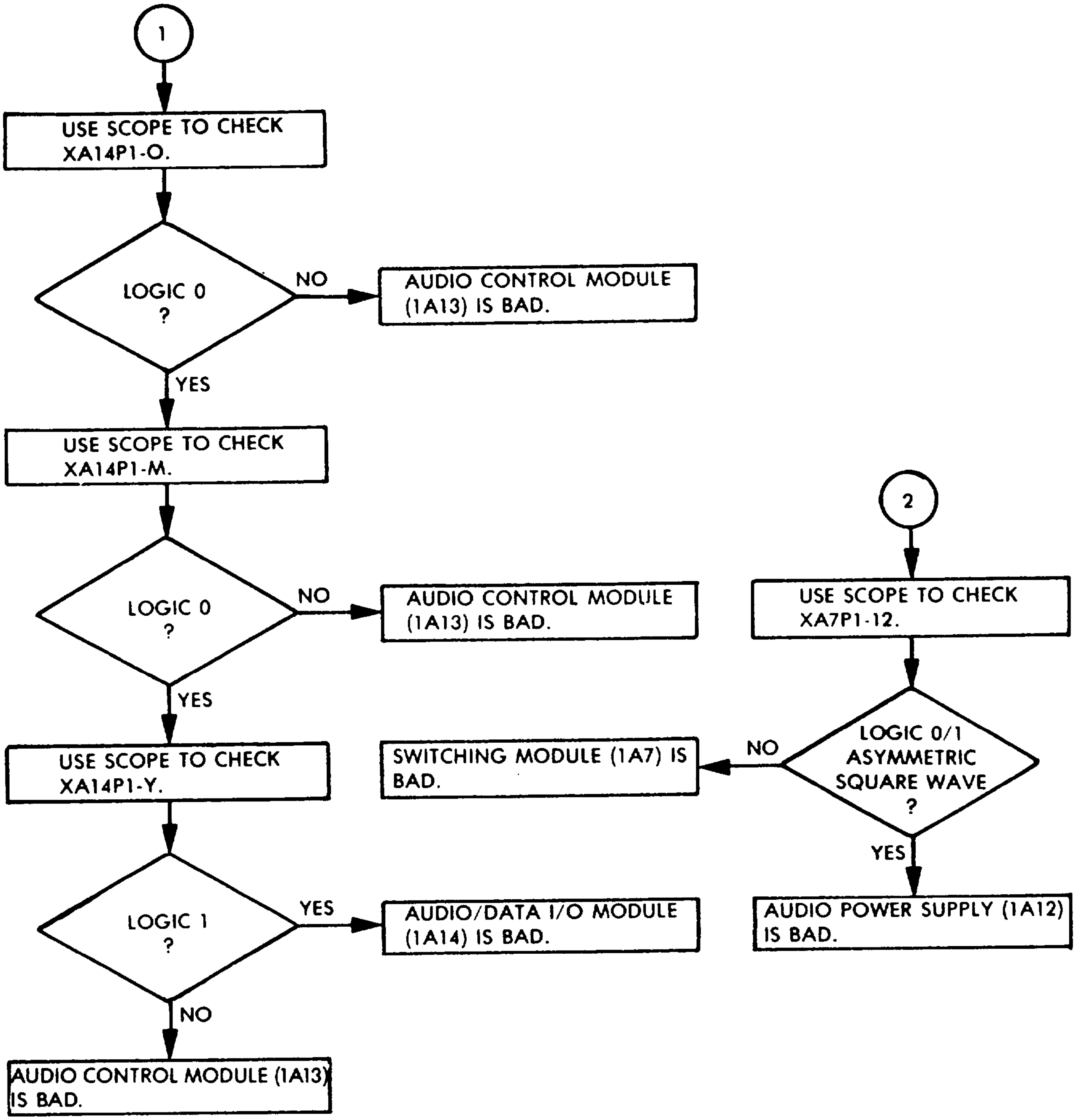
TEST RADIO:
CB1: ON

Figure 2-22. Receive Test Setup (SC, AD2, PT).

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 34

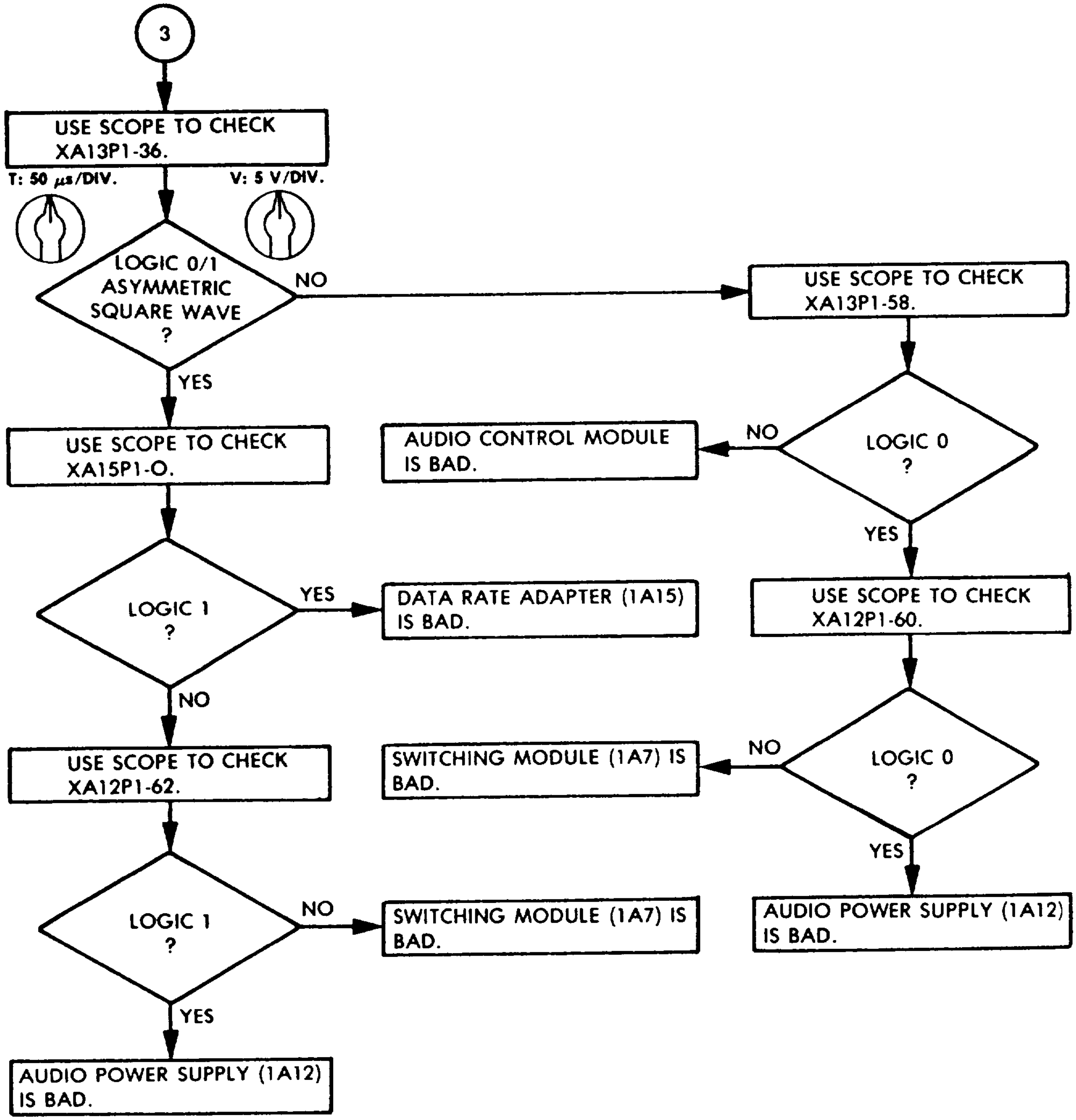
Troubleshooting AD2 Receive Circuits
(Sheet 2 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 34

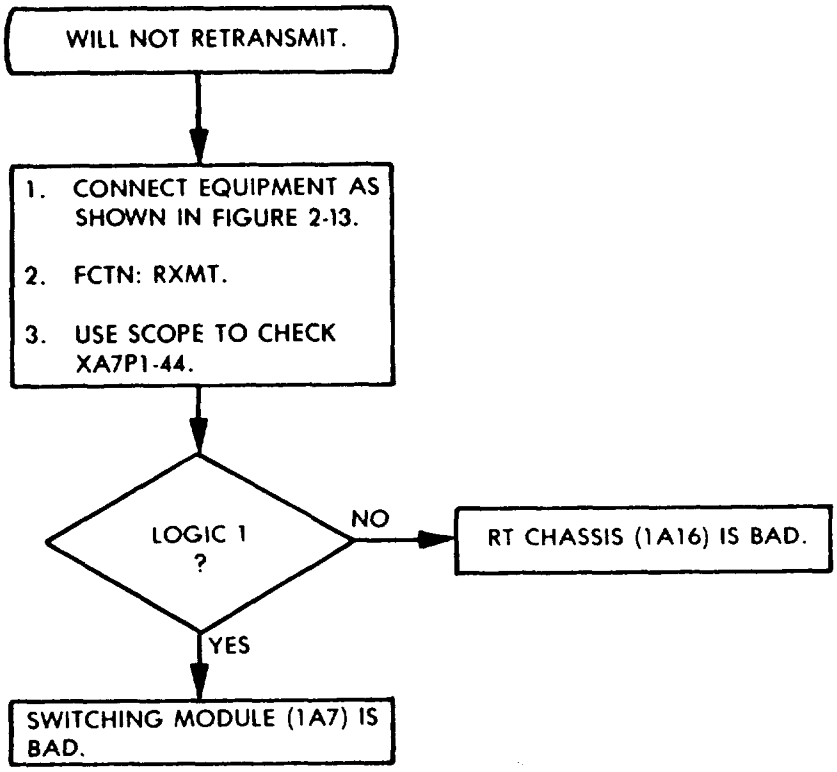
Troubleshooting A02 Receive Circuits
(Sheet 3 of 3)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 35

Troubleshooting Retransmit Circuits
(Sheet 1 of 1)



NOTE

See FO-9 for diagram of these circuit paths.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 36

Troubleshooting Receiver Sensitivity
(Sheet 1 of 2)

RECEIVE SENSITIVITY LOW (−116 dBm).

1. CONNECT EQUIPMENT AS SHOWN IN FIGURE 2-23.
2. DISCONNECT RF CABLE 1W1 FROM EXCITER/POWER AMPLIFIER (1A11).
3. CONNECT SIGNAL GENERATOR TO EXCITER/POWER AMPLIFIER (1A11) WHERE RF CABLE 1W1 WAS REMOVED. READ SCOPE.

14 TO 20 V P-P WAVEFORM 1 SEE NOTE 2. ?

YES: IMPEDANCE MATCHING NETWORK (1A1) IS BAD.

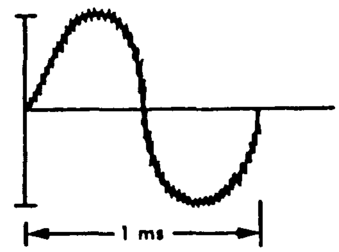
NO:

1. DISCONNECT SIGNAL GENERATOR FROM EXCITER/POWER AMPLIFIER AND RECONNECT RF CABLE 1W1 TO EXCITER/POWER AMPLIFIER (1A11).
2. SIGNAL GENERATOR LEVEL: −117 dBm.
3. DISCONNECT RF CABLE 1W2 FROM TUNER/MIXER (1A9).
4. CONNECT SIGNAL GENERATOR TO TUNER/MIXER (1A9). READ SCOPE.

1 SH 2

NOTES

1. See FO-1 for diagram of these circuit paths.
2. WAVE FORM 1:



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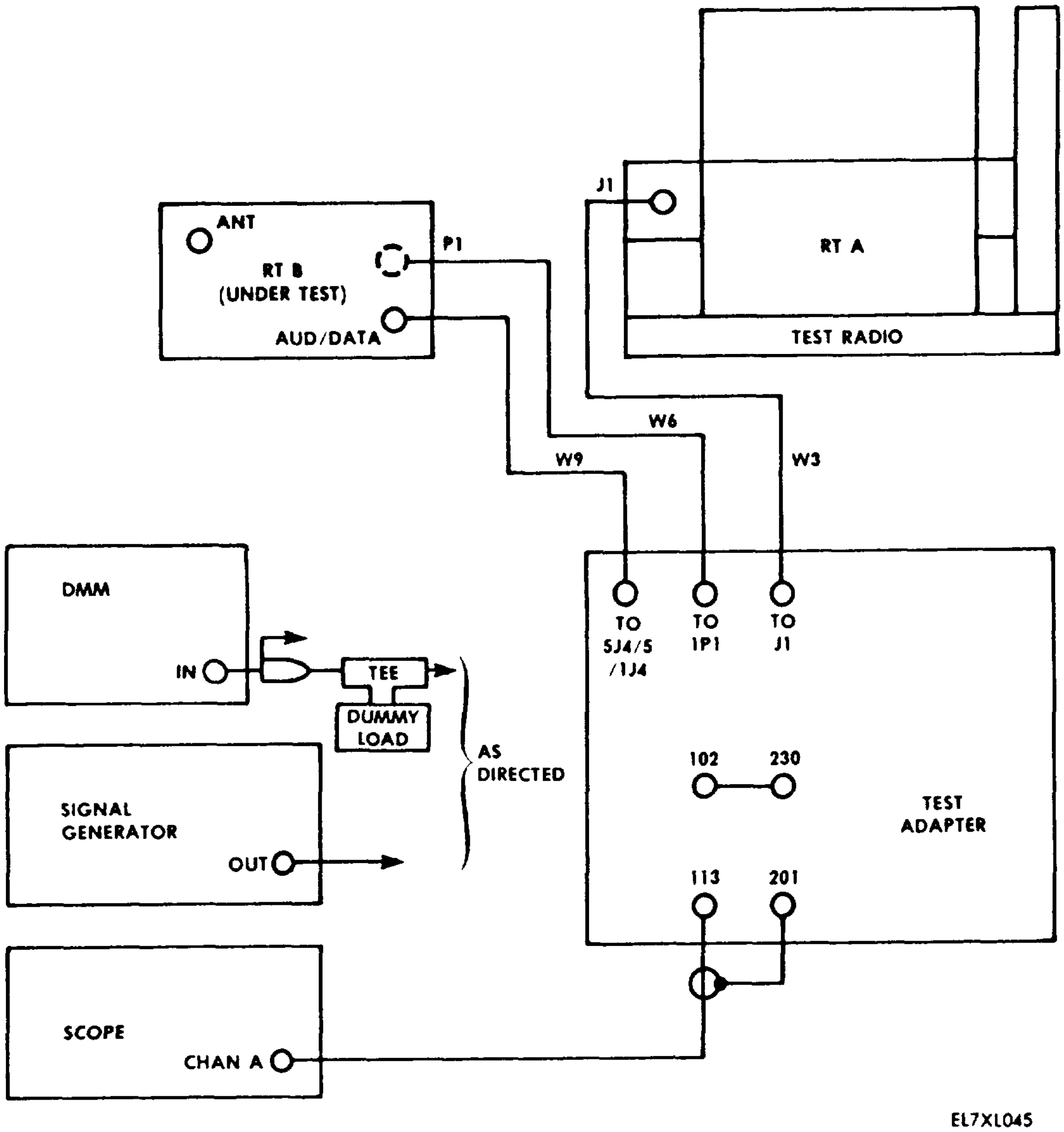


EQUIPMENT PRESETS

RT (UNDER TEST)
TOP AND BOTTOM COVERS REMOVED.

RT B:
RF: LO
FCTN: SQ OFF
MODE: SC
DATA: OFF
CHAN: 1
VOL: FULL CW

SIGNAL GENERATOR:
FREQ: 37.875 MHz (37.8748 TO 37.8752 MHz)
LEVEL: -116 dBm
FM MODE: INT
MOD: 1 kHz AT ±6.5 kHz DEV

TEST RADIO:
CB1: ON
RT A FCTN: OFF

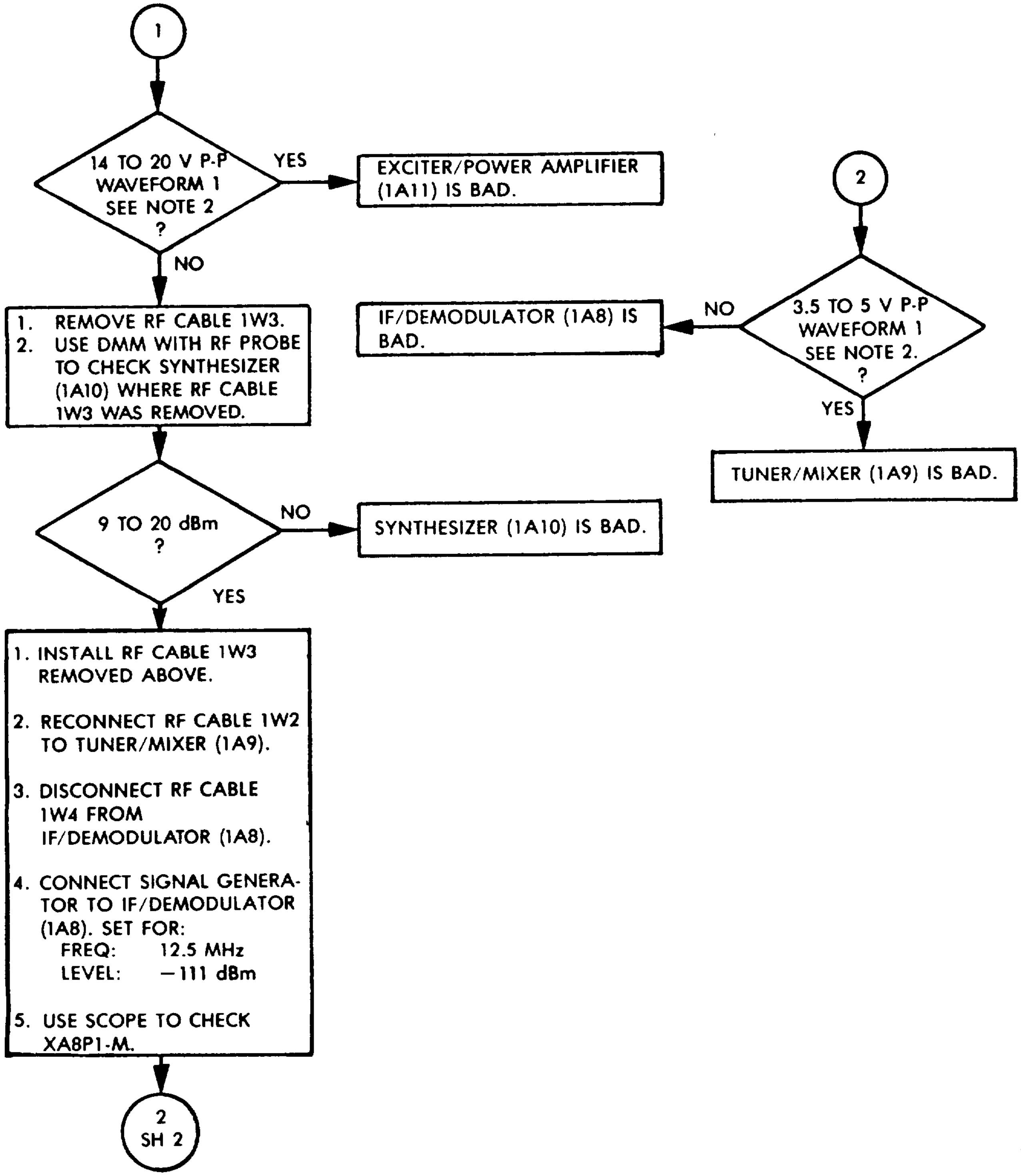
DMM:
FUNCTION: dBm. 50 W ref.

Figure 2-23. Receiver Sensitivity Test Setup.

2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 36

Troubleshooting Receiver Sensitivity
(Sheet 2 of 2)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 37

Troubleshooting Receiver Sensitivity
(Sheet 1 of 2)

RECEIVE SENSITIVITY LOW (−106 dBm).

1. CONNECT EQUIPMENT AS SHOWN IN FIGURE 2-23.
2. SIGNAL GENERATOR LEVEL: −106 dBm.
3. DISCONNECT RF CABLE 1W1 FROM EXCITER/ POWER AMPLIFIER (1A11).
4. CONNECT SIGNAL GENERATOR TO EXCITER/ POWER AMPLIFIER (1A11) WHERE RF CABLE 1W1 WAS REMOVED. READ SCOPE.

14 TO 20 V P-P WAVEFORM 1 SEE NOTE 2. ?

YES: IMPEDANCE MATCHING NETWORK (1A1) IS BAD.

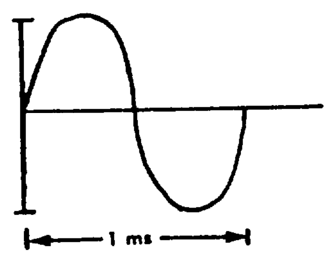
NO:

1. DISCONNECT SIGNAL GENERATOR FROM EXCITER/ POWER AMPLIFIER (1A11) AND RECONNECT RF CABLE 1W1 TO EXCITER/ POWER AMPLIFIER (1A11).
2. SIGNAL GENERATOR LEVEL: −107 dBm.
3. DISCONNECT RF CABLE 1W2 FROM TUNER/MIXER (1A9).
4. CONNECT SIGNAL GENERATOR TO TUNER/MIXER (1A9) WHERE RF CABLE 1W2 WAS REMOVED. READ SCOPE.

1 SH 2

NOTES

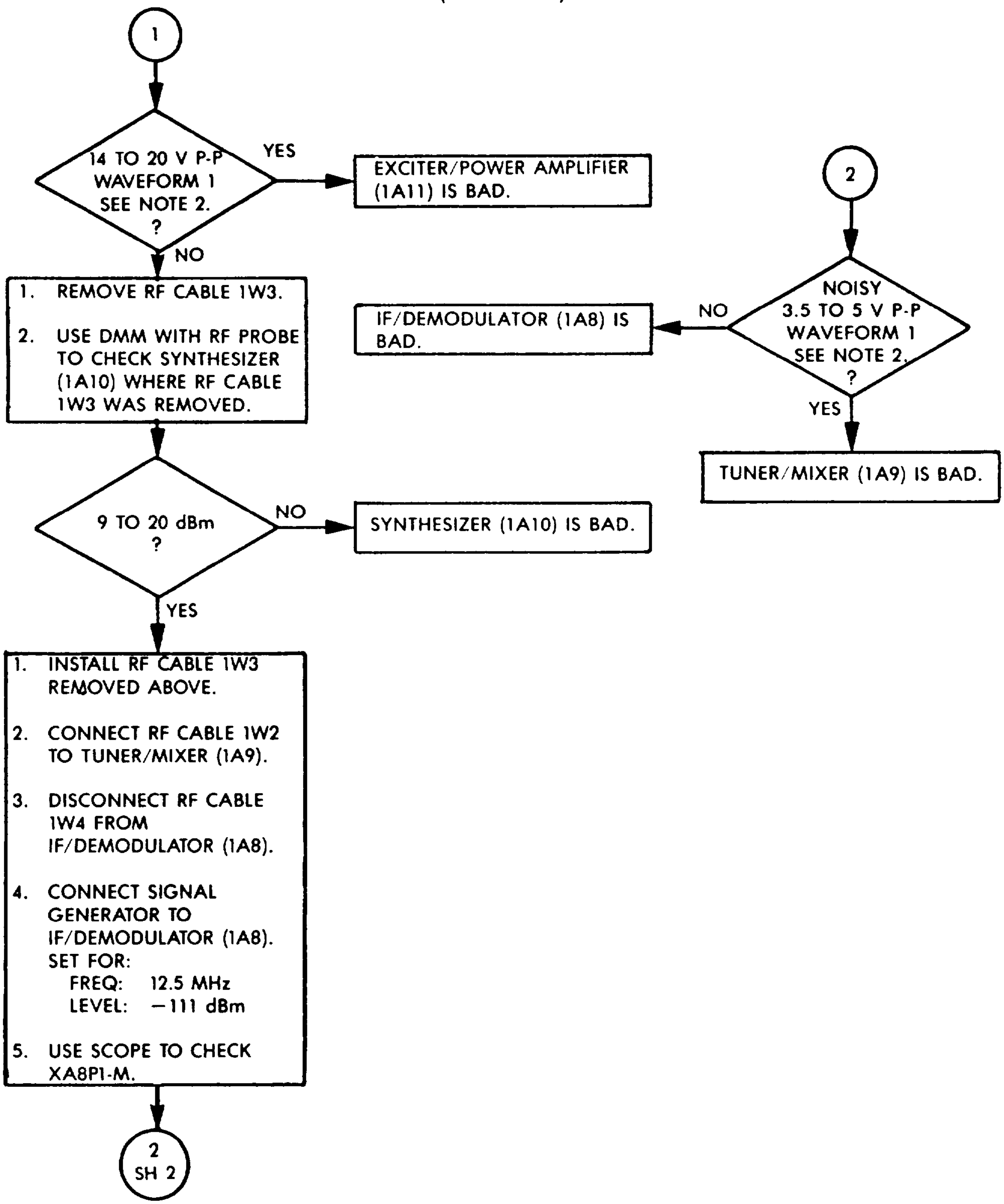
1. See FO-1 for diagram of these circuit paths.
2. WAVE FORM 1:



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 37

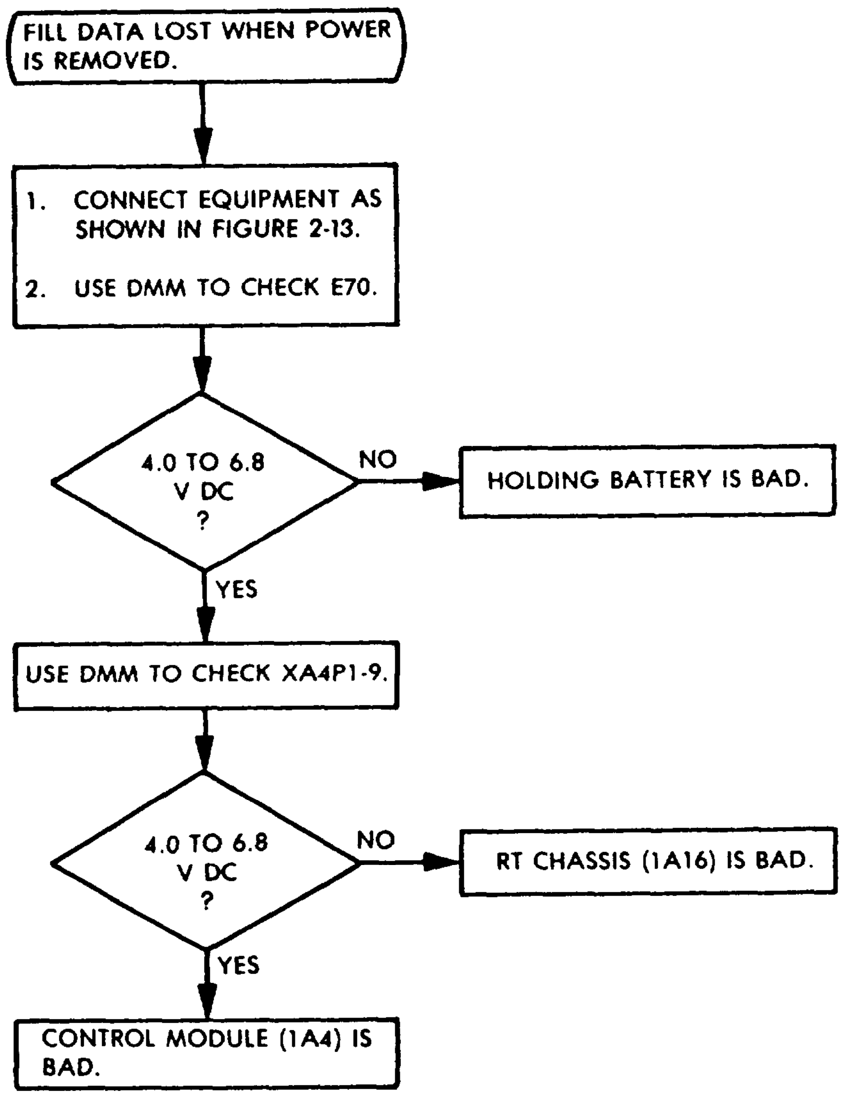
Troubleshooting Receiver Sensitivity Circuitry
(Sheet 2 of 2)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 38

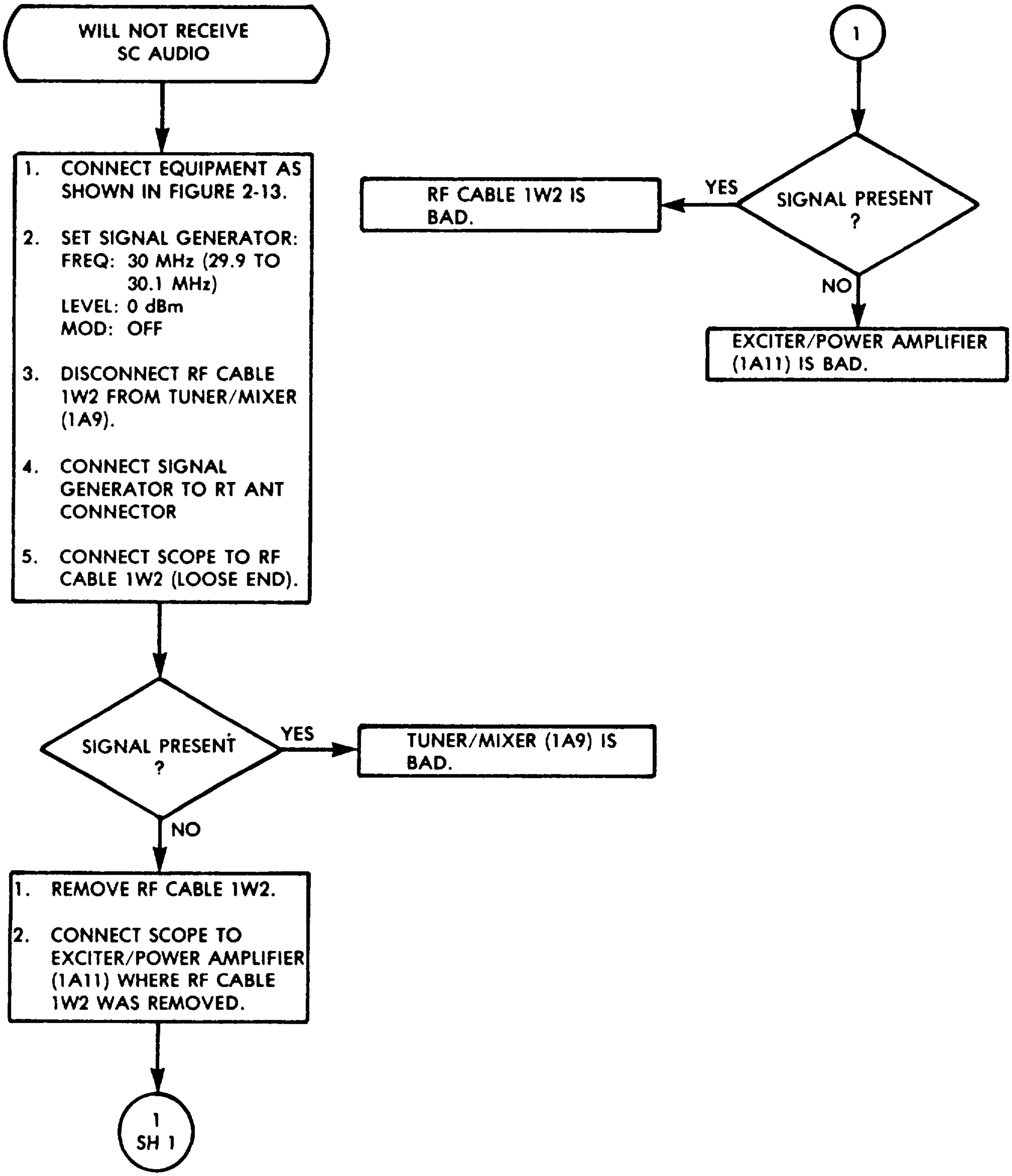
Troubleshooting Holding Battery Circuitry
(Sheet 1 of 1)



2-31. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 39

Troubleshooting Receive SC Path
(Sheet 1 of 1)



Section IV. MAINTENANCE PROCEDURES

2-32. GENERAL.

This section includes the operational check and the repair procedures. The operational check is used to verify the operation of a repaired rt. It is also used to verify the symptom of a faulty It. It will identify the troubleshooting chart to be used. When a bad module is identified, replace it using the procedure in this section.

2-33. OPERATIONAL CHECK.

The operational check provides a step-by-step procedure for evaluating an rt. if the operational check is passed, the rt can be returned to service. If it does not, the bad module or the troubleshooting chart to be used will be identified. The troubleshooting procedures ore in section III.

The operational check is divided into steps. Each step verifies a particular function. Follow the instruction in the "Action" column. Check the response. If the response is correct, proceed with the next lettered step. When a STEP has been completed, proceed with the next STEP. A "no response" in the "Response" column means that any response is not of interest. If the pre-troubleshooting check has already been performed, STEPS 1,2, and 3 may be skipped.

The switch settings for the test equipment are given in the "EQUIPMENT PRESETS" section of each test setup figure. Set the test equipment switches to the indicated presets and then verify the settings. If o test response is incorrect, check the equipment settings and the test adapter cabling before going to a troubleshooting chart or replacing a bad module.

Some test setups may get complicated because of the number of cables connected to the test adapter. The following suggestions can help improve the speed and accuracy of test setups.

a. Label each cable with the name and section of the piece of test equipment with which it is connected.

b. Unify the ground of each test cable and move only the positive leads of each cable.

c. Examine the next test setup before changing any cabling. Some test setups may need only a few changes from the previous one.

2-33. OPERATIONAL CHECK. Continued

WARNING

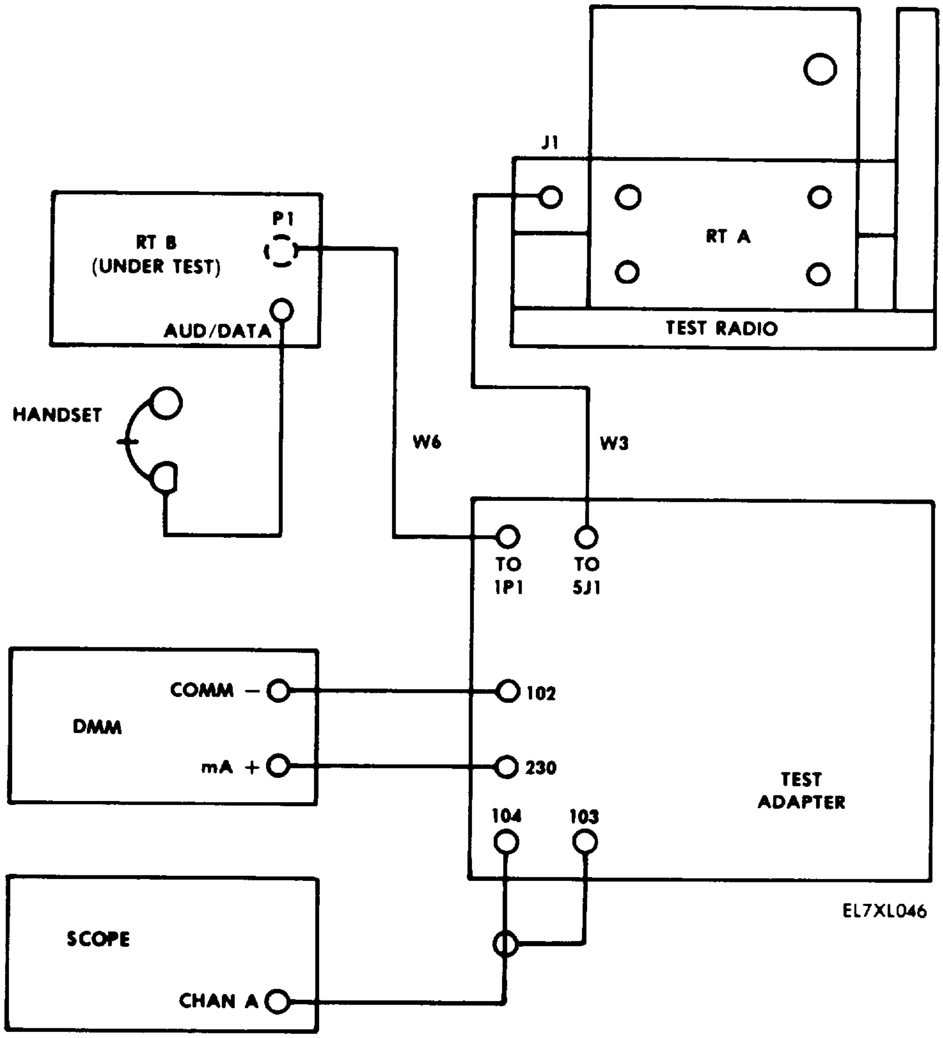
Connect the test setups only when directed, and with the power supply set to OFF. The large current capacity of the test power supply can cause personal injury. Verify the test setup before turning the power supply on.

CAUTION

During the operational check the rt top cover is removed and a module must also be removed. Whenever either cover is removed, take all proper electrostatic discharge (ESD) precautions. Static electricity can damage the rt modules.

Step 1. CURRENT CHECK

Action	Response
a. Connect equipment as shown in figure 2-24.	a. No response.
b. Rt B FCTN: Z-A	b. Responses: (1) Multimeter reading is greater than 0 A but not greater than 800 mA when rt display is on. (2) Rt displays "Good" for 7 seconds. (3) Multimeter reading is not greater than 350 mA when rt display is blank. IF: — THEN: Current 0 or high with display on — Chart 1 "Good" not displayed correctly — Chart 2 Current high with display blank — Chart 3
c. Set rt FCTN switch to LD-V then Z-A. Check operation of DIM control.	c. Ccw dims and cw brightens display. If not, replace rt chassis (1A16).



EQUIPMENT PRESETS

RT B:
FCTN: STW
DATA: OFF
MODE: SC
CHAN: MAN
DIM: FULL CW
VOL: MID-RANGE
REMOVE TOP COVER AND PULL THE
TRANSEC INTERLOCK SWITCH OUT

TEST RADIO:
CB1: ON
RT A FCTN: OFF

DMM:
2000 mA SCALE

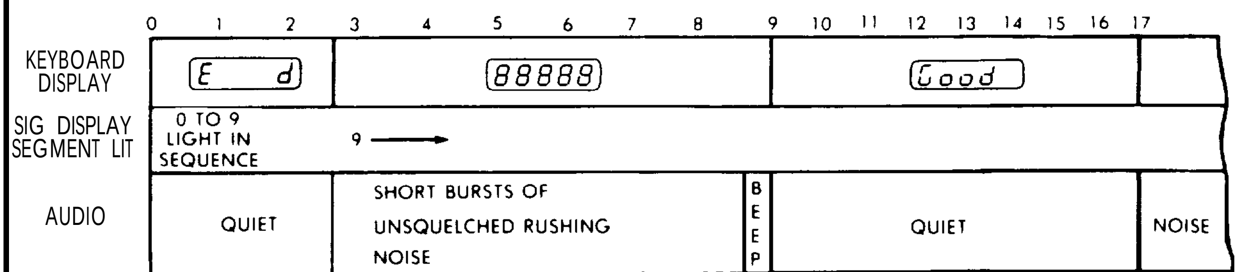
Figure 2-24. Current Check, Self-Test, and SC Load Check Test Setup.

2-33. OPERATIONAL CHECK. Continued

Step 2. SELF-TEST

Action	Response
NOTE Test setup should be as shown in figure 2-24. a. Rt FCTN: TST	a. Responses:

TIME AFTER FCTN SWITCH SET TO TEST (SECONDS)



* TIME APPROXIMATE

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Action	Response
	IF: / THEN: Any SIG display segment does not light — Rt chassis (1A16) is bad No “E d” display — Chart 4 Any keyboard display segment does not light — Rt chassis (1A16) is bad No “rushing noise” — Chart 5 Audio not correct, or no “Good” display. — Chart 6 No “BEEP” — Chart 7
b. Rt FCTN: REM.	b. SIG display lights segments 9 through 0 in sequence, then goes blank. If not, rt chassis (1A16) is bad. Scope scan A displays bursts of a greater than 1.5 V p-p , 2870 to 2890 Hz sine wave. If not, go to chart 9.
c. Press and hold rt CALL/BATT button and handset PTT switch.	c. “CALL” displayed on rt. If not, go to chart 9. NOTE If rt is being checked for a remote operations fault and has passed step 2, repeat instructions a through c 7 or 8 times.

2-33. OPERATIONAL CHECK. Continued

Step 3. SC LOAD CHECK

Action	Response
NOTE Test setup should be as shown in figure 2-24.	
a, Rt: RF: LO MODE: SC FCTN: LD CHAN: 1 DATA: OFF	a. No response.
b. Press rt FREQ button.	b. "00000" displayed on rt. If not, go to chart 10.
c. Press rt CLR button.	c " _ _ _ _ _" displayed on rt. If not, go to chart 11.
d. Press 3, 7, 8, 7, 5 buttons.	d. Display responds correctly. If not, go to chart 11.
e. Press rt Sto/ENT button.	e. Display blinks then displays "37875." If not, go to chart 11.
f. Load the following frequencies into the channels indicated:	f. Frequencies load correctly. If not, go to chart 12.

CHAN	FREQUENCY (kHz)
2	42975
3	43375
4	49075
5	56200
6	68775
CUE	87975

2-33. OPERATIONAL CHECK. Continued

Step 4. OFFSET LOAD CHECK

Action	Response
NOTE Test setup should be OS shown in figure 2-24.	
a. Rt CHAN: 1.	a. No response.
b. Load +5 kHz offset into CHAN 1.	b. "37880" displayed on rt. If not, go to chart 11.
c. Load -10 kHz offset into CHAN 1.	c. "37865" displayed on rt. If not, go to chart 11.
d. Clear offset in CHAN 1.	d. "37875" displayed on rt. If not, go to chart 11.

Step 5. FH LOAD CHECK

Action	Response
NOTE Test setup should be as shown in figure 2-24.	**NOTE** During this step load the same variables as are loaded into the test radio.
a. Rt A and B: RF: LO MODE: SC FCTN: LD CHAN: MAN DATA: OFF	a. No response.
b. Load time-of-day into rt A and rt B. Use 15 days, 1200 hours. Check after loading. They must be within 4 seconds of each other.	b. Time-of-day loads correctly. If not, go to chart 11.
c. Connect ECCM fill device to rt B AUD/FILL connector.	c. No response.
d. Rt B: MODE: FH FCTN: LD-V	d. "FILLt" displayed on rt. Tone present in handset.
e. ECCM fill device: Function: ON Select: T1	e. No response.

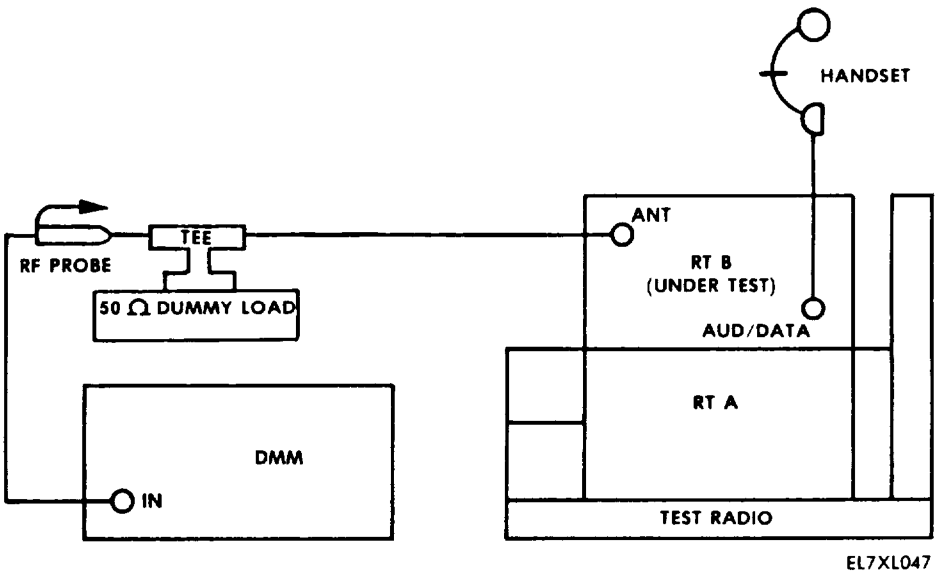
2-33. OPERATIONAL CHECK. Continued

Step 5. FH LOAD CHECK Continued

Action	Response
f. Press H•Ld/0 button.	f. "LOAd" then "St0 t" displayed on rt. Disregard odditional displays. If not, go to chart 13.
g. Set ECCM fill device select switch to lockout set position.	g. No response.
h. Rt FCTN: LD.	h. No response.
i. Press H•Ld/0 button.	i. "LOAD" then 'HLnnn" displayed on rt. If not, go to chart 14.
i. Press Sto/ENT button.	i. "Sto^{L}n" displayed on rt. If not, go to chart 11.
k. Set ECCM fill device select switch to hopset position.	k. No response.
l, Press buttons: H•Ld/0 Sto/ENT 2	l. "LOAd", "HFnnn", "Sto _" and "Sto 2" displayed on rt. If not, ECCM module (1A5) is bad.
m. ECCM fill device: FCTN: OFF Remove from rt.	m. No response.

Step 6. RF OUTPUT CHECK

Action	Response
a. Connect equipment as shown in figure 2-25.	a. No response.
b. Press and hold handset PTT switch. Set CHAN switch to each position.	b. DMM reading is 35 to 39 dBm for all channels. If not, go to chart 15.
C. Press handset PTT switch.	C. SIG display reading is 5, 6, or 7. If not, go to chart 16.
d. Rt B RF: M.	d. No response.
e. Press handset PTT switch.	e. DMM'reading is 20 to 24 dBm. If not, go to chart 17.
f. Press handset PTT switch.	f. SIG display reading is 2, 3, or 4. If not, rt chassis (1A16) is bad.



EQUIPMENT PRESETS

RT B:
- MODE: SC
- FCTN: SQ ON
- RF: HI
- DATA: OFF
- CHAN: MAN (WITH ALL TEST FREQUENCIES LOADED)

TEST RADIO:
- CB1: ON
- RT A FCTN: OFF

DMM:
- FUNCTION: dBm, 50 Ω ref.

Figure 2-25. RF Power Output Test Setup.

2-33. OPERATIONAL CHECK. Continued

Step 6. RF OUTPUT CHECK Continued

Action	Response
f. Press handset PTT switch.	f. SIG display reading is 2, 3, or 4. If not, rt chassis (1A16) is bad.
g. Rt B RF: LO.	g. No response.
h. Press handset PTT switch.	h. DMM reading is -7 to + 1 dBm. If not, go to chart 18.
i. Press handset PTT switch.	i. SIG display reading is 0 or 1. If not, rt chassis (1A16) is bad.
i. Disconnect rf probe from dummy load. Connect rf cable from dummy load to frequency counter. Press and hold handset PTT switch. Set CHAN switch to each position.	j Frequency counter reads: CHAN. FREQUENCY (MHZ) : MAN 29.999850 to 30,000150 1 37.874800 to 37.875200 2 42.974800 to 42.975200 3 43.374800 to 43.375200 4 49.074750 to 49.075250 5 56.199700 to 56.200300 6 68.774650 to 68.775350 CUE 87.974550 to 87.975450 If any channel is incorrect, go to chart 15 at 1.
k. Rt B RF: HI.	k. No response.

Step 7. SIDETONE CHECK

Action	Response
NOTE Test setup should be as shown in figure 2-25.	
a. Disconnect rf cable from dummy load.	a. No response.
b. Press handset PTT switch and check for sidetone.	b. Sidetone should not be present. If it is, go to chart 19.
c. Reconnect rf cable to dummy load.	c. No response.
d. Press handset PTT switch and check for sidetone.	d. Sidetone should be present. If not, go to chart 20.

2-33. OPERATIONAL CHECK. Continued

Step 8. SQUELCH CHECK

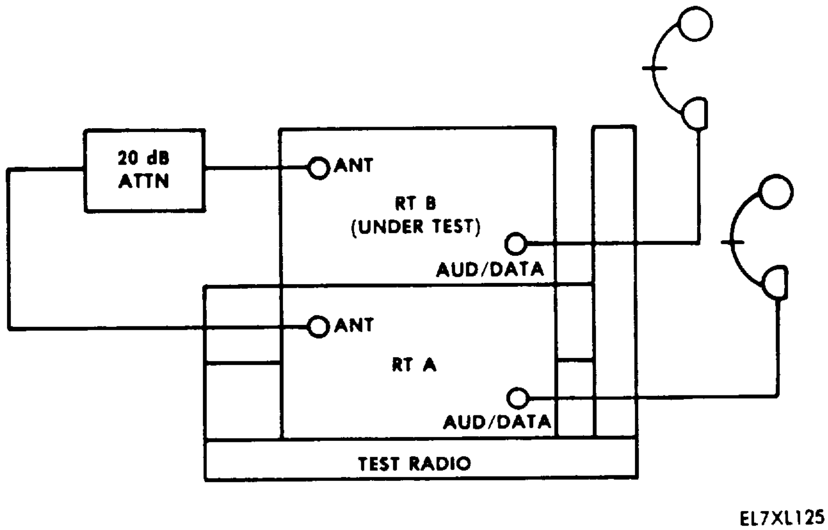
Action	Response
NOTE Test setup should be as shown in figure 2-25.	
a. Rt B FCTN: SQ OFF. Listen to handset.	a. Rushing noise present in handset. If not, go to chart 21.
b. Turn VOL control.	b. Volume in handset varies, if not go to chart 8.
c. RT B FCTN: SQ ON. Listen to handset.	c. Rushing noise not present in handset. If it is present, go to chart 22.

Step 9. TRANSMIT/RECEIVE SC AND FH AUDIO CHECK

Action	Response
a. Connect equipment as shown in figure 2-26.	a. No response.
b. Rt B: Press handset PTT switch and speak into handset.	b. Message is heard in rt A handset. If not, go to chart 23.
c. Set rt A and rt B CHAN switches to each position. A and B must be the some. Repeat step b for each channel.	c. Message is heard in rt A handset for each channel. If not, exciter/power amplifier (1A11) is bad.
d. Rt A: Press handset PTT switch and speak into handset.	d. Message is heard in rt B handset. If not, go to chart 39.
e. Rt A and B: MODE: FH CHAN: 2	e. No response.
f. Rt A: Press handset PTT switch and speak into handset.	f. Message is heard in rt B handset. If not, go to chart 32.
g. Rt B: Press handset PTT switch and speak into handset.	d. Message is heard in rt A handset. If not, go to chart 32.

Step 10. TRANSMIT CHECK (SC, AUDIO, CIPHER TEXT)

Action	Response
a. Connect equipment as shown in figure 2-27.	



EQUIPMENT PRESETS

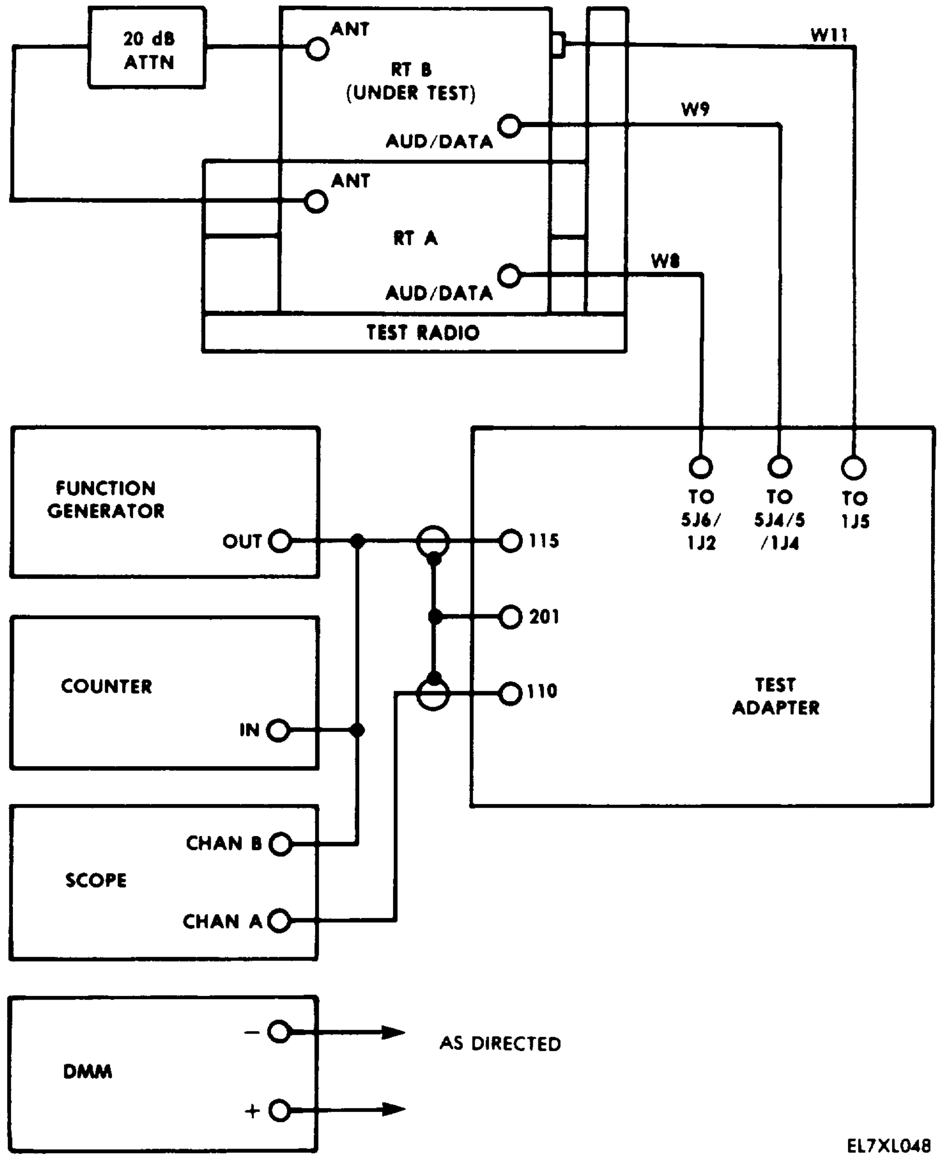
RT A AND B:

MODE: SC
FCTN: SQ ON
RF: LO
DATA: OFF
CHAN: MAN

TEST RADIO:

CB1: ON

Figure 2-26. Transmit/Receive SC and FH Audio Check lost Setup.



EQUIPMENT PRESETS

RT A AND RT B:
- RF: LO
- FCTN: SQ ON
- CHAN: MAN
- MODE: SC
- DATA: OFF
- VOL: FULL CW

FUNCTION GENERATOR:
- FREQ: 1000 Hz (900 TO 1100 Hz)
- LEVEL: 120 mV P-P (100 TO 140 mV P-P)
- FUNCTION: SINE

TEST RADIO:
- CB1: ON

Figure 2-27. Transmit Test Setup.

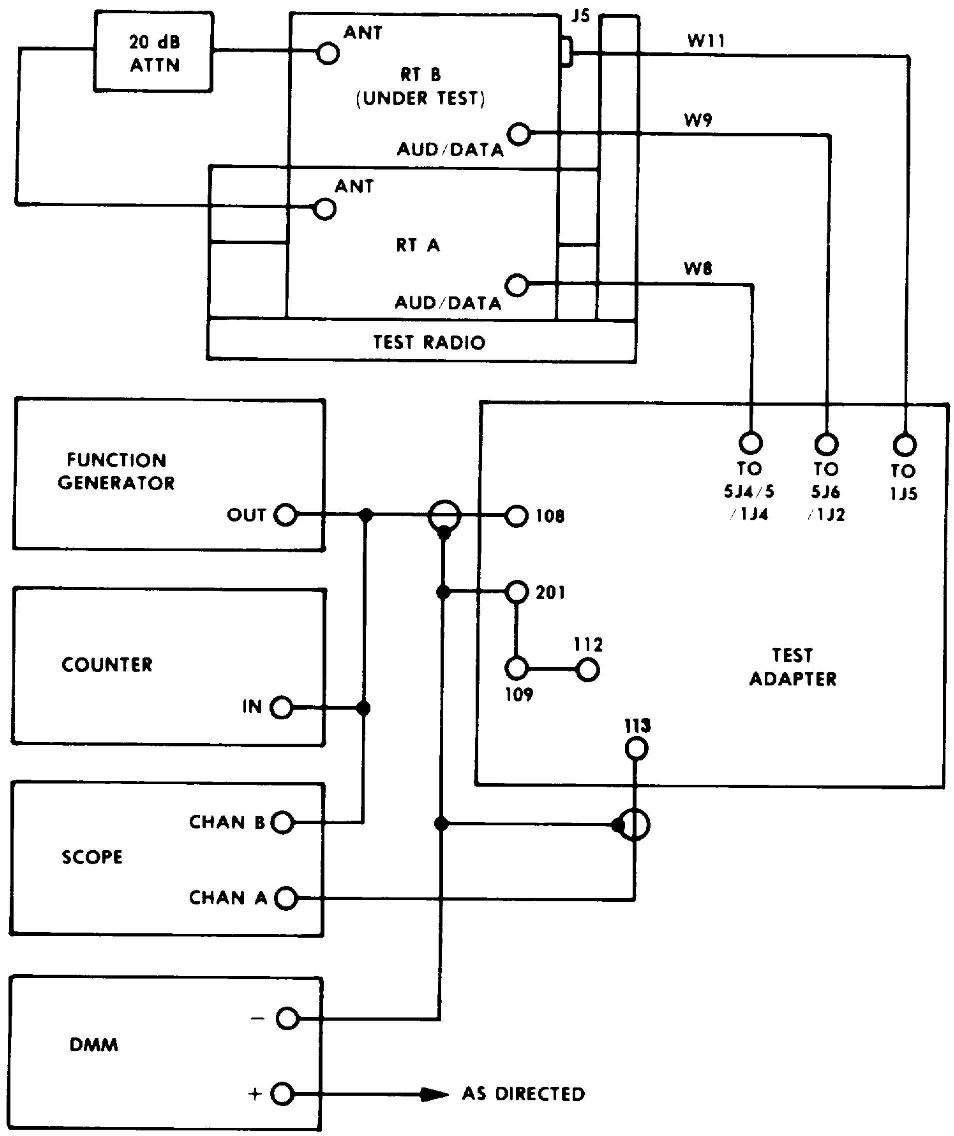
2-33. OPERATIONAL CHECK. Continued

Step 10. TRANSMIT CHECK (SC, AUDIO, CIPHER TEXT) Continued

Action	Response
b. Connect jumper cable from TP201 to TP114.	b. Scope than A displays 1.5 to 2.5 V p-p, 900 to 1100 Hz sine wave. If not, go to chart 24.
c. Connect jumper cable from TP112 to TP201. Move scope than A probe to TP224.	c. No signal present on scope than A. If signal present, go to chart 25.
d. Remove jumper cable from TP201 and TP114.	d. No response.
e. Set DMM to measure resistance. Connect probes to TP111 (+) and TP201 (-).	e. DMM reading is 4.4 to 5.4 MΩ If not, audio control module (1A13) is bad.
f. Move DMM (+) probe to TP233.	f. DMM reading is 4.4 to 5.4 MΩ. If not, audio control module (1A13) is bad.
g. Move DMM (+) probe to TP106.	g. DMM reading is ∞ W. If not, audio control module (1A13) is bad.
h. Connect jumper cable from TP114 to TP201.	h. DMM reading is less than 200 Ω If not, audio control module (1A13) is bad.
i. Connect equipment as shown in figure 2-28.	i. Scope than A displays 200 to 400 mV wave form. Single trace is sine wave. Total wave form is modulated. If not, switching module (1A7) is bad.

Step 11. RECEIVE CHECK (SC, AUDIO, CT)

Action	Response
a. Connect equipment as shown in figure 2-29.	a. Scope than A displays 4.5 to 6.5 V p-p, 900 to 1100 Hz sine wave + the 150 Hz squelch tone. If not, switching module (1A7) is bad.
b. Connect equipment as shown in figure 2-30.	b. Scope than A displays 4 to 6 V p-p, 900 to 1100 Hz sine wave. Same of the 150-Hz squelch tone may be present. If not, go to chart 26.



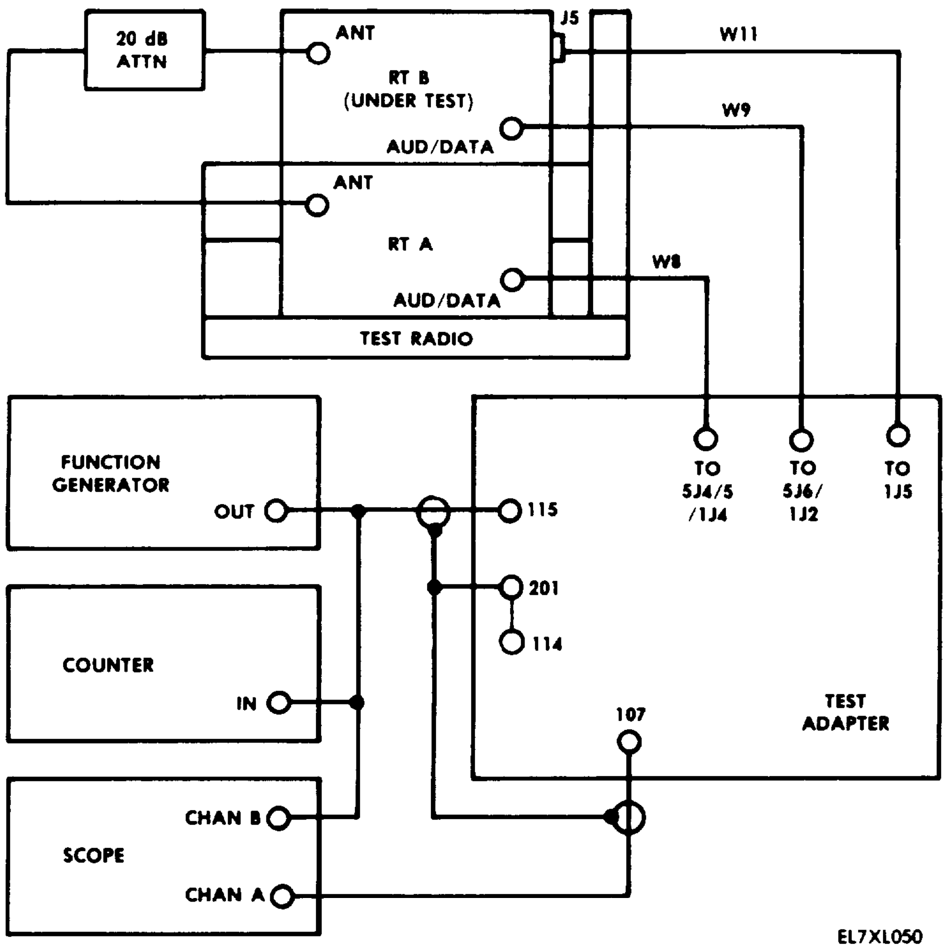
EQUIPMENT PRESETS

RT A AND RT B:
- RF: LO
- FCTN: SQ ON
- MODE: SC
- DATA: OFF
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 8000 Hz (7990 TO 8010 Hz)
- LEVEL: 10 V P-P (9.5 TO 10.5 V P-P)
- FUNCTION: SQUARE

TEST RADIO:
- CB1: ON

Figure 2-28. Transmit Test Setup (SC, AUDIO, CT).



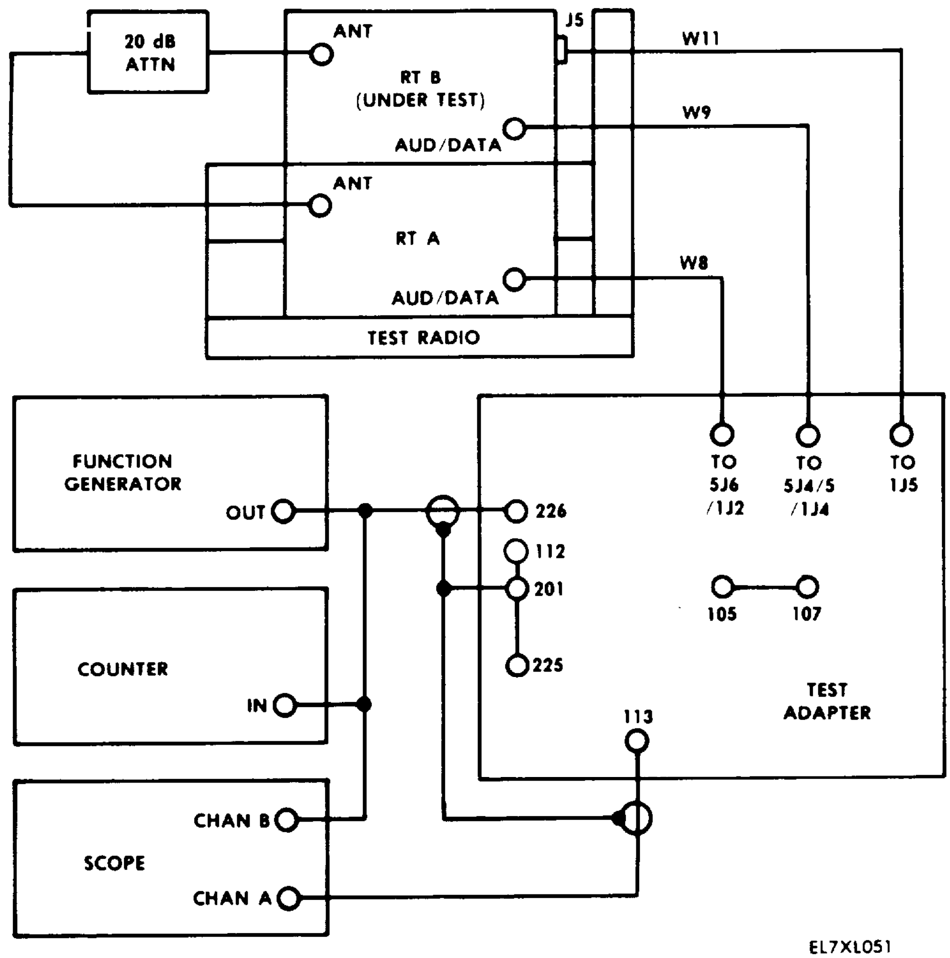
EQUIPMENT PRESETS

RT A AND RT B:
- RF: LO
- FCTN: SQ ON
- MODE: SC
- DATA: OFF
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 1000 Hz (900 TO 1100 Hz)
- LEVEL: 120 mV P-P (100 TO 140 mV)
- FUNCTION: SINE

TEST RADIO:
- CB1: ON

Figure 2-29. Receive Test Setup (SC, AUDIO, CT).



EQUIPMENT PRESETS

RT A AND RT B:
RF: LO
FCTN: SQ ON
MODE: SC
DATA OFF
CHAN: 1

FUNCTION GENERATOR:
FREQ: 1000 Hz (900 TO 1100 Hz)
LEVEL: 120 mV P-P (100 TO 140 mV P-P)
FUNCTION: SINE

TEST RADIO:
CB1: ON

Figure 2-30. Receive Test Setup (SC, AUDIO, CT).

2-33. OPERATIONAL CHECK. Continued

Step 12. TRANSMIT CHECK (SC, 4.8K DATA)

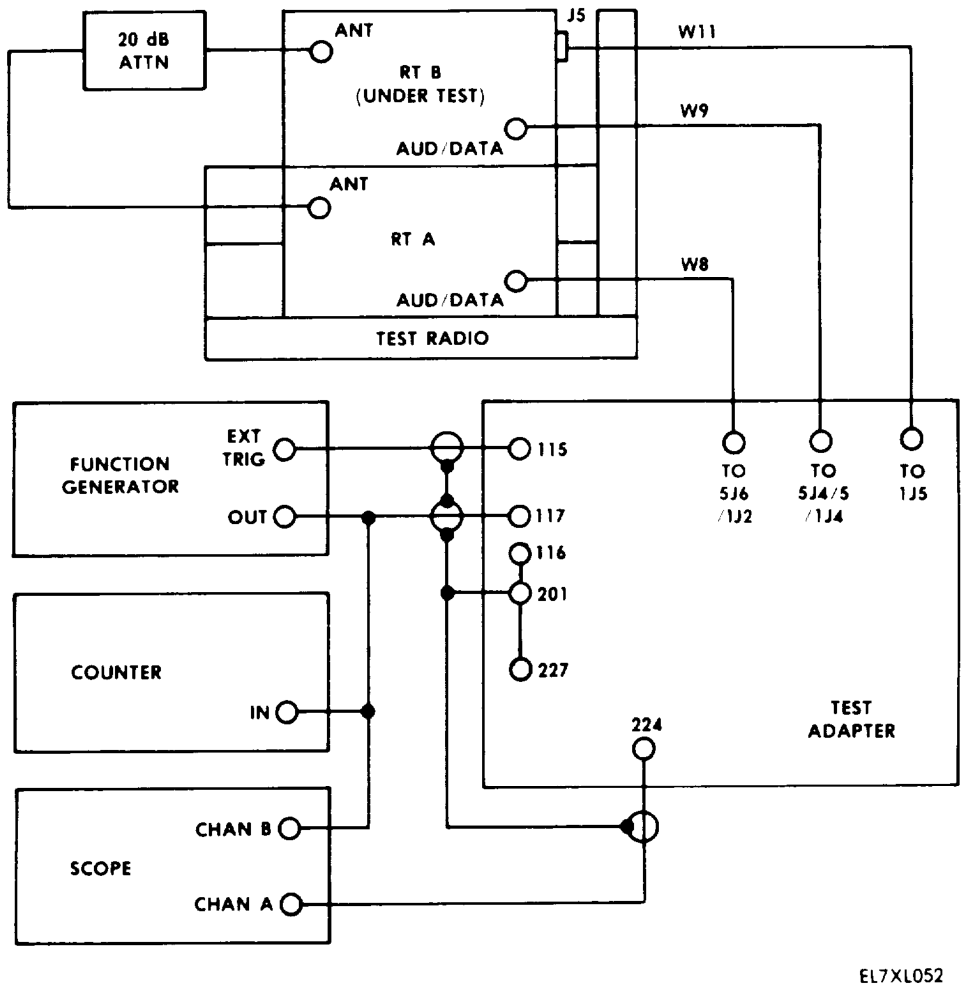
Action	Response
a. Connect equipment as shown in figure 2-31.	a. No response.
b. Connect a jumper cable from TP114 to to TP201.	b. Scope chan A displays 9 to 11 V p-p, 2390 to 2410 Hz square wove. If not, go to chart 27.
c. Remove jumper from TP114 and TP201.	c. No response.

Step 13. TRANSMIT CHECK (SC, 4.8K DATA, CT)

Action	Response
a. Connect equipment as shown in figure 2-32.	a. No response.
b. Connect jumper cable from TP114 to TP201.	b. Scope than A displays 9 to 11 V p-p, 2390 to 2410 Hz asymmetric square wave. If not, go to chart 28.
c. Remove jumper cable from TP114 to TP201.	c. No response.

Step 14. RECEIVE CHECK (SC, 4.8K DATA)

Action	Response
a. Connect equipment as shown in figure 2-33.	a. No response.
b. Connect jumper cable from TP114 to TP201.	b. Scope than A displays 9 to 11 V p-p, 2390 to 2410 Hz square wave. If not, go to chart 29.
c. Move scope than A probe from TP224 to TP226.	c. Scope chan A displays 9 to 11 V p-p, 4790 to 4810 Hz square wave. If not, go to chart 30.
d. Remove jumper cable from TP114 to TP201.	d. No response.



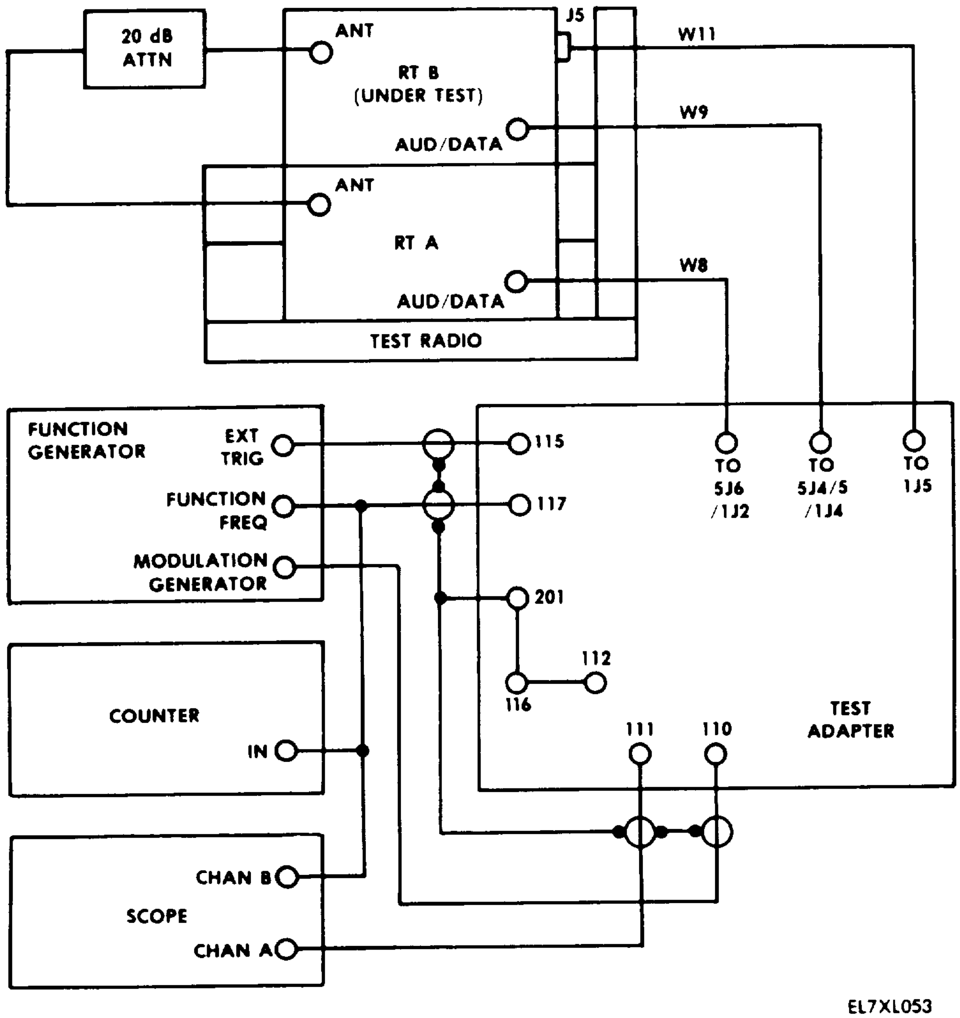
EQUIPMENT PRESETS

RT A AND RT B:
- RF: LO
- FCTN: SQ ON
- MODE: SC
- DATA 4.8K
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 2400 Hz (2390 TO 2410 Hz)
- LEVEL: 10 V P-P (9.5 TO 10.5 Hz)
- FUNCTION: SQUARE
- TRIGGER: EXT TRIG
- TRIG LEVEL: MID-RANGE

TEST RADIO:
- CB1: ON

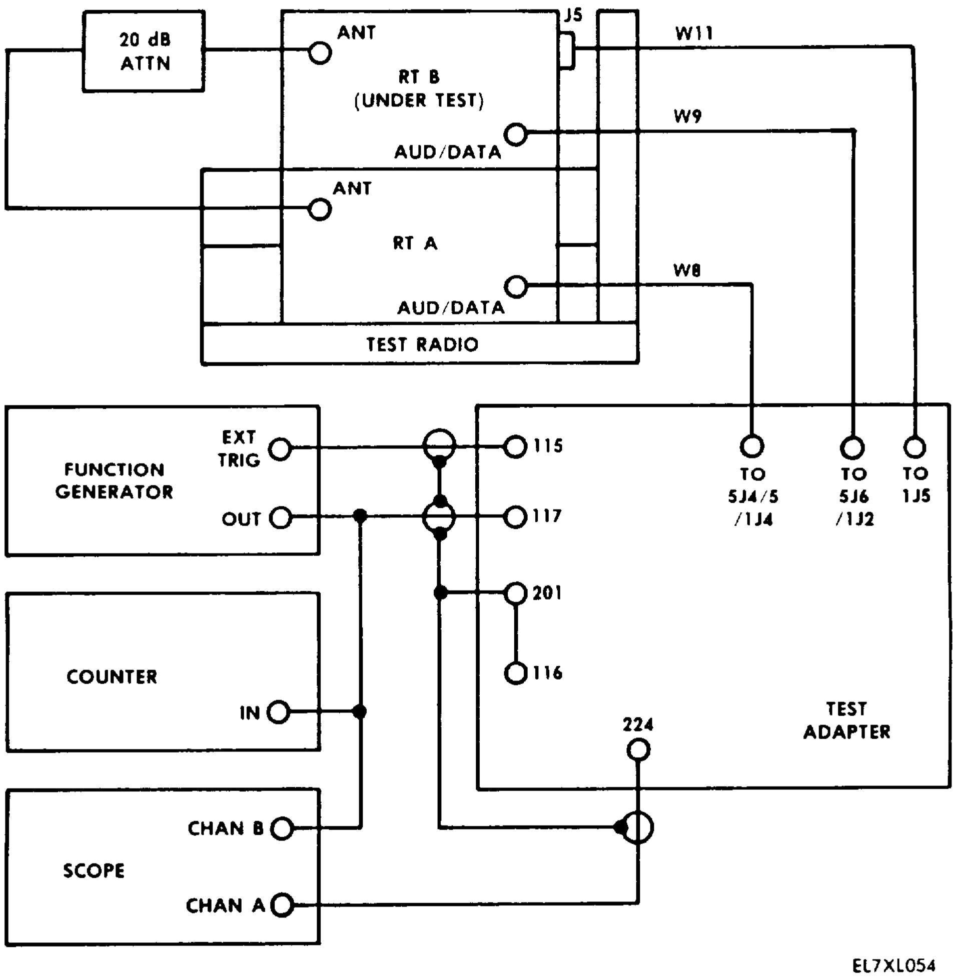
Figure 2-31. Transmit Test Setup (SC, 4.8K DATA).



EQUIPMENT PRESETS

RT A AND RT B:	FUNCTION GENERATOR:	
RF: LO	FUNCTION FREQ:	2400 Hz (2390 TO 2410 Hz)
FCTN: SQ ON	MODULATION GEN:	16000 Hz (15990 TO 16010 Hz)
MODE: SC	LEVEL:	10 v P-P (9.5 TO 10.5 V P-P) (BOTH)
DATA 16K	FUNCTION:	SQUARE (BOTH)
CHAN: 1	TRIGGER:	EXT
	TRIG LEVEL:	MID-RANGE
	TEST RADIO:	
	CB1: ON	

Figure 2-32. Transmit Test Setup (SC, 4.8K DATA, CT).



EQUIPMENT PRESETS

RT A AND RT B:
- RF: LO
- FCTN: SQ ON
- MODE: SC
- DATA 4.8K
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 2400 Hz (2390 TO 2410 Hz)
- LEVEL: 10 V P-P (9.5 TO 10.5 V P-P)
- FUNCTION: SQUARE
- TRIGGER: EXT TRIG
- TRIG LEVEL: MID-RANGE

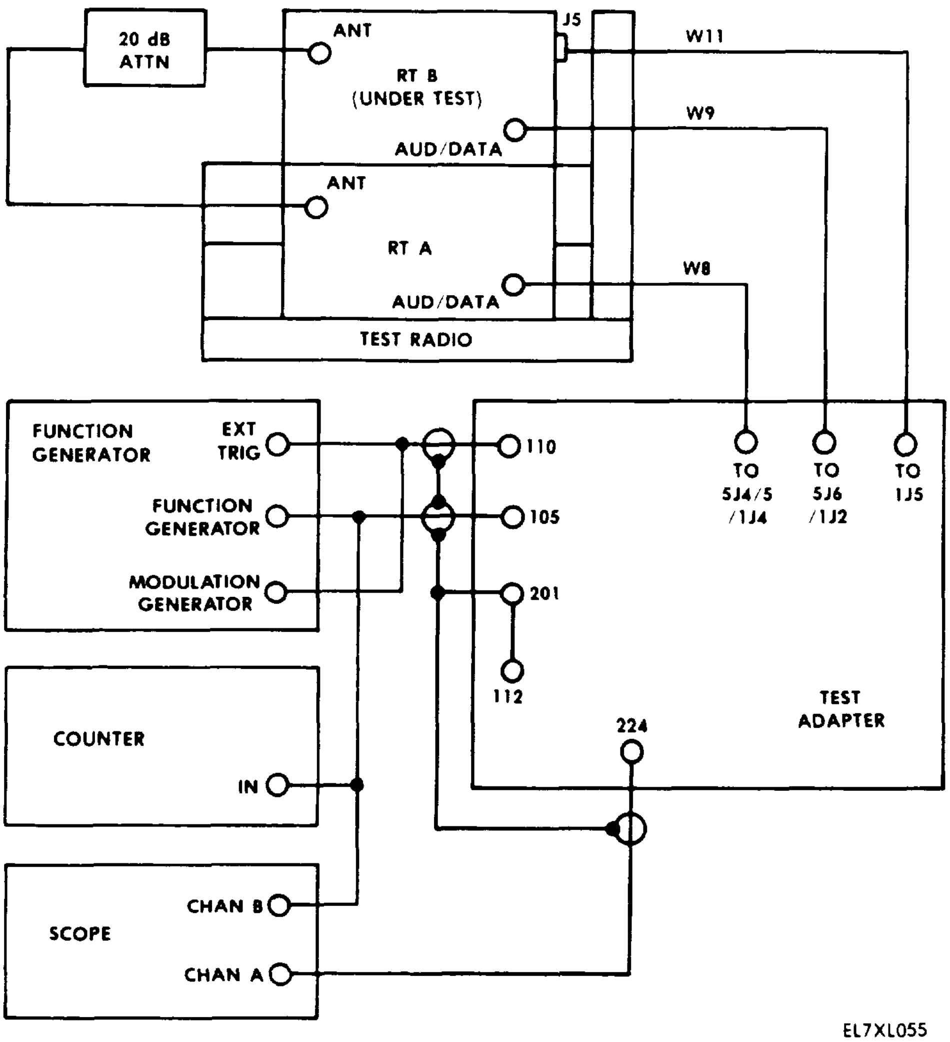
TEST RADIO:
- CB1: ON

Figure 2-33. Receive Test Setup (SC, 4.8K DATA).

2-33. OPERATIONAL CHECK. Continued

Step 15. RECEIVE CHECK (CT, DIGITAL DATA)

Action	Response
 CAUTION The data rate adapter (1A15) is electrostatic sensitive. Observe all ESD precautions.	
a. Rt B FCTN: OFF	a. No response.
b. CB1: OFF	b. No response.
c. Remove data rate adapter (1A15) from rt B.	c. No response.
d. Connect equipment as shown in figure 2-34.	d. No response.
e. Connect jumper cable from TP114 to TP201.	e. Scope chan A displays 9 to 10 V p-p, 7990 to 8010 Hz square wave. if not, go to chart 31.
f. Move scope chan A probe from TP224 to TP226.	f. Scope chan A displays 9 to 10 V p-p, 15990 to 16010 Hz square wave. If not, go to chart 30.
g. Remove jumper cable from TP114 and TP201.	g. No response.
h. Rt B FCTN: OFF	h. No response.
i. Install data rate adapter in rt B.	i. No response.



EQUIPMENT PRESETS

RT B:
- RF: LO
- FCTN: SQ ON
- MODE: SC
- DATA: 16K
- CHAN: 1

RT A:
- FCTN: OFF

FUNCTION GENERATOR:
- FUNCTION FREQ: 8000 Hz (7990 TO 8010 Hz)
- MODULATION GEN. 16000 Hz (15990 TO 16010 Hz)
- LEVEL: 10 V P-P (9.5 TO 10.5 V P-P) (BOTH)
- FUNCTION: SQUARE (BOTH)
- TRIGGER: EXT TRIG
- TRIG LEVEL: MID-RANGE

TEST RADIO:
- CB1: ON

Figure 2-34. Receive Test Setup (CT, Digital Data).

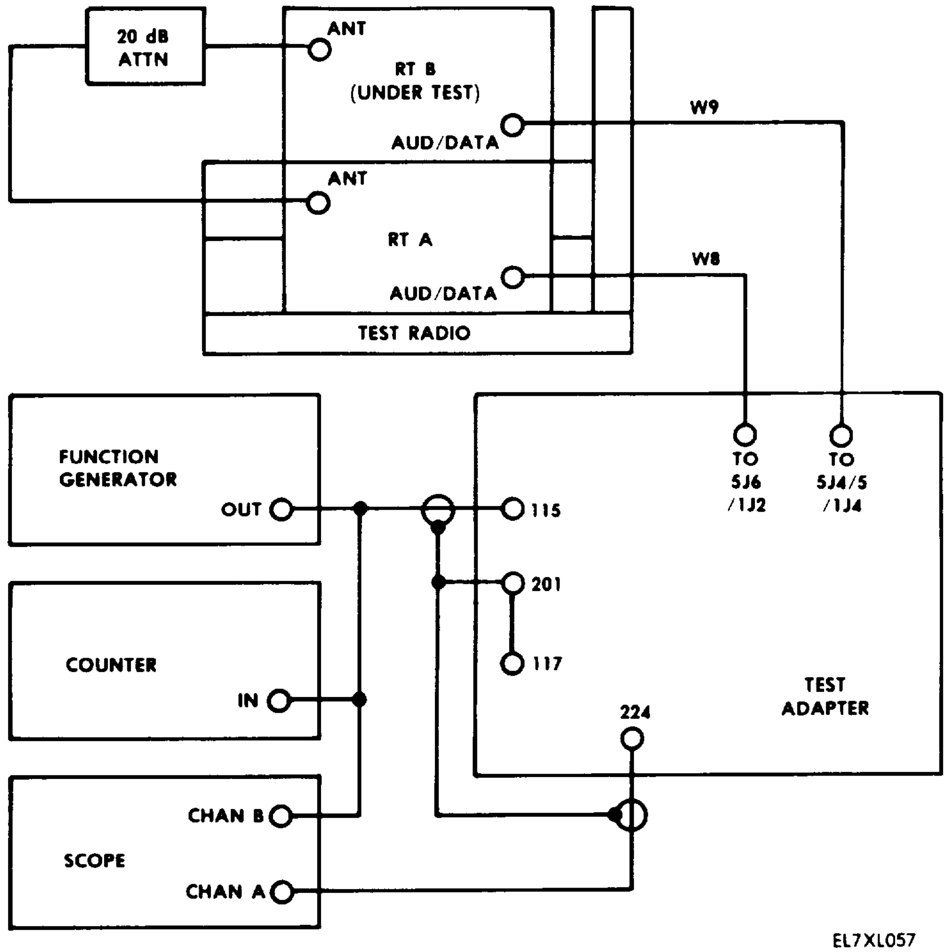
2-33. OPERATIONAL CHECK. Continued

Step 16. TRANSMIT CHECK (SC, AD2)

Action	Response
a. Connect equipment as shown in figure 2-35.	a. No response.
b. Connect jumper cable from TP114 to TP201.	b. Scope chan A displays 1.5 to 2.5 V p-p, 2390 to 2410 Hz sine wave (distorted). If not, go to chart 33.
c. Remove jumper cable from TP114 to TP201.	c. No response.

Step 17. RECEIVE CHECK (SC, AD2)

Action	Response
a. Connect equipment as shown in figure 2-36.	a. No response.
b. Connect jumper cable from TP114 to TP201.	b. Scope chan A displays 1.5 to 2.5 V p-p, 2390 to 2410 Hz sine wave (distorted). If not, go to chart 34.
c. Remove jumper cable from TP114 and TP201.	c. No response.



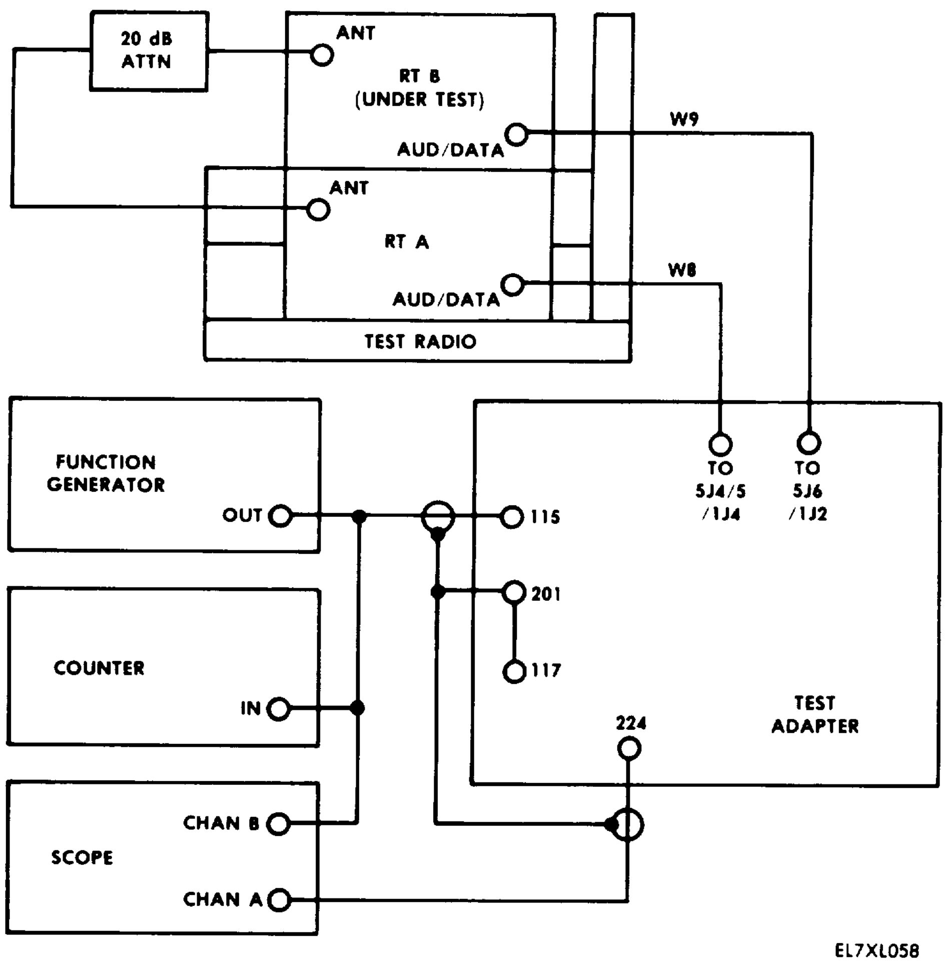
EQUIPMENT PRESETS

RT A AND RT B:
- RF: LO
- MODE: SC
- FCTN: SQ ON
- DATA AD2
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 2400 Hz (2390 TO 2410 Hz)
- LEVEL: 120 mV P-P (100 TO 140 mV P-P)
- FUNCTION: SINE

TEST RADIO:
- CB1: ON

Figure 2-35. Transmit Test Setup (SC, AD2).



EQUIPMENT PRESETS

RT A AND RT B:
RF: LO
MODE: SC
FCTN: SQ ON
DATA AD2
CHAN: 1

FUNCTION GENERATOR:
FREQ: 2400 Hz (2390 TO 2410 Hz)
LEVEL: 120 mV P-P (100 TO 140 mV P-P)
FUNCTION: SINE

TEST RADIO:
CB1: ON

Figure 2-36. Receive Test Setup (SC, AD2).

2-33. OPERATIONAL CHECK. Continued

Step 18. RETRANSMIT CHECK

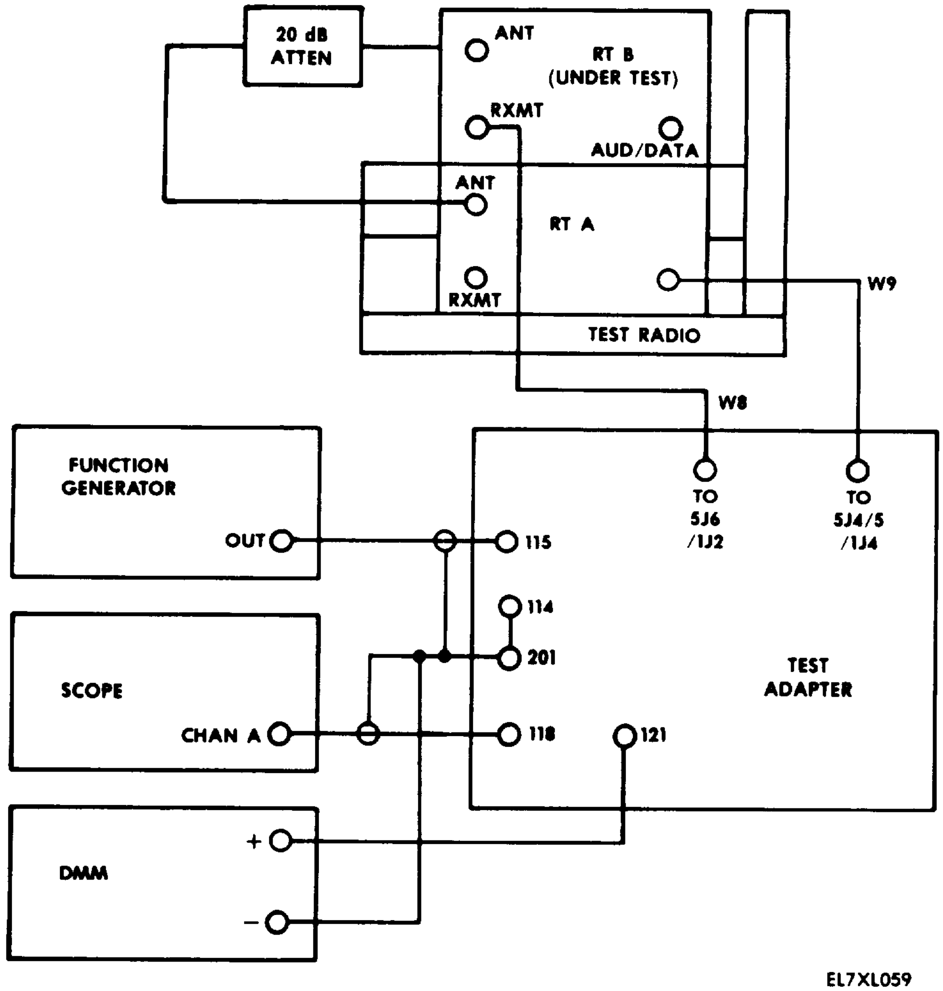
Action	Response
a. Connect equipment as shown in figure 2-37.	a. Scope chan A displays 560 to 700 mV p-p, 900 to 1100 Hz sine wave. If not, go to chart 35.
b. Read DMM.	b. Reading is -0.5 to 0.5 V dc. If not, go to chart 35.
c. Move DMM (+) lead to TP122.	c. DMM reading is 1.0 to 3.0 V dc. If not, replace switching module (1A7).
d. Move DMM (+) lead to TP119.	d. DMM reading is 1.0 to 3.0 V dc. If not, replace switching module (1A7).

Step 19. RECEIVER SENSITIVITY

Action	Response
a. Connect equipment as shown in figure 2-38.	a. Scope chan A displays sine wave with some noise, greater than 15 V p-p, 1 kHz that changes when the signal generator RF output is turned OFF and ON again. If not, go to chart 36.
b. Increase signal generator output to - 106 dBm.	b. Scope chan A displays same sine wave as step a without noise. If not, go to chart 37.

Step 20. HOLDING BATTERY CHECK

Action	Response
NOTE Any test setup with rt B powered by the test radio is adequate.	
a. Rt B FCTN: OFF.	a. No response.
b. CB1: OFF and wait 30 seconds.	b. No response.
c. CB1: ON.	c. No response.
d. Rt B: FCTN: ON CHAN: 2 MODE: FH	d. Rt displays ID for hopset loaded into channel 2. If not, go to chart 38.
e. Operational check complete.	



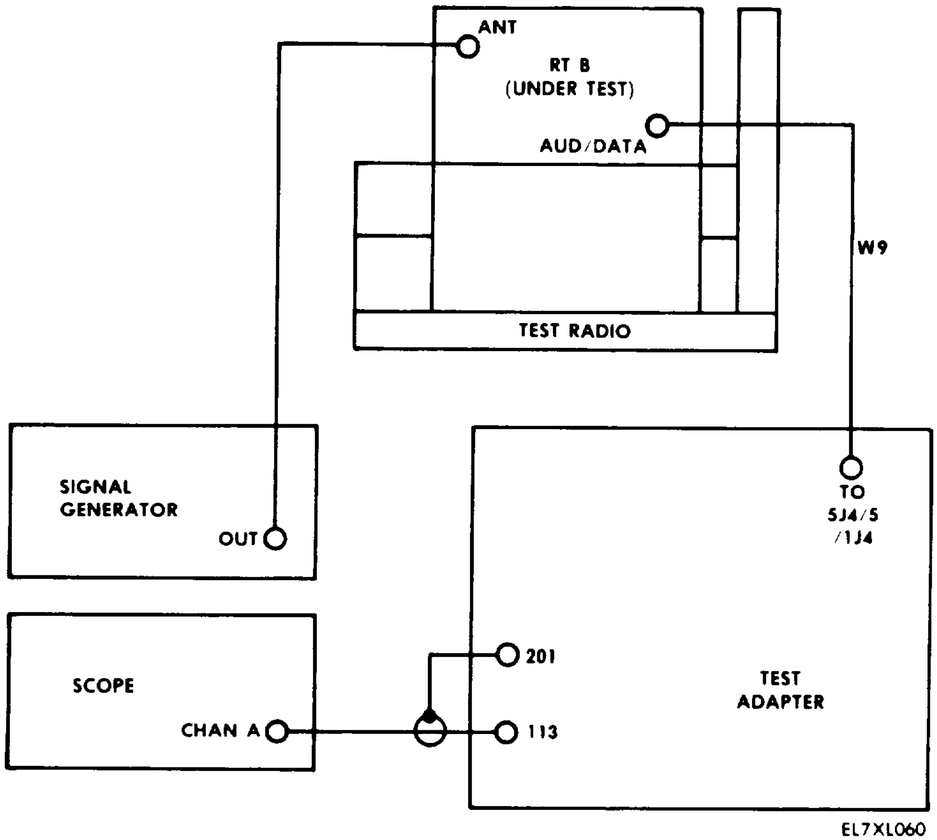
EQUIPMENT PRESETS

RT A:
- RF: LO
- CHAN: 1
- MODE: SC
- DATA: OFF
- FCTN: SQ ON

RT B:
- RF: LO
- CHAN: 1
- MODE: SC
- DATA: OFF
- FCTN: RXMT

FUNCTION GENERATOR:
- FREQ: 1 kHz (900 TO 1100 Hz)
- LEVEL: 120 mV P-P (100 TO 140 mV P-P)
- FCTN: SINE

Figure 2-37. Retransmit Test Setup.



EQUIPMENT PRESETS

RT B:
- MODE: SC
- CHAN: 1
- FCTN: SQ OFF
- VOL FULL CW
- DATA: OFF

TEST RADIO:
- CB1: ON

SIGNAL GENERATOR:
- FREQ: 37.8750 MHz (37.8748 TO 37.8752 MHz)
- LEVEL: -116 dBm (-116.5 TO -115.5 dBm)
- FM MOD: INT
- MOD: 1 kHz AT ± 6.5 kHz DEV

NOTE

Make sure FCTN switch is set to SQ OFF and not to SQ ON.

Figure 2-38. Receiver Sensitivity Test Setup.

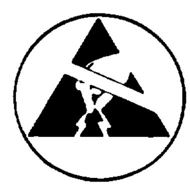
2-34. REPAIR PROCEDURES.

Repair of the rt consists of replacing a bad module. A module is replaced by removing it and installing a good module. Procedures for doing this follow.

a. General Instructions. The following instructions apply to all repair tasks.

1. Set FCTN switch to STW.
2. Remove any cables connected to the rt.
3. Inspect the rt for damage. Repair any obvious physical damage.
4. Use the module extractor to remove the circuit card assemblies. It is included in the maintenance tool kit. It is used as follows:
   a) Locate the module to be removed.
   b) Hook the module extractor through the two holes in the top corners of the module.
   c) Hold the module extractor with one hand. Rest the other hand on the rt with the fingers of the hand on top of the module to be removed.
   d) Pull steadily with the module extractor until the module connector is free of the parent board.
   e) Remove the module.
   f) Unhook the module extractor from the module.
5. Handle all modules carefully.
6. Before installing a module, check the connector for bent or broken pins. Do not install if damaged.
7. Perform the operational check.

b. Repair Precautions.



CAUTION

Static electricity can damage the rt modules. Ground the rt and all tools before removing a module. Use a grounded wrist strap when handling a module.

2-35. REPLACEMENT OF RT COVERS.

a. Removal and Installation of lop Cover.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt	Set on work surface with top side up	

2-35. REPLACEMENT OF RT COVERS. Continued

a. Removal and Installation of lop Cover. Continued

ITEM	ACTION	REMARKS
b. Eleven captive screws	Fully loosen.	
c. Top cover	Lift free from rt.	
INSTALLATION		
d. Top cover	Set in place on rt.	
e. HCP Eleven captive screws	Thread and tighten. Torque to 9 in-lb.	

b. Removal and Installation of Bottom Cover.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt	Place on work surface with bottom side up.	
b. Thirteen captive screws	Fully loosen.	
c. Bottom cover	Lift free from rt.	
INSTALLATION		
d. Bottom cover	Set in place on rt.	
e. HCP Thirteen captive screws	Thread and tighten. Torque to 9 in-lb.	

2-36. REPLACEMENT OF MODULES 1A2, 1A6, 1A7, 1A12, 1A13, 1A14, AND 1A15.

This procedure is for replacement of the following modules.

Remote I/O Module (1A2)
Two-Wire Interface (1A6)
Switching Module (1A7)
Audio Power Supply (1A12)
Audio Control Module (1A13)
Audio/Data I/O Module (1A14)
Data Rate Adapter (1A15)

Figure 2-39 shows the locations of these modules.

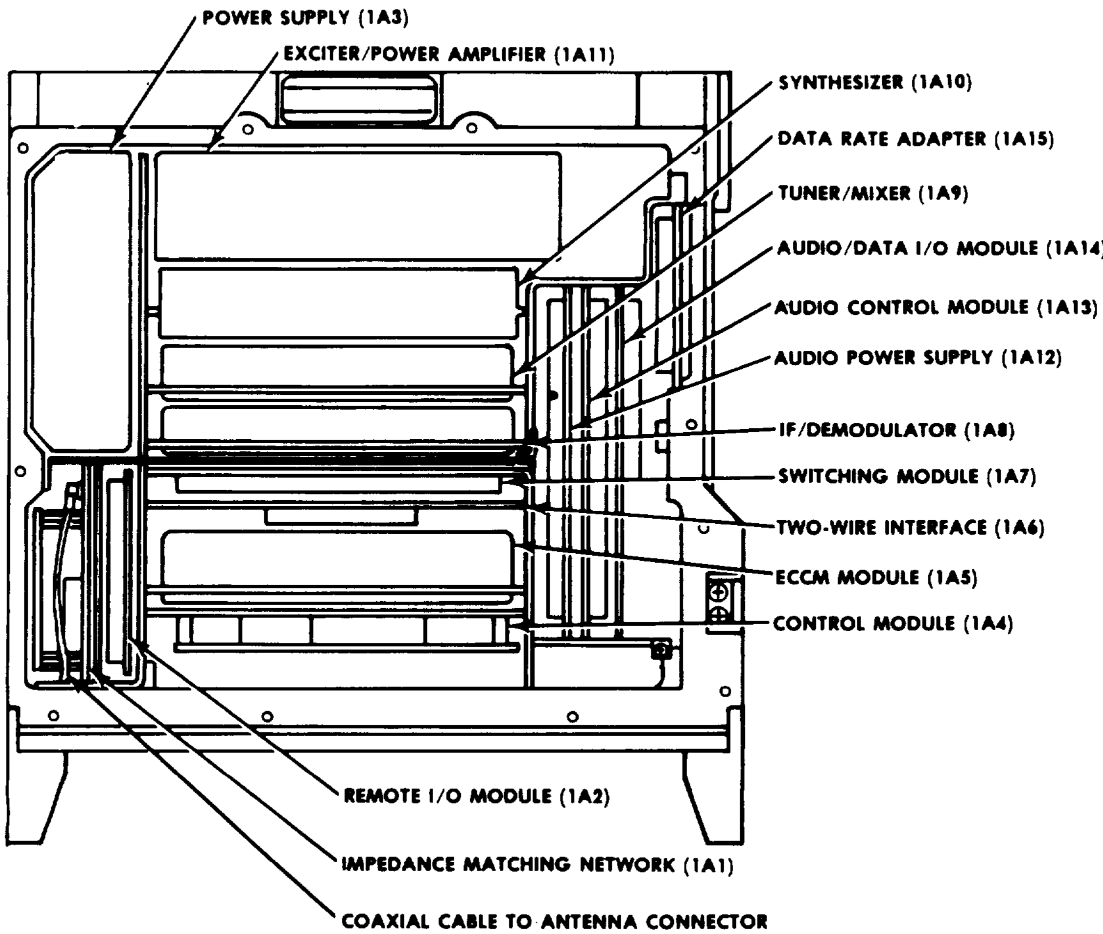


Figure 2-39. RT Module Locations.

2-36. REPLACEMENT OF MODULES 1A2, 1A6, 1A7, 1A12, 1A13, 1A14, AND 1A15. Continued

Tools:

Flat tip screwdriver
Module extractor
Torque adapter
Torque wrench

Reference:

Paragraph 2-35.a for removal and installation of top cover.
Paragraph 2-34.b for use of the module extractor.

ITEM	ACTION	REMARKS
REMOVAL		
a. Top cover	Remove.	
b. Module	Hook module extractor to module.	
c. Module	Pull free of rt.	
INSTALLATION		
d. Module	Check connector location and place module in card guide. Press down to fully seat module connector.	
e. HCP Top cover	Install.	

2-37. REPLACEMENT OF IMPEDANCE MATCHING NETWORK (1A1).

Tools:

Flat tip screwdriver
Torque adapter
Module extractor
Round nose pliers
Torque wrench

References:

Paragraph 2-35 for removal and installation of the rt covers.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt bottom cover	Remove.	
b. Rf cable (1W1)	Remove from impedance matching network.	
c. Rt top cover	Remove.	

2-37. REPLACEMENT OF IMPEDANCE MATCHING NETWORK (1A1). Continued

ITEM	ACTION	REMARKS
REMOVAL Continued		
d. Rf cable	Remove end connected to impedance matching network. See figure 2-39 for cable location.	
e. Impedance matching network	Use module extractor to pull free from rt.	
INSTALLATION		
f. Rf cable	Hold away from module location.	
g. Impedance matching network	Check connector location and place in card guide. Press down to fully seat connector.	
h. Rf cable	Attach to connector on impedance matching network.	
i. HCP Rt top cover	Install.	
i. Rf cable (1W1)	Attach to impedance matching network.	
k. HCP Rt bottom cover	Install.	

2-38. REPLACEMENT OF POWER SUPPLY (1A3).

Tools:

- Flat tip screwdriver
- Torque adapter
- Module extractor
- Torque wrench

References:

Paragraph 2-35 for removal and installation of rt covers.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt bottom cover.	Remove.	
b. Two screws	Unscrew and remove two screws securing power supply. See figure 2-40 for screw locations.	
c. Rt top cover	Remove.	
d. Power supply	Remove using module extractor.	

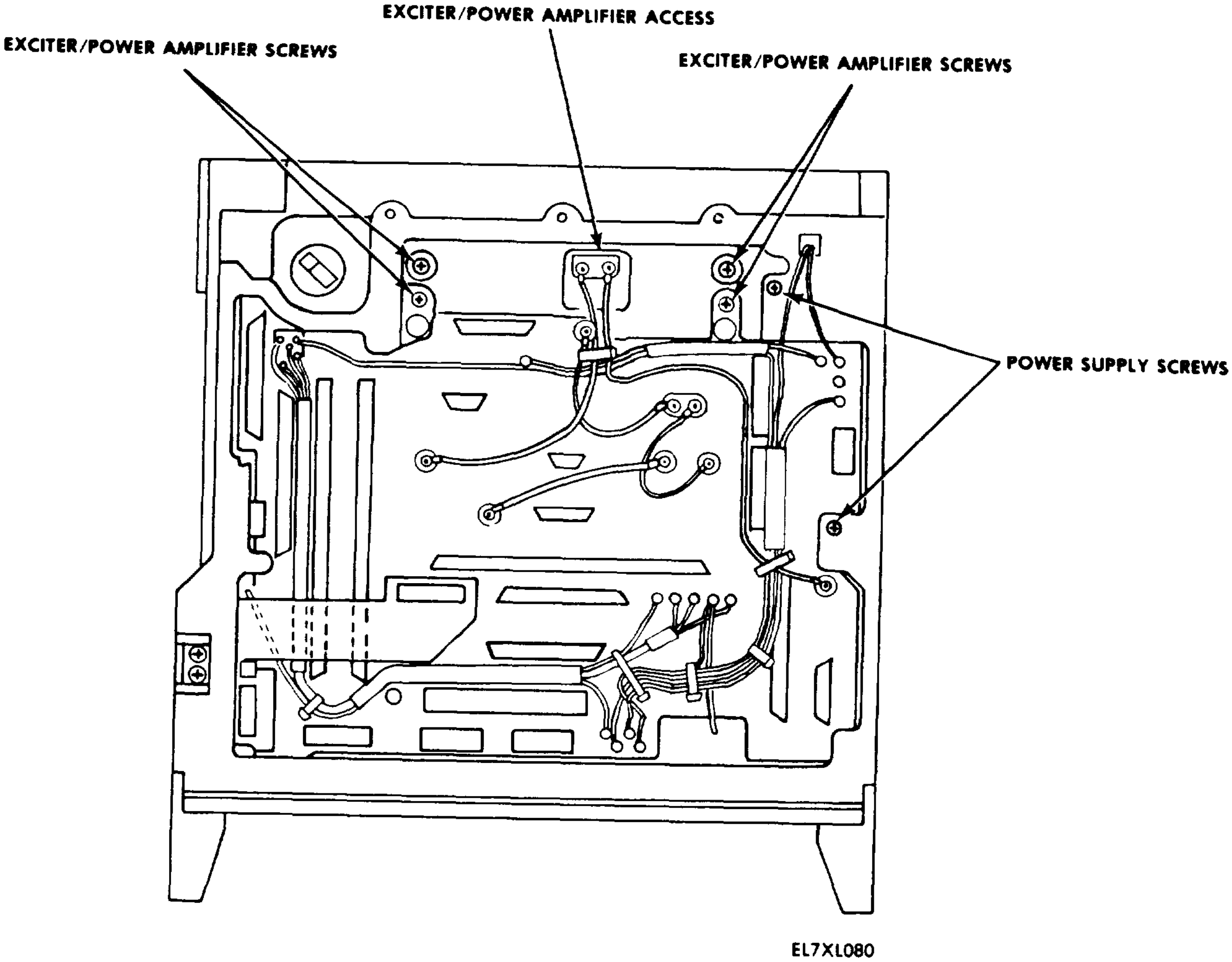


Figure 2-40. Module Screw locations.

2-38. REPLACEMENT OF POWER SUPPLY (1A3). Continued

ITEM	ACTION	REMARKS
INSTALLATION		
e. Power supply	Check connector location and insert power supply. Press down to seat fully.	
f. Two screws	Thread and tighten two screws removed in step b. Torque to 9 in-lb.	
g. HCP Rt bottom cover	Install.	
h. HCP Rt top cover	Install.	

2-39. REPLACEMENT OF ECCM MODULE (1A5).

Tools:

Flat tip screwdriver
Torque adapter
Module extractor
Torque wrench

References:

Paragraph 2-35 for removal and installation of rt top cover.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt top cover	Remove.	
b. ECCM module	Use module extractor to remove from rt.	
c. Control module	Press down to reseat.	
INSTALLATION		
d. ECCM module	Check connector location and place in card guide. Press down until ECCM module connector touches control module connector. Carefully aline ECCM module with control module. Press down to fully seat both connectors.	**CAUTION** Carefully aline ECCM module with control module to avoid connector damage.
e. HCP Rt top cover.	Install.	

2-40. REPLACEMENT OF THE CONTROL MODULE (1A4).

Tools:

Fiat tip screwdriver
Torque adapter
Module extractor
Torque wrench

References:

Paragraph 2-35 for removal and installation of rt top cover.
Paragraph 2-39 for removal and installation of ECCM module.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt top cover	Remove.	
b. ECCM module	Remove.	
C. Control module	Use module extractor to remove from rt.	
INSTALLATION		
d. Control module	Check connector location and place in card guide. Press down to fully seat connector.	
e. ECCM module	Install.	
f. $\boxed{\text{HCP}}$ Rt top cover	Install.	

2-41. REPLACEMENT OF IF/DEMODULATOR (1A8).

Tools:

Flat tip screwdriver
Module extractor
Torque adapter
Round nose pliers
Torque wrench

References:

Paragraph 2-35 for removal and installation of rt covers.
Figure 2-41 for location of RF cables.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt bottom cover	Remove.	
b. Rf cable (1W4)	Disconnect from IF/Demodulator.	

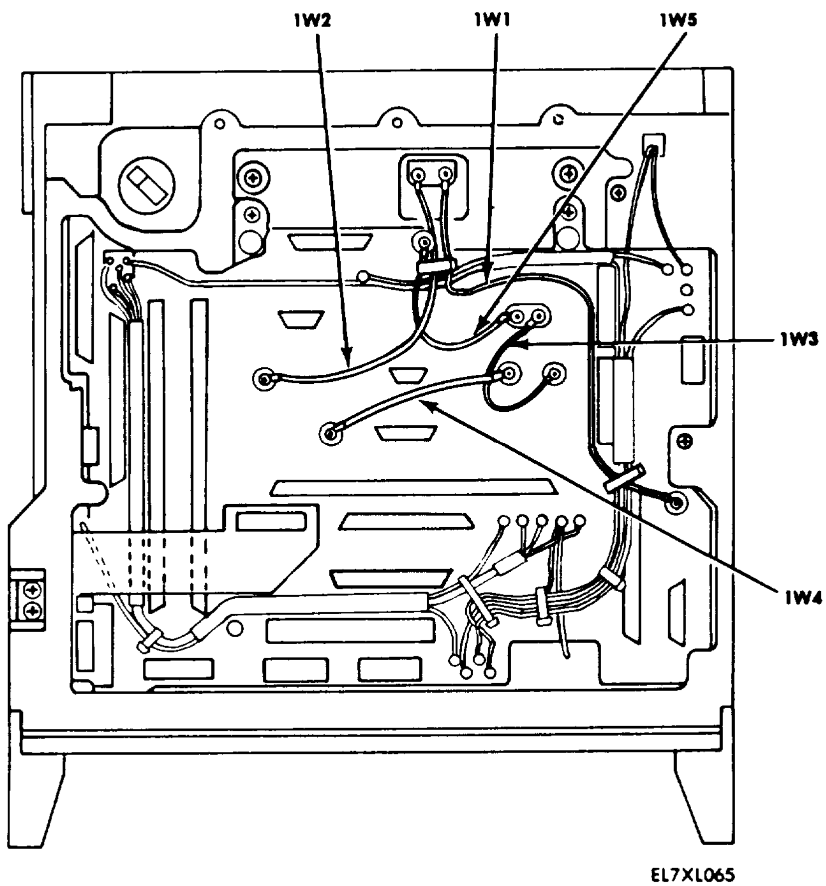


Figure 2-41. RF Cable Locations.

2-41. REPLACEMENT OF IF/DEMODULATOR (1A8). Continued

ITEM	ACTION	REMARKS
REMOVAL Continued		
c. Rt top cover	Remove.	
d. IF/demodulator module	Use module extractor to remove from rt.	
INSTALLATION		
e. IF/demodulator	Check connector location and place in card guides. Press down to fully seat connector.	
f. Rf cable (1W4)	Connect to IF/demodulator	
g. HCP Rt bottom cover	Install.	
h. HCP Rt top cover	Install.	

2-42. REPLACEMENT OF TUNER/MIXER (1A9).

Tools:

Flat tip screwdriver
Module extractor
Torque adapter
Torque wrench

References:

Paragraph 2-35 for removal and installation of rt covers.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt bottom cover.	Remove.	
b. Rf cables (1W2, 1W3, and 1W4)	Disconnect from tuner/mixer.	
C. Rt top cover	Remove.	
d. Tuner/mixer	Use module extractor to remove from rt.	

2-42. REPLACEMENT OF TUNER/MIXER (1A9). Continued

ITEM	ACTION	REMARKS
INSTALLATION		
e. Tuner/mixer	Check connector location and place in cord guides. Press down to fully seat connector.	
f. Rf cables (1W2, 1W3, and 1W4)	Connect to tuner/mixer.	
g. HCP Rt bottom cover	Install.	
h. HCP Rt top cover	Install.	

2-43. REPLACEMENT OF SYNTHESIZER (1A10).

Tools:

Flat tip screwdriver
Module extractor
Torque adapter
Torque wrench

References:

Paragraph 2-35 far removal and installation of rt covers.

ITEM	ACTION	REMARKS
REMOVAL		
o. Rt bottom cover	Remove.	
b. Rf cables (1W3 and 1W5)	Disconnect from synthesizers.	
c. Rt top cover	Remove.	
d. Synthesizer	Use module extractor to remove from rt.	
INSTALLATION		
e. Synthesizer	Check connector location and place in card guides. Press down to fully seat connector.	
f. Rf cables (1W3 and 1W5)	Connect to synthesizer.	
g. HCP Rt bottom cover	Install.	
h. HCP Rt top cover	Install.	

2-44. REPLACEMENT OF EXCITER/POWER AMPLIFIER (1A11).

Tools:

Flat tip screwdriver
Torque adapter
Module extractor
Round nose pliers
Torque wrench

References:

Paragraph 2-35 for removal and installation of rt covers.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt bottom cover	Remove.	
b. Rf cables (1W1, 1W2, and 1W5)	Disconnect from exciter/power amplifier.	
c. Four screws	Unscrew and remove screws holding exciter/power amplifier.	There may only be two screws securing the exciter/power amplifier. If so, there will only be two screw holes in the rt chassis.
d. Rt top cover	Remove.	
e. Exciter/power amplifier	Push from bottom and remove exciter/power amplifier. See figure 2-40 for location of access area.	
INSTALLATION		
f. Exciter/power amplifier	Check connector location and install. Press dawn to fully seat connector.	
g. Four screws	Thread and tighten. Torque to 9 in-lb.	
h. Rf cables (1W1, 1W2, and 1W5)	Attach to exciter/power amplifier. See figure 2-41 for locations.	
i. HCP Rt bottom cover	Install.	
i. HCP Rt top cover	Install	

2-45. REPLACEMENT OF RF CABLES 1W1 THROUGH 1W5.

Tools:
- Flat tip screwdriver
- Torque adapter
- Round nose pliers
- Torque wrench

Reference:
- Paragraph 2-35 for removal and installation of rt bottom cover.
- Figure 2-41 for location of RF cables.

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt bottom cover	Remove.	
b. Cable ties	Cut any cable ties securing the rf cable.	
C. Rf cable	locate proper cable and pull to disconnect at each end.	
INSTALLATION		
d. Rf cable	Push each end of the new cable onto its connector.	
e. Rf cable	Secure with new cable tie. Trim excess off the cable tie.	
f. HCP Rt bottom cover	Install.	

2-46. REPLACEMENT OF RT CHASSIS (1A16).

Tools:
- Flat tip screwdriver
- Torque adapter
- Module extractor
- Round nose pliers
- Torque wrench

References:
- Paragraph 2-35 for removal and installation of rt covers.
- Paragraph 2-46 for removal and installation of rf cables.
- Paragraphs 2-36 through 2-44 for removal and installation of all rt modules.

ITEM	ACTION	REMARKS
a. Rt top cover	Remove.	
b. Rt bottom cover	Remove.	
c. Modules	Remove each module one at a time. Install each module in proper place in new rt chassis.	

2-46. REPLACEMENT OF RT CHASSIS (1A16). Continued

ITEM	ACTION	REMARKS
d. Modules	Check the bad rt chassis to make sure all 15 modules are removed. Check the good rt chassis to make sure all 15 modules ore properly installed.	
e. Rf cables	Attach all rf cables to their proper connectors.	
f. HCP Rt bottom cover	Install.	
g. HCP Rt top cover	Install.	

2-47. REPLACEMENT OF DATA ENTRY KEYBOARD.

Tools:

Cross tip screwdriver
Needle nose pliers

Expendable supplies:

Silicone compound

ITEM	ACTION	REMARKS
REMOVAL		
a. Rt	Stand on work surface with front panel up.	
b. Four screws	Remove four screws holding keyboard to the front panel. See figure 2-42 for locations.	
c. Keyboard	Pull keyboard straight out from front panel.	
d. Sealing gasket	Carefully remove from front panel with needle nose pliers. Clean any remaining silicone compound from front panel.	

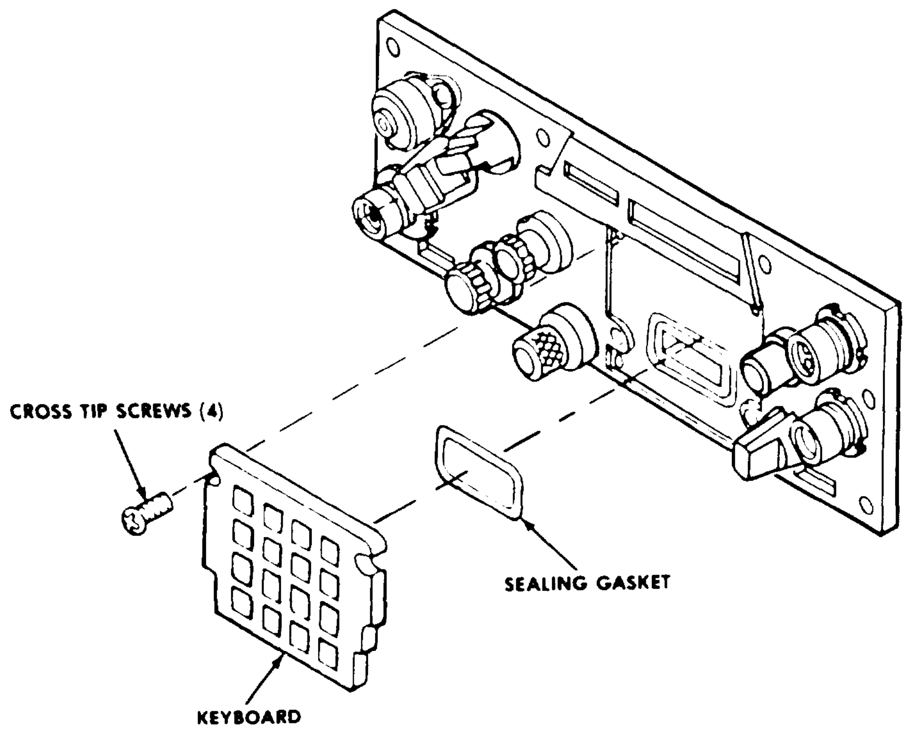


Figure 2-42. RT Front Panel Keyboard.

2-47. REPLACEMENT OF DATA ENTRY KEYBOARD. Continued

ITEM	ACTION	REMARKS

INSTALLATION

CAUTION

The connector pins on the bock of the keyboard are long and easily bent. Carefully aline the keyboard with its mounting screw holes. Insert the keyboard slowly and carefully until the pins are fully seated.

ITEM	ACTION	REMARKS
d. Sealing Gasket	Apply silicone compound to gasket.	
e. Keyboard	Aline screw holes in keyboard with those in front panel. Carefully insert keyboard. Feel for when the connector pins meet the connector inside. If there is unusual resistance, do not force. Remove and try again.	
f. HCP Four screws	Thread and tighten four screws.	

2-48. REPLACEMENT OF THREADED SCREW INSERTS.

Refer to paragraph 9-22 for specific replacement procedure of threaded screw inserts.

Section V. PREPARATION FOR STORAGE OR SHIPMENT

2-49. GENERAL INFORMATION.

a. Pack the rt and modules in approved shipping containers.

b. All modules must be shipped enclosed in material that provides protection from static electricity. See the following paragraph.

2-50. PACKING STATIC SENSITIVE MODULES.

The following steps should be followed when packing a static sensitive module for storage of shipment.

CAUTION

To avoid damaging static sensitive modules, use an antistatic pad on the work surface and wear a grounded wrist strap when handling the module.

ITEM	ACTION	REMARKS
a. Module (1)	Place inside antistatic bag (2) or inside antistatic wrapping material (3). See figure 2-43.	
b. Antistatic package (4)	Seal with adhesive tape. Attach “static sensitive contents” unit pack label (5).	
c. Antistatic package (4)	Place inside approved shipping container (6). Attach “static sensitive contents” intermediate pack label (7).	

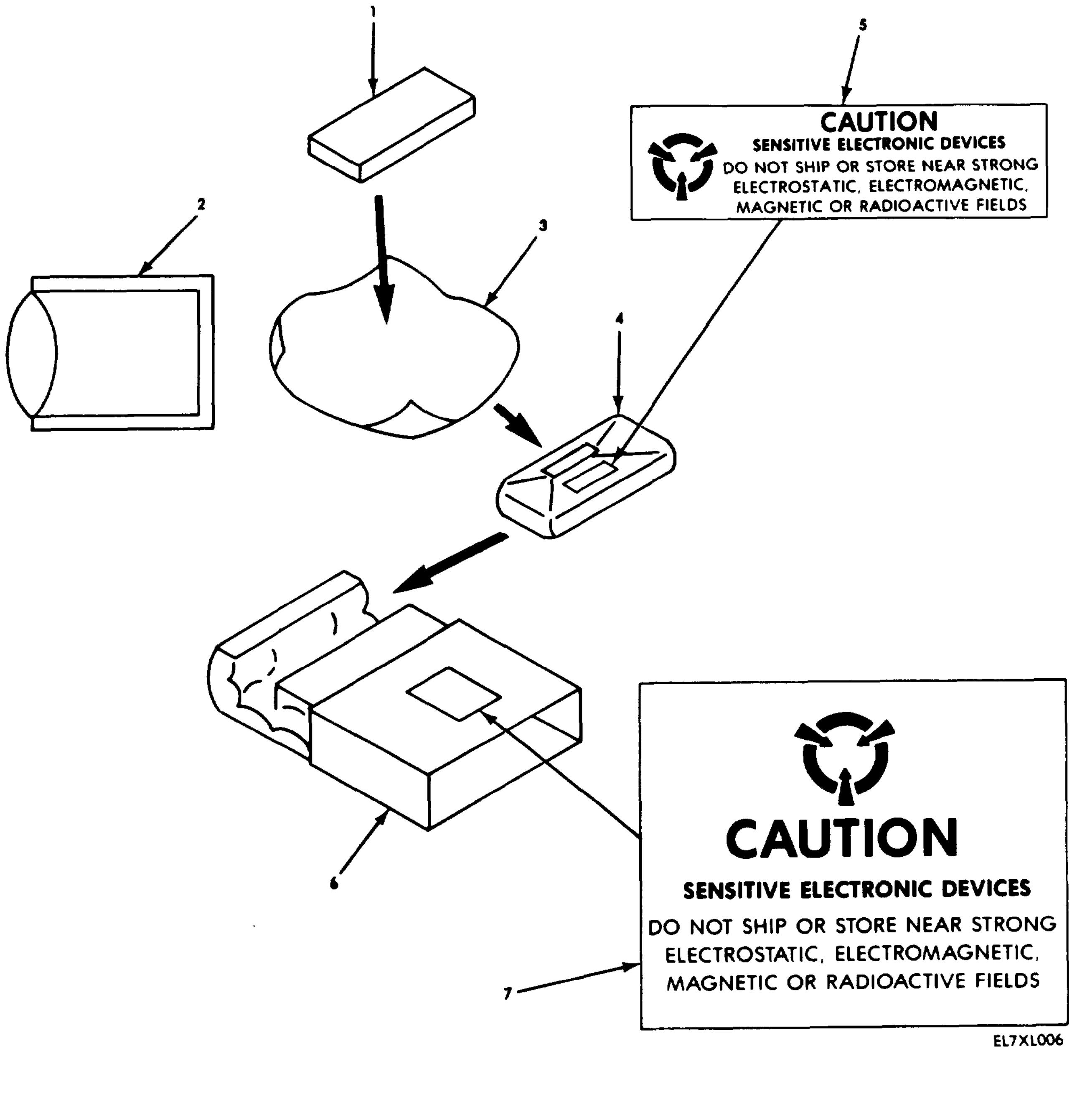


Figure 2-43. Packing Static Sensitive Modules.

CHAPTER 3

AMPLIFIER-ADAPTER, VEHICULAR AM-7239/VRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

3-1. INTRODUCTION.

The mounting adapter's three main sections are:

Power Supply, Amplifier-Adapter 5A1 (power supply)

Circuit Card Assembly, One-Watt Audio Amplifier 5A2 (audio amplifier)

Chassis, Electrical Equipment, Amplifier-Adapter 5A3 (mounting adapter chassis)

They are described in the following paragraphs:

3-2. POWER SUPPLY.

The power supply is mounted on the back of the mounting adapter. It provides two basic functions:

It suppresses transients on the input power line.

It converts the dc input power into the dc voltages required by the radio components.

The input power must be 22 to 32 V dc. The current required depends on the output loads. Normally, 2 to 12 A of input current is required. A block diagram of the power supply is included in FO-14.

a. Transient Suppressor. The transient suppressor protects the radio from transients that may be on the input power line. The transients, surges, and ripple on the input power line must be within the requirements of MIL-STD-1275. The output of the transient suppressor is not short-circuit protected. If shorted to ground, CB1 will trip. Its output is typically 0.5 V below the input voltage.

3-2. POWER SUPPLY. Continued

b. DC-to-DC Converter. The output of the transient suppressor is fed into the dc-to-dc converter. It provides the following regulated output voltage.

DC Output Voltage (V dc)	Maximum Current (A)	Maximum Ripple (mV p-p)
6.75 (6.55 to 6.95)	1.5	75
13.0 (12.6 to 13.4)	4.3	75
200 (180 to 220)	0.008	3000

These outputs are short-circuit protected. The power supply will not be damaged if on output is shorted to ground.

3-3. AUDIO AMPLIFIER.

The audio amplifier performs the following functions:

Amplifies the audio input to 1 W to drive a loudspeaker.

Amplifies the audio input to 200 mW for the intercom set.

Detects FSK (TACFIRE) tones to generate the required control signal.

Additional filtering of 13 V dc line.

A functional block diagram of the audio amplifier is included in figure 3-1.

a. One-Watt Audio Amplifier. The analog receive (AR-A or AR-B) signals from the rt are amplified by the 1 W audio amplifier. The output level is determined by the rt VOL control setting. An input signal of 5.5 V rms will be amplified to 1 W into 600 ohms. The frequency response is from 300 to 3000 Hz. An analog switch is used to attenuate the output when-either PTT line or the MUTE line is grounded.

b. Intercom Audio Amplifiers. The analog receive signals from the rt are also amplified by the intercom amplifiers. AR-A and AR-B are amplified separately to 200 mW. The output level is determined by the rt VOL control setting. The frequency response is also 300 to 3000 Hz.

c. FSK (TACFIRE) Detector. The FSK permits using one radio for audio and analog data. The analog data mode control (ADMC) line at the transmitting rt must be grounded when the analog transmit (AT) signal is analog data and AD2 is used. The FSK detector does this for the user.

It is a four stage process. The AT signal is amplified to the required level. A notch filter attenuates all frequencies outside the 300 to 3000 Hz range. This prevents harmonics from triggering the tone detector. The tone detector checks for the 1200 and 2400 Hz FSK tones. If both are present, an FSK PRESENT signal passes to the output processing circuit. The output processing circuit begins when a PTT is received. The ADMC line is held open for 120 ms after a PTT. After 120 ms, the output of the tone detector is checked. If FSK tones were detected, the ADMC line is grounded until the PTT is released. If the tones were not detected in the 120 ms, the line is held open until the PTT is released. A separate FSK detector is provided for AT-A and AT-B.

3-4. MOUNTING ADAPTER CHASSIS.

The mounting adopter chassis provides the basic radio interconnections as shown in FO-14. Several other functions are also performed. The power input is switched on and off by CB1. EMP protection is provided by CR1 through CR6, VR1, VR2, and El2 through E15. The remote control transformers couple the rt and control-monitor. The SNAP line driver passes signals between rt A and the SNAP. Q1 and R1 are electronically part of the voltage regulator on the audio amplifier.

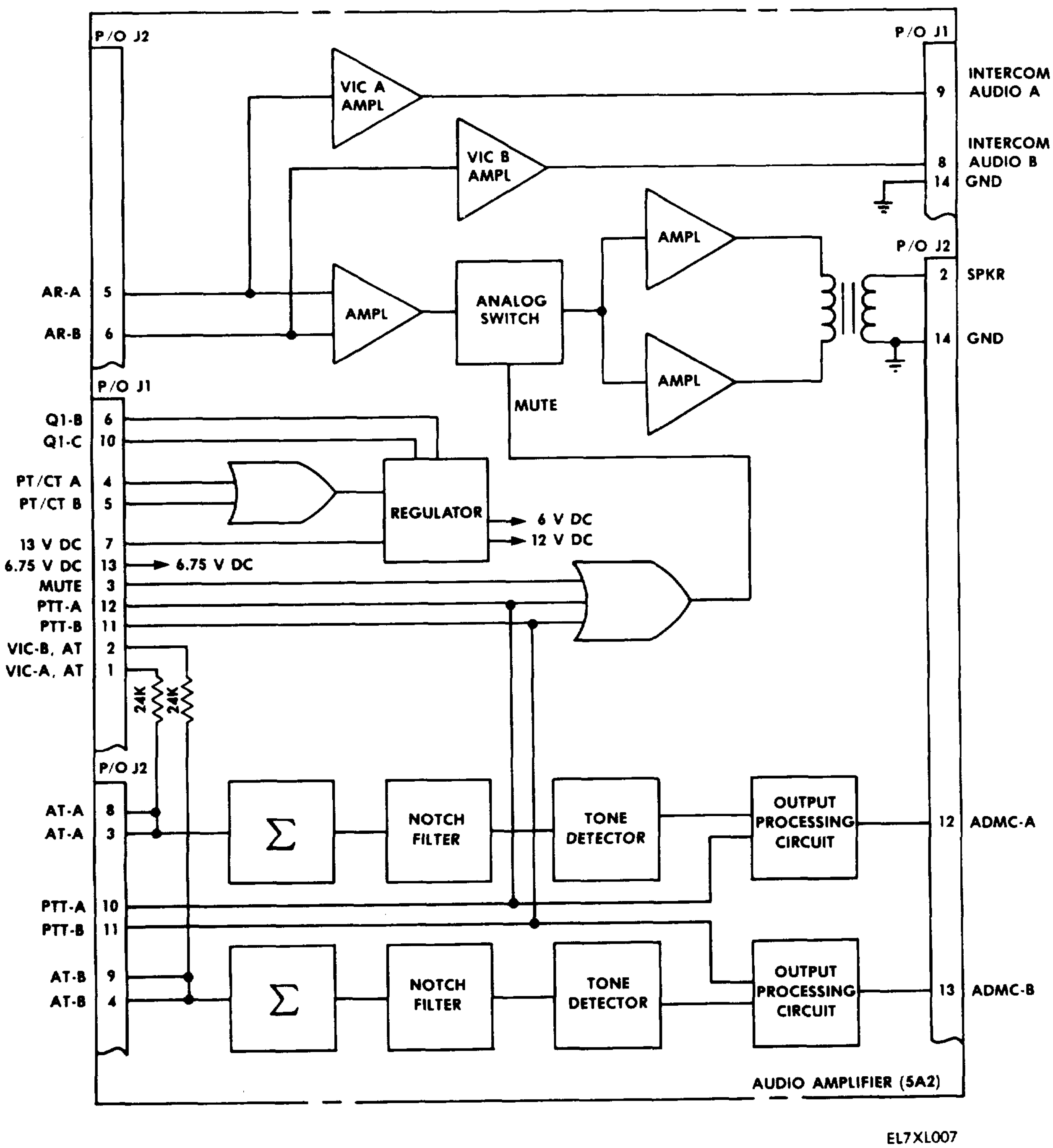


Figure 3-1. Audio Amplifier Block Diagram

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-5. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

3-6. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

For the TMDE and support equipment required for I(DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

3-7. REPAIR PARTS.

Repairs parts are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering I(DS) maintenance for this equipment.

Section III. TROUBLESHOOTING

3-8. GENERAL.

This section provides the troubleshooting procedures used to fault isolate a defective mounting adapter. The troubleshooting information is presented in the form of flow charts. They systematically get from a symptom to the bad module.

3-9. TROUBLESHOOTING.

Troubleshooting is done on a faulty mounting adapter. The steps to determine if a mounting adapter is faulty and how to troubleshoot it are as follows:

a. When a mounting adapter is received from unit maintenance, inspect it for damage. Repair any damage before proceeding with testing. See section IV if repairs are necessary.

b. Verify the symptom. Perform the operational check in section IV. This will direct you to the correct trouble-shooting flow chart.

c. Troubleshoot the mounting adapter using the flow chart. It will identify the defective module or component.

d. Replace the defective module or component. Follow the procedures in section IV.

e. Verify the repair. Repeat the operational check in section IV that failed. If it passes, then continue with the rest of the operational check. When the operational check is passed, the mounting adapter can be returned for use.

3-10. TEST PRECAUTIONS AND NOTES.

WARNING

High voltage (200 V dc) is present at mounting adapter connector J1 and TP232 on the test adapter. Use caution when connecting the test setup and taking measurements to avoid personal injury.

Set the test power supply to OFF before connecting or disconnecting a test setup, Current capacities are large enough to cause personal injury. Equipment con also be damaged if care is not taken.

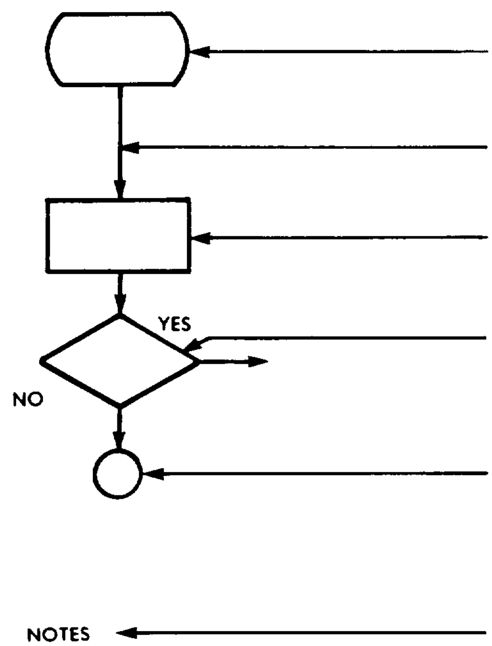
NOTE

The Principles of Operation section, functional block diagrams, and FO-14 can be used to fault isolate unusual problems not covered in the troubleshooting procedures.

3-11. EXPLANATION OF SYMBOLS AND NOTES.

SYMBOL

EXPLANATION



Test Procedure Start: (Rectangle with rounded sides) Indicates start of the test procedure and contains o brief description of the symptom of trouble.

Test Procedure Flow Line: (Heavy line and arrowhead) Indicates direction of the procedure flow.

Test Procedure Instruction: (Rectangle) Provides instructions for doing a specific test.

Decision: (Diamond) Indicates that a decision must be made (YES or NO) in answer to a question about the previous test. Path taken depends on the answer (YES or NO).

Connector: (Circle) Directs user to an entry point of another chart. Contains an entry number that is same as entry number of other chart and a sheet number (Sh No.) that indicates the number of follow-on pages.

Notes Column: Presents additional information, such as: more specific instructions about how to do a test, cautions and warnings that must be observed when doing a test, and additional information about what to do after doing a test. Also provides references to appropriate circuit diagrams.

3-12. TROUBLESHOOTING FLOW CHARTS.

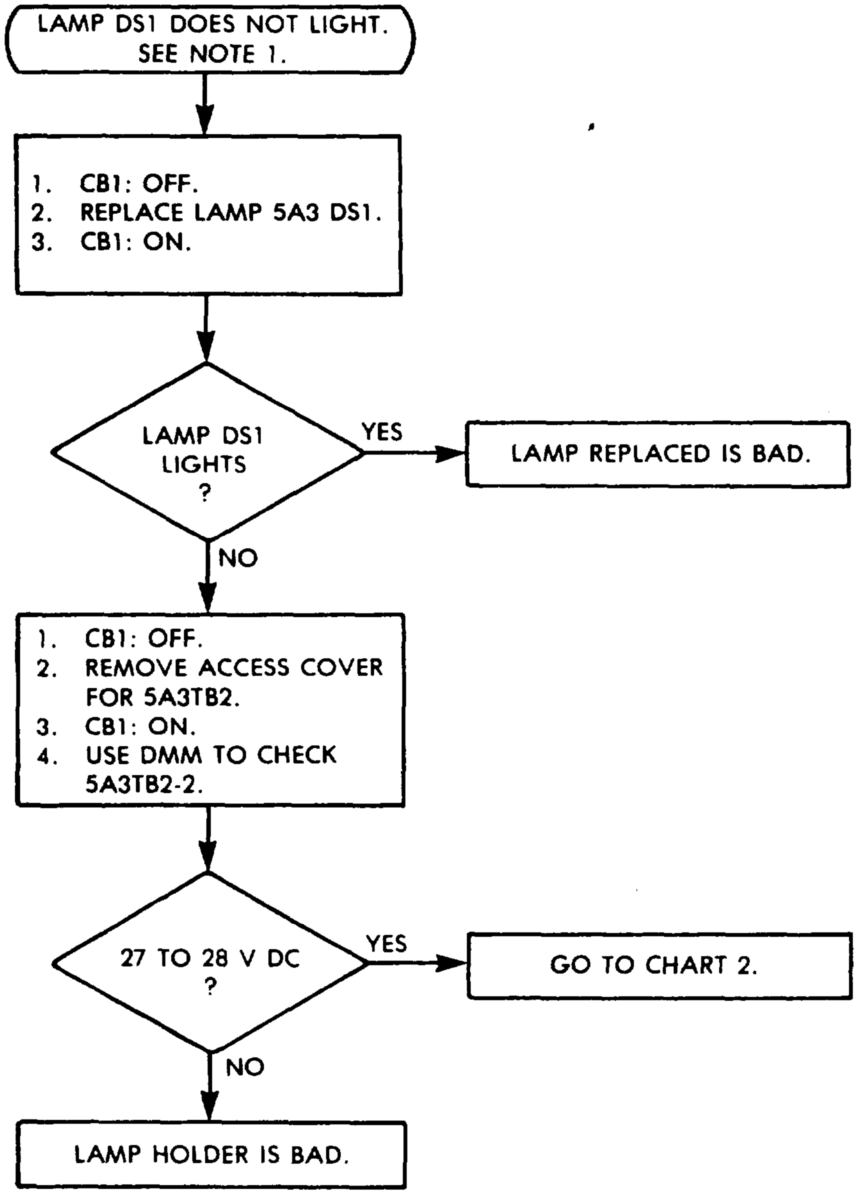
The following charts are included:

Chart	Symptom
1	Lamp DS1 does not light
2	CB1 trips
3	CB1 trips when RLY CONT power applied
4	6.75 V dc power absent
5	COMSEC 13 V line filter inoperative

3-12. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 1

Troubleshooting Primary Power Circuit
(Sheet 1 of 1)



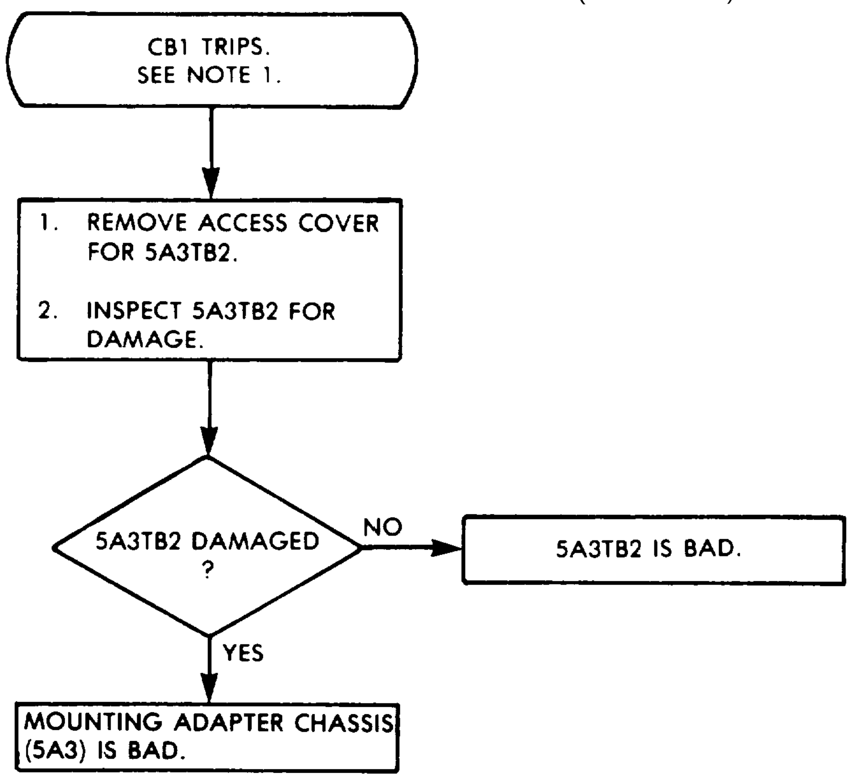
NOTE

Refer to FO-14 for diagram of these circuits.

3-12. TROUBLESHOOTING FLOW CHARTS. Continued

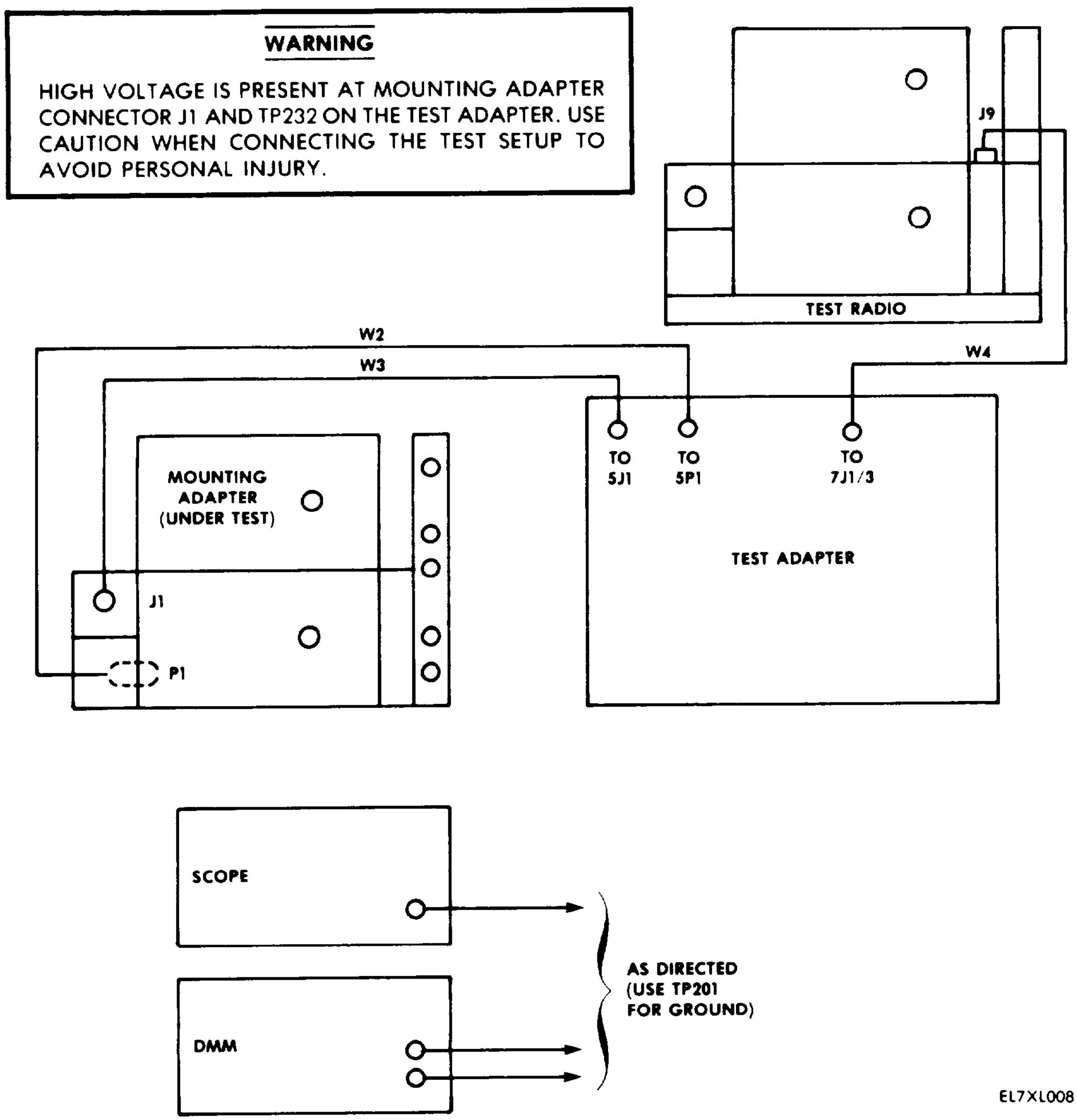
Chart 2

Troubleshoot Primary Power Circuit
(Sheet 1 of 1)



NOTE

Refer to FO-14 for diagram of these circuits.



EQUIPMENT PRESETS

POWER SUPPLY:
- OUTPUT: 27.5 V DC
- CURRENT LIMIT: MAXIMUM

TEST RADIO:
- CB1: ON

DMM:
- FUNCTION: VOLTS DC
- SCALE: 200V

Figure 3-2. Mounting Adapter Test Setup

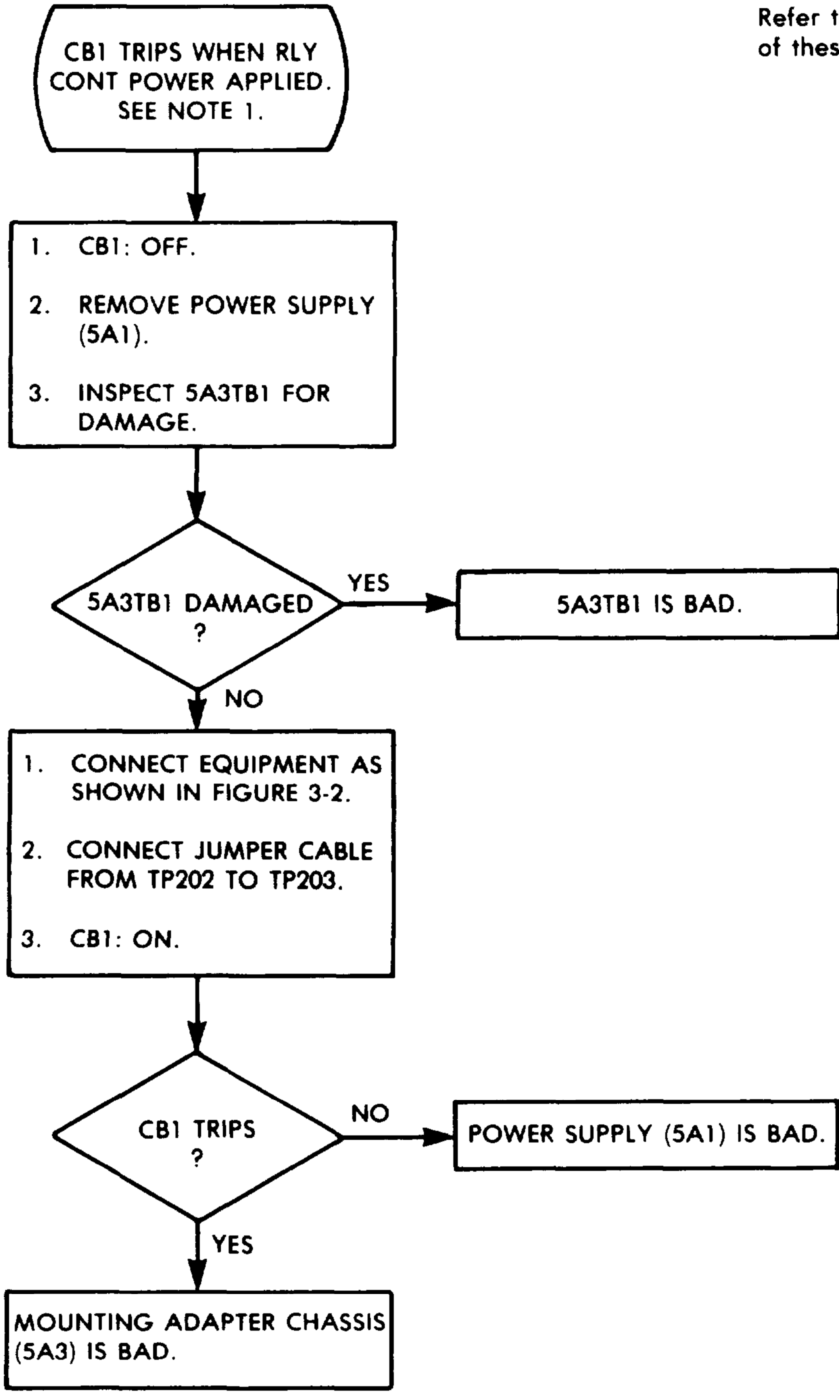
3-12. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 3

Troubleshooting Relay Control Circuit
(Sheet 1 of 1)

NOTE

Refer to FO-14 for diagram of these circuits.



3-12. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 4

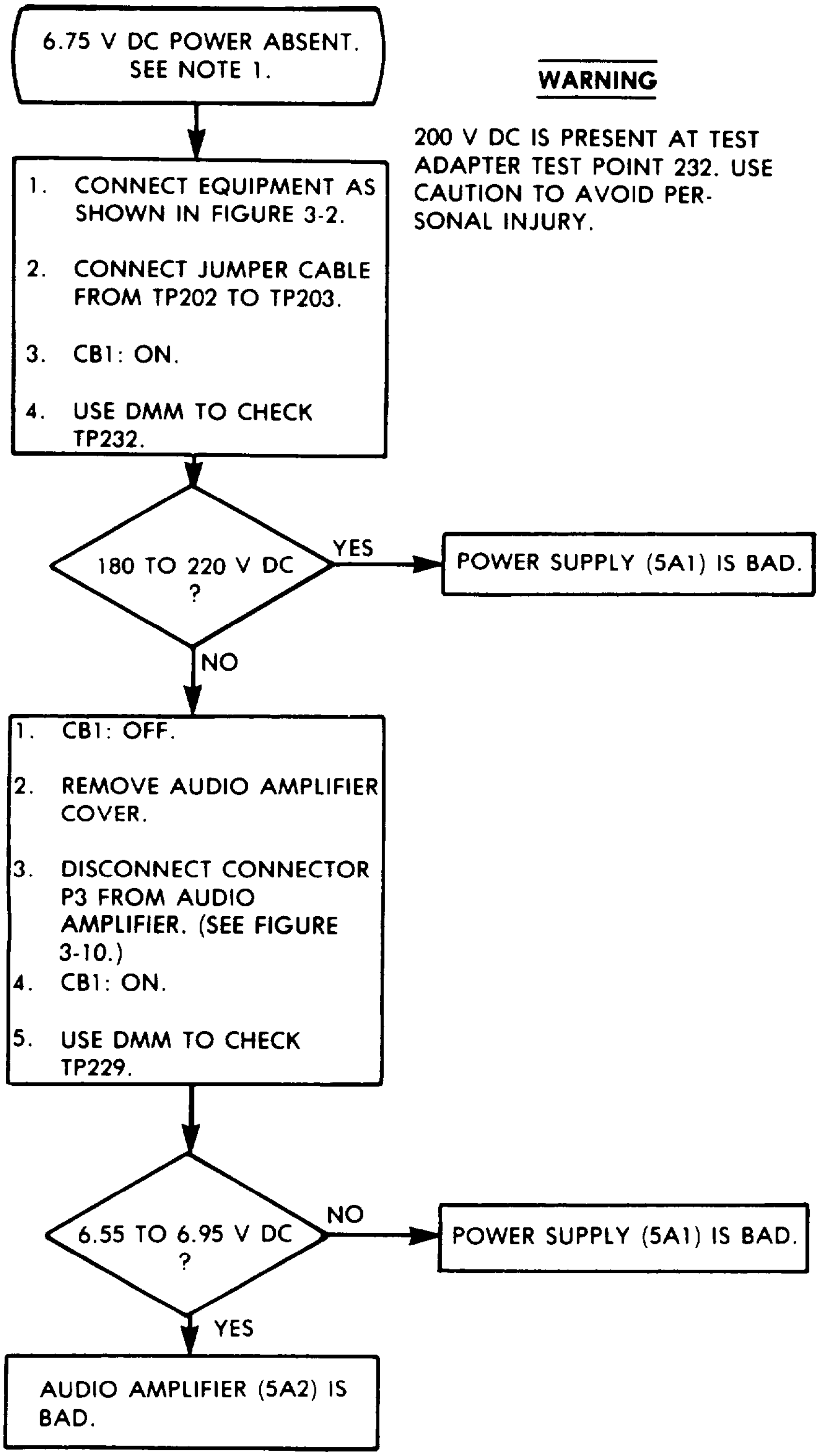
Troubleshooting Power Supply 6.75 V DC Output
(Sheet 1 of 1)

WARNING

200 V DC IS PRESENT AT TEST ADAPTER TEST POINT 232. USE CAUTION TO AVOID PERSONAL INJURY.

NOTE

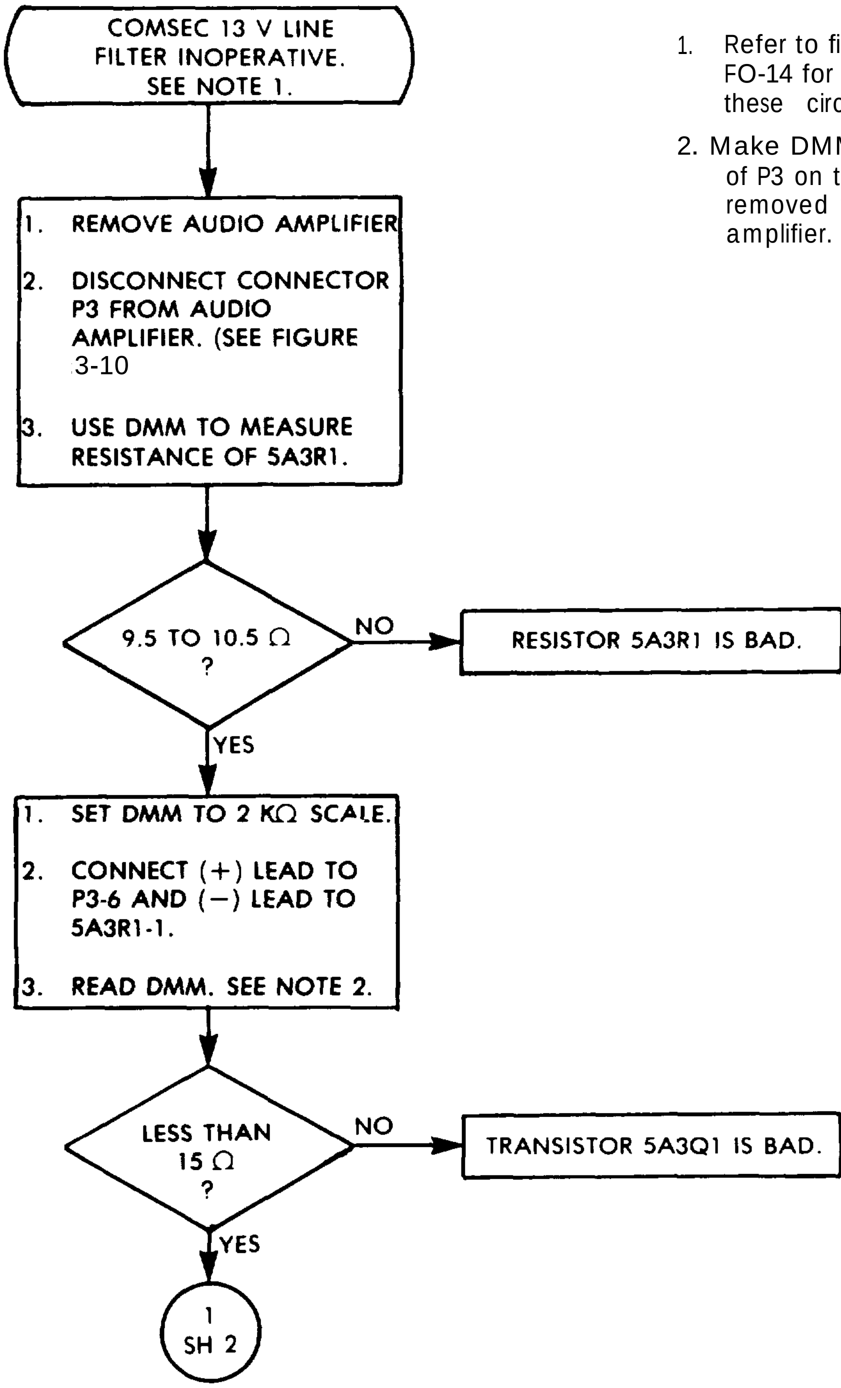
Refer to FO-14 for diagram of these circuits.



3-12. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 5

Troubleshooting COMSEC 13V Line Filtering
(Sheet 1 of 2)



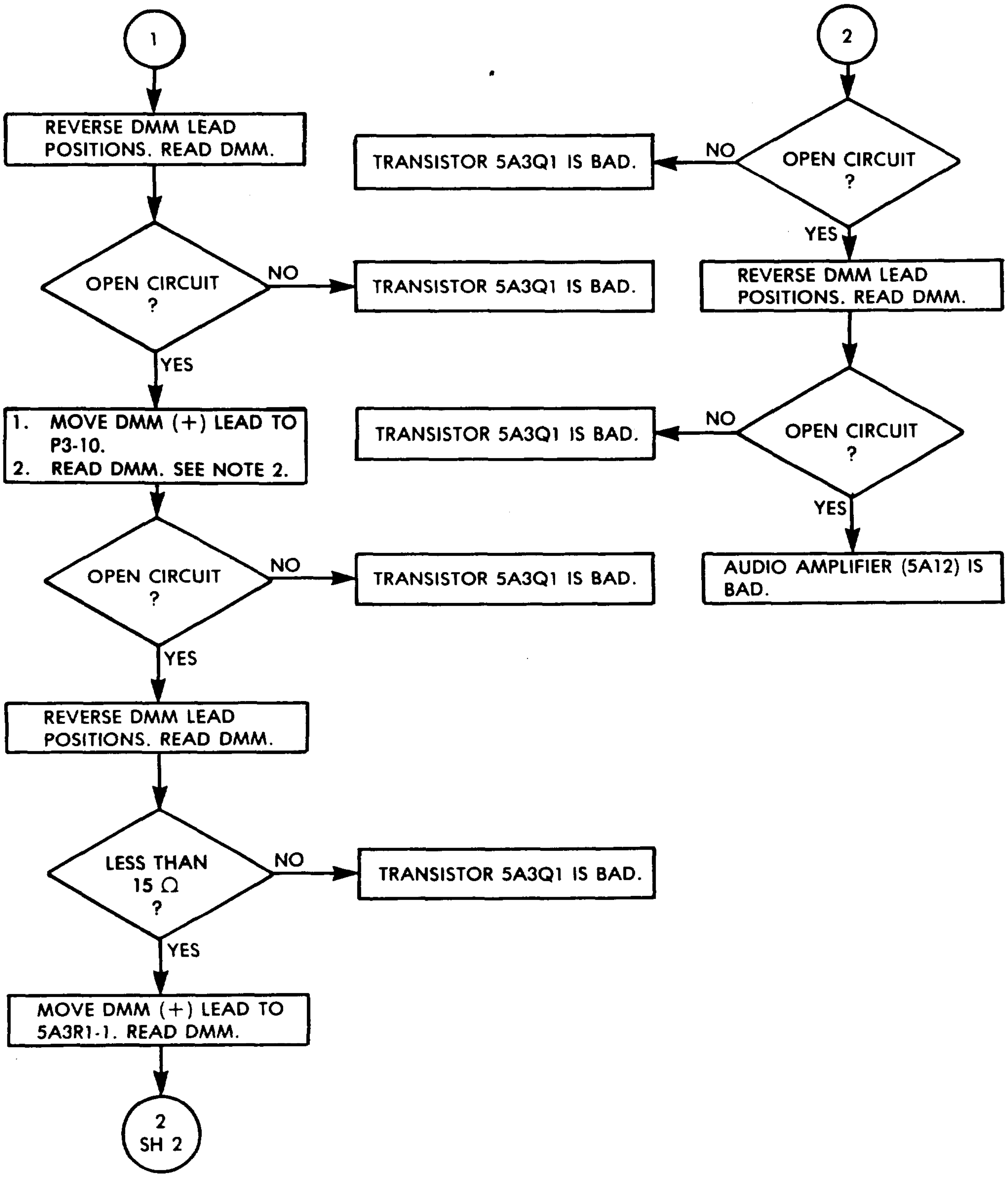
NOTES

1. Refer to figure 3-1 and FO-14 for diagrams of these circuits.
2. Make DMM measurements of P3 on the connector removed from the audio amplifier.

3-12. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 5

Troubleshooting COMSEC 13V Line Filtering
(Sheet 2 of 2)



Section IV. MAINTENANCE PROCEDURES

3-13. GENERAL.

This section includes the operational check and the repair procedures. The operational check is used to verify the operation of a repaired mounting adapter. It is also used to verify the symptom of a faulty mounting adapter. It will identify the troubleshooting chart to be used. When a bad module is identified, replace it using the procedure in this section.

3-14. OPERATIONAL CHECK.

The operational check provides a step-by-step procedure for evaluating a mounting adapter. If the operational check is passed, the mounting adapter can be returned to service. If it does not, the bad module or troubleshooting chart to be used will be identified. The troubleshooting procedures are in section III.

The operational check is broken into steps. Each step verifies a particular function. Follow the instructions in the "Action" column. Check the response. If the response is correct, proceed with the next lettered step. When a STEP has been completed, proceed with the next STEP. A "no response" in the "Response" column means that any response is not of interest.

The switch settings for the test equipment are given in the "EQUIPMENT PRESETS" section of each tet setup figure.

WARNING

High voltage (200 V dc) is present at mounting adapter connector J1 and TP232 on the test adapter. Use caution when connecting the test setup and taking measurements to avoid personal injury.

Connect the test setups only when directed and with the power supply set to OFF. The large current capacity of the test power supply can cause personal injury. Verify the test setup before turning the power supply on.

Step 1. INPUT POWER CHECK

Action	Response
a. Remove the remote operation shorting bar. See para 3-16.	a. No response.
b. Connect equipment as shown in figure 3-2.	b. No response.
c. CB1: ON. Adjust lamp DS1 for maximum brightness.	c. Lamp DS1 lights. If not, go to chart 1 If CB1 trips to OFF, go to chart 2.

3-14. OPERATIONAL CHECK. Continued

Step 1. INPUT POWER CHECK Continued

Action	Response
d. Use DMM to check TP204.	d. DMM reading is 0 V dc. If a voltage is present, mounting adapter chassis (5A3) is bad.
e. Use a jumper cable to connect TP202 to TP203.	e. CB1 stays on. If CB1 trips to OFF, go to chart 3.
f. Use DMM to check TP204.	f. DMM reading is 26 to 28 V dc. If not, mounting adapter chassis (5A3) is bad.

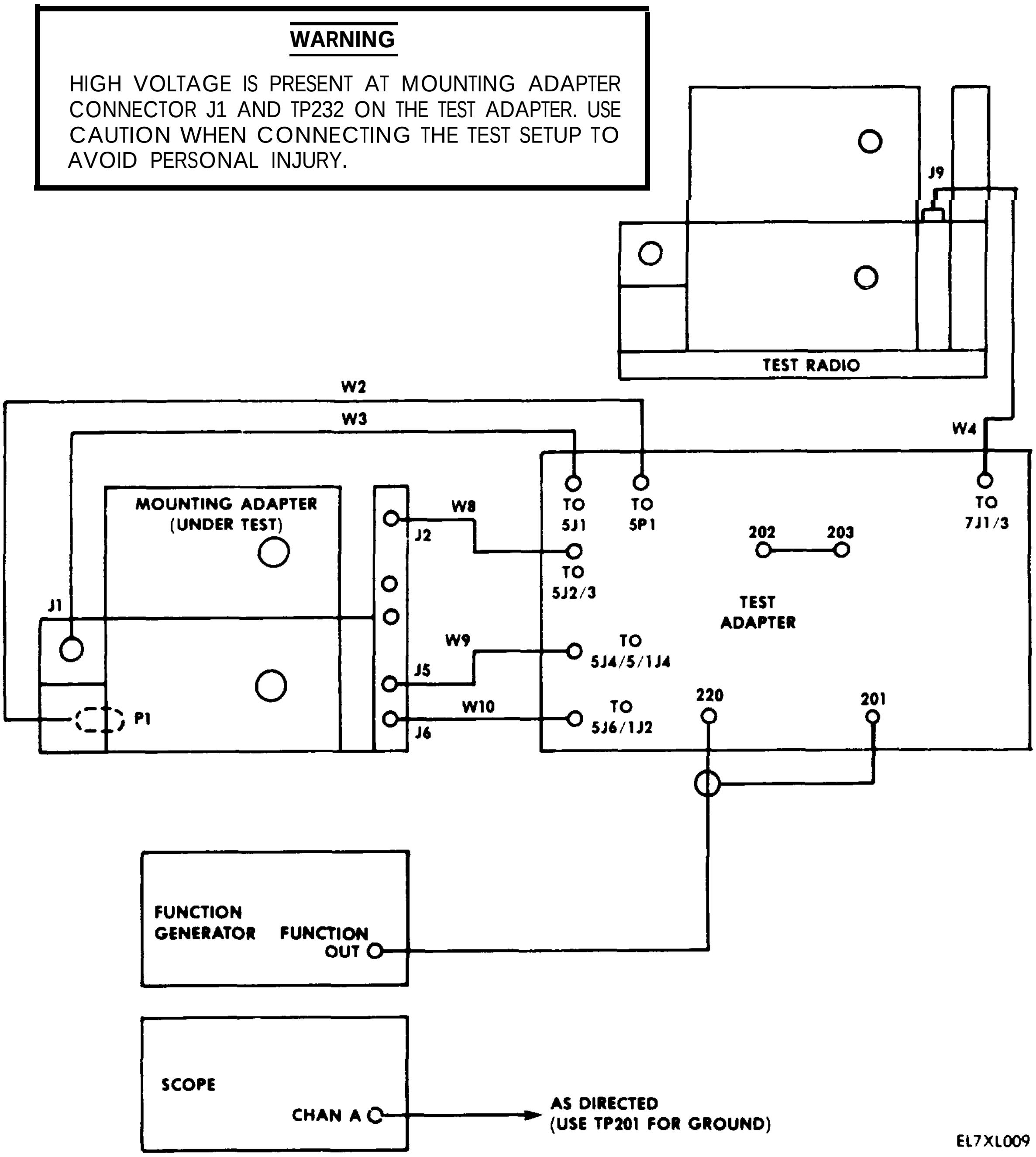
Step 2. POWER SUPPLY OUTPUT CHECK

Action	Response
a. Use DMM to check TP229.	a. DMM reading is 6.55 to 6.95 V dc. If not, go to chart 4.
b. Use DMM to check TP230.	b. DMM reading is 12.6 to 13.4 V dc. If not, power supply (5A1) is bad.
c. Use DMM to check TP231.	c. DMM reading is 25 to 29 V dc. If not, power supply (5A1) is bad.
WARNING 200 V dc is present at test adapter test point 232. Use caution to avoid personal injury.	
d. Use DMM to check TP232.	d. DMM reading is 180 to 220 V dc. If not, power supply (5A1) is bad.
e. Use scope to check ac voltage at TP229, TP230, and TP231.	e. Each should have an ac ripple voltage of less than 100 mV p-p. If the ripple voltage is greater than 100 mV p-p, power supply (5A1) is bad.
f. CB1: OFF.	

3-14. OPERATIONAL CHECK. Continued

Step 3. AUDIO AMPLIFIER CHECK

Action	Response
a. Connect equipment as shown in figure 3-3.	a. No response.
b. CB1: ON.	b. No response.
c. Use scope to check TP205.	c. Scope reading is 13 to 19 V p-p. If not, audio amplifier (5A2) is bad.
d. Use scope to check TP206.	d. Scope reading is less than 1.4 V p-p. If not, audio amplifier (5A2) is bad.
e. Use scope to check TP227. Connect TP236 to GND.	e. Scope reading is 60 to 78 V p-p. If not, audio amplifier (5A2) is bad.
f. Use jumper cable to connect TP221 to TP201. Use scope to check TP227.	f. Scope reading is less than 0.5 V p-p. If not, audio amplifier (5A2) is bad.
g. Disconnect jumper from TP221. Disconnect function generator from TP220 and connect to TP214.	g. No response.
h. Use scope to check TP206.	h. Scope reading is 13 to 19 V p-p. If not, audio amplifier (5A2) is bad.
i. Use scope to check TP205.	i. Scope reading is less than 1.4 V p-p. If not, audio amplifier (5A2) is bad.
j. Use scope to check TP227.	j. Scope reading is 60 to 78 V p-p. If not, audio amplifier (5A2) is bad.
k. Use scope to check TP227 when TP215, TP221 and TP213 are connected to TP201 one at a time using a jumper cable.	k. Scope reading is less than 0.5 V p-p when each of the test points are grounded. If not, audio amplifier (5A2) is bad.
l. CB1: OFF (both mounting adapters).	l. No response.
m. Connect equipment as shown in figure 3-4.	m. No response.
n. CB1: ON (both mounting adapters). Read scope.	n. Scope reading is -0.2 to 0.2 V dc. If not, audio amplifier (5A2) is bad.
o. Connect a juniper cable from TP221 to TP201.	o. Scope reading is 0.8 to 1.3 V dc. If not, audio amplifier (5A2) is bad.
p. Remove jumper cable connecting TP221 to TP201.	p. No response.
q. Move cable W9 from J5 to J4.	q. Scope reading is -0.2 to 0.2 V dc. If not, audio amplifier (5A2) is bad.



EQUIPMENT PRESETS

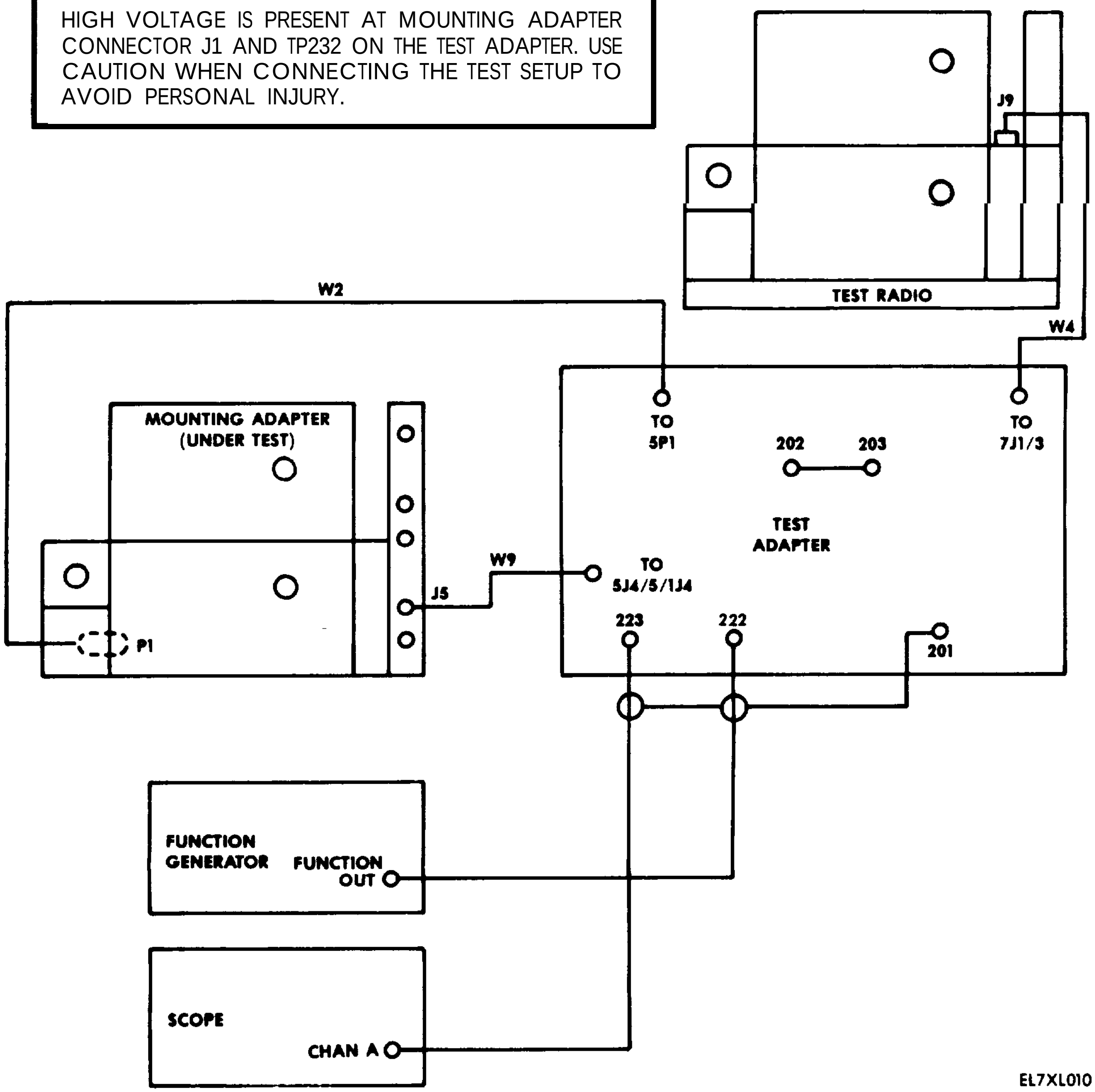
FUNCTION GENERATOR:
FREQ: 1 kHz (900 TO 1100 Hz)
LEVEL 16 V P-P (14 TO 16 V P-P)
FUNCTION: SINE WAVE

TEST RADIO:
CB1: ON

Figure 3-3. Audio Amplifier Checks Test Setup.

WARNING

HIGH VOLTAGE IS PRESENT AT MOUNTING ADAPTER CONNECTOR J1 AND TP232 ON THE TEST ADAPTER. USE CAUTION WHEN CONNECTING THE TEST SETUP TO AVOID PERSONAL INJURY.



EQUIPMENT PRESETS

FUNCTION GENERATOR
- FREQUENCY: 1800 Hz (1700 TO 1900 Hz)
- FUNCTION: SINE
- LEVEL: 300 mV P-P (250 TO 350 mV P-P)
- MODULATION: FM
- MOD FREQUENCY: 600 Hz (550 TO 650 Hz)
- MOD AMPLITUDE: MID-RANGE
- MOD FUNCTION: SINE

Figure 3-4. TACFIRE Detect Test Setup.

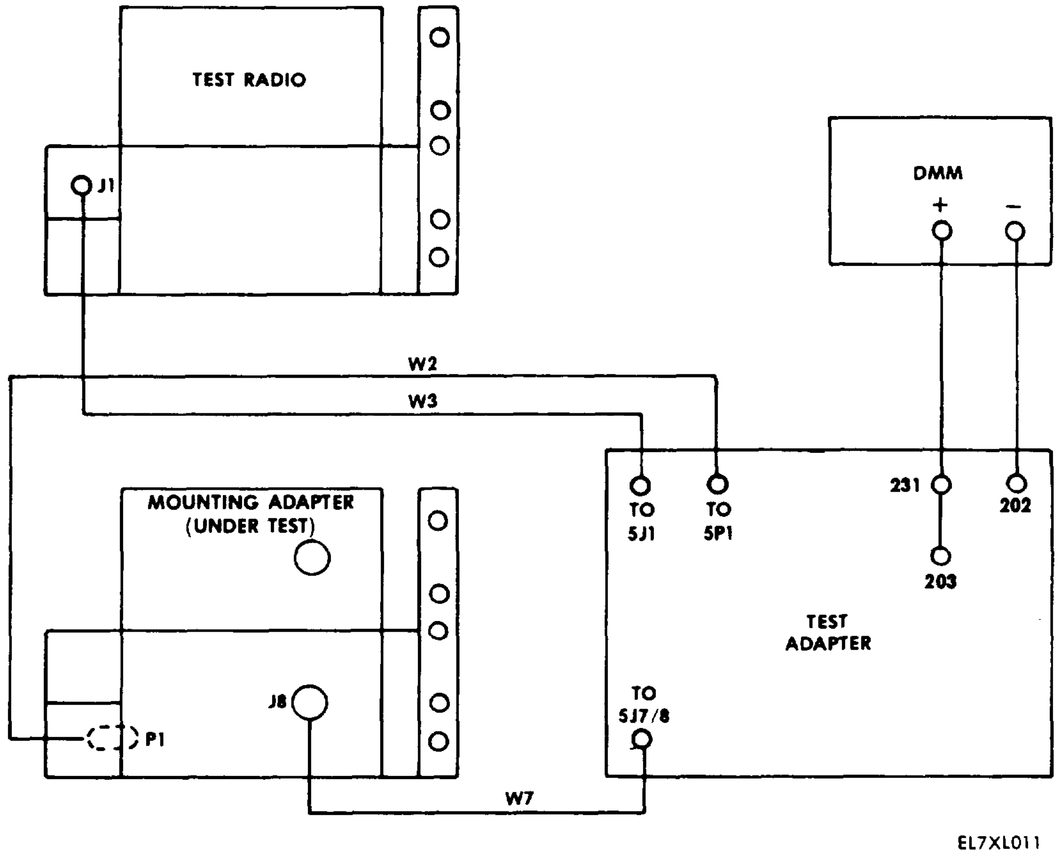
3-14. OPERATIONAL CHECK. Continued

Step 3. AUDIO AMPLIFIER CHECK Continued

Action	Response
q. Connect o jumper cable from TP221 to TP201.	q. No response.
r. Read scope.	r. Scope reading is 0.8 to 1.3 V dc. If not, audio amplifier (5A2) is bad.
s. CB1: OFF.	s. No response.
t. Connect equipment as shown in figure 3-5.	t. No response.
u. CB1: ON.	u. No response.
v. Record current measured by DMM.	v. Needed for reference.
w. Connect a jumper cable from TP217 to TP229. Read the DMM.	w. DMM reading is 200 to 800 mA greater than recorded in step v. If not, go to chart 5.
x. Remove jumper cable connecting TP217 to TP229.	x. No response.
y. Move cable W7 from J8 to J7.	y. No response.
z. Connect a jumper cable from TP217 to TP229. Read the DMM.	z. DMM reading is 200 to 800 mA greater than recorded in step v. If not, go to amplifier (5A2) is bad.
aa. CB1: OFF.	aa. No response.

WARNING

HIGH VOLTAGE IS PRESENT AT MOUNTING ADAPTER CONNECTOR J1 AND TP232 ON THE TEST ADAPTER. USE CAUTION WHEN CONNECTING THE TEST SETUP TO AVOID PERSONAL INJURY.



EQUIPMENT PRESETS

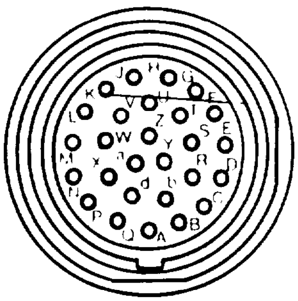
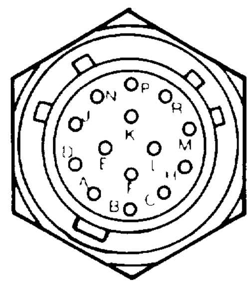
DMM:
FUNCTION: AMMETER
SCALE: 2000 mA

TEST RADIO
CB1: ON

Figure 3-5. Cipher Text Filter Test Setup.

3-14. OPERATIONAL CHECK. Continued

Step 4. POWER AMPLIFIER INTERFACE

<table>
<tr><th>Action</th><th>Response</th></tr>
<tr><td>J7, J8

EL7XL163</td><td>J1, J11

EL7XL164</td></tr>
<tr><td>a. Use the DMM to check for continuity between the following sets of connector pins:

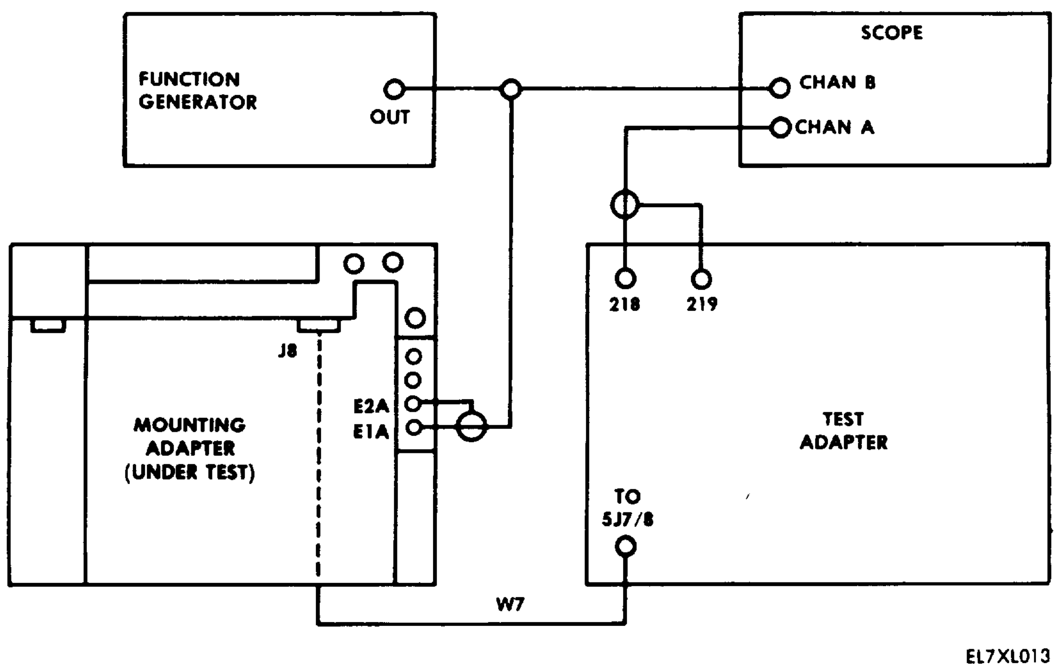
<table>
<tr><th>J1</th><th>J8</th></tr>
<tr><td>K</td><td>J</td></tr>
<tr><td>J</td><td>X</td></tr>
<tr><td>N</td><td>H</td></tr>
<tr><td>M</td><td>V</td></tr>
<tr><td>R</td><td>L</td></tr>
<tr><td>P</td><td>M</td></tr>
<tr><td>A</td><td>GND</td></tr>
</table></td><td>a. If any measure greater than 5 Ω, the mounting adapter chassis (5A3) is bad.</td></tr>
<tr><td>b. Use the DMM to check for continuity between the following sets of connector pins:

<table>
<tr><th>J11</th><th>J7</th></tr>
<tr><td>K</td><td>J</td></tr>
<tr><td>J</td><td>X</td></tr>
<tr><td>N</td><td>H</td></tr>
<tr><td>M</td><td>V</td></tr>
<tr><td>R</td><td>L</td></tr>
<tr><td>P</td><td>M</td></tr>
<tr><td>A</td><td>GND</td></tr>
</table></td><td>b. If any measure greater than 5 Ω, the mounting adapter chassis (5A3) is bad.</td></tr>
</table>

3-14. OPERATIONAL CHECK. Continued

Step 5. REMOTE CONTROL TRANSFORMERS CHECK

Action	Response
a. Connect equipment as shown in figure 3-6.	a. No response.
b. Read scope.	b. Scope reading is 325 to 625 mV p-p sine wave. If not, mounting adopter chassis (5A3) is bad.
c. Move cable W7 from JB to J7.	c. No response.
d. Move function generator output from E1A and E2A to El B and E2B. Read scope.	d. Scope reading is 375 to 625 mV p-p sine wave. If not, mounting adapter chassis (5A3) is bad.



EQUIPMENT PRESETS

FUNCTION GENERATOR:
FREQUENCY: 40 kHz (38 TO 42 kHz)
LEVEL: 500 mV p-p (450 TO 550 mV p-p)
FUNCTION: SINE WAVE

Figure 3-6. Remote Control Transformer Check Test Setup.

3-14. OPERATIONAL CHECK. Continued

Step 6. INTERCOM AUDIO PATH CHECK

Action	Response
a. Connect equipment as shown in figure 3-7.	a. No response.
b. Read DMM.	b. DMM reading is 21.6 k ohms to 26.4 k ohms. If not, audio amplifier (5A2) is bad.
c. Move cable W9 from J5 to J4.	c. No response.
d. Use DMM to check resistance between TP212 and TP222.	d. DMM reading is 21.6 k ohms to 26.4 k ohms. If not, audio amplifier (5A2) is bad.
e. Install shorting bar.	e. Operational check complete.

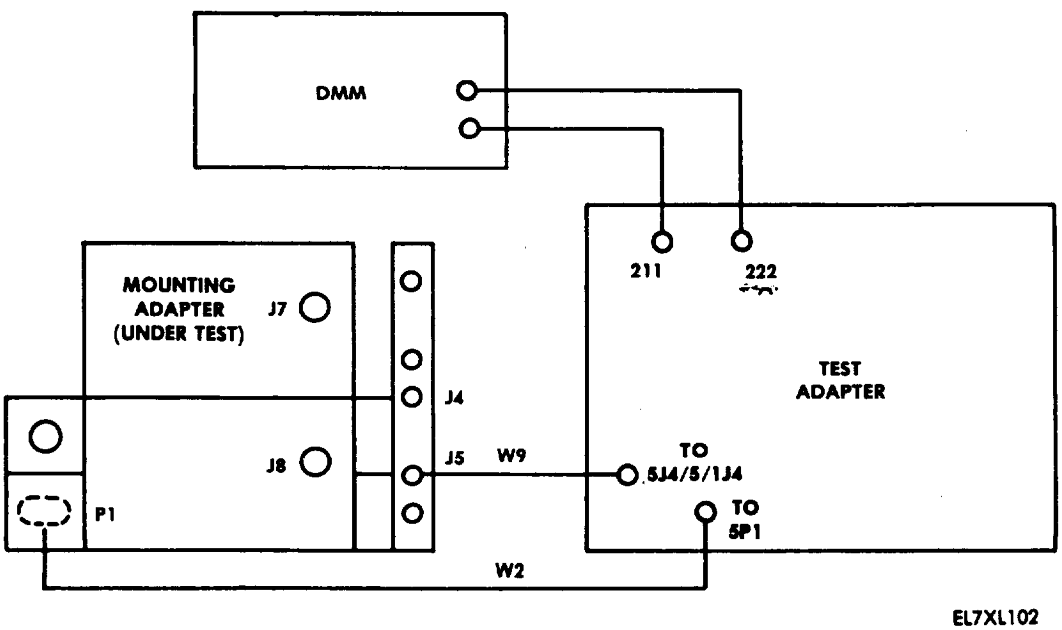


Figure 3-7. Intercom Audio Path Check Test Setup

3-15. REPAIR PROCEDURES.

The following instructions apply to all repair tasks unless otherwise noted in the procedure.

a. Begin procedure with mounting adapter switch CB1 set to OFF.

b. Disconnect any external cables connected to mounting adapter.

c. Inspect mounting adapter. Replace mounting adapter chassis if the mounting adopter is physically damaged, such as with a broken connector.

CAUTION

Steps marked with HCP must be performed exactly as written. They are critical in maintaining the nuclear hardness of the mounting adapter. Seals must not be damaged. All screws must be torqued to the limits specified in Appendix B.

d. Mounting adapter must be tested after the replacement of a module.

3-16. REMOVAL AND INSTALLATION OF 5A3TB2 SHORTING BAR.

The 5A3TB2 must be removed prior to testing the mounting adapter. It must be installed prior to returning the mounting adapter to service.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

ITEM	ACTION	REMARKS
a. Mounting adapter	Set on its right side with bottom toward you.	
b. Six captive screws on access cover (1)	Fully loosen. See figure 3-8.	
c. Access cover and seal (2)	Lift off of mounting adapter.	
d. Shorting bar (3)	Check its position, If it is properly installed, skip to step e. Otherwise, loosen and remove screws securing shorting bar. Install it as needed.	For local operation, it should connect 5A3TB2-1 to 5A3TB2-2. For remote operation or testing, it must not connect 53TB2-1 to 5A3TB2-2.
e. HCP Access cover and seal	Check seal. If damaged, replace cover. Otherwise, set in place and tighten screws. Torque to 12 in-lb.	

3-16. REMOVAL AND INSTALLATION OF 5A3TB2 SHORTING BAR. Continued

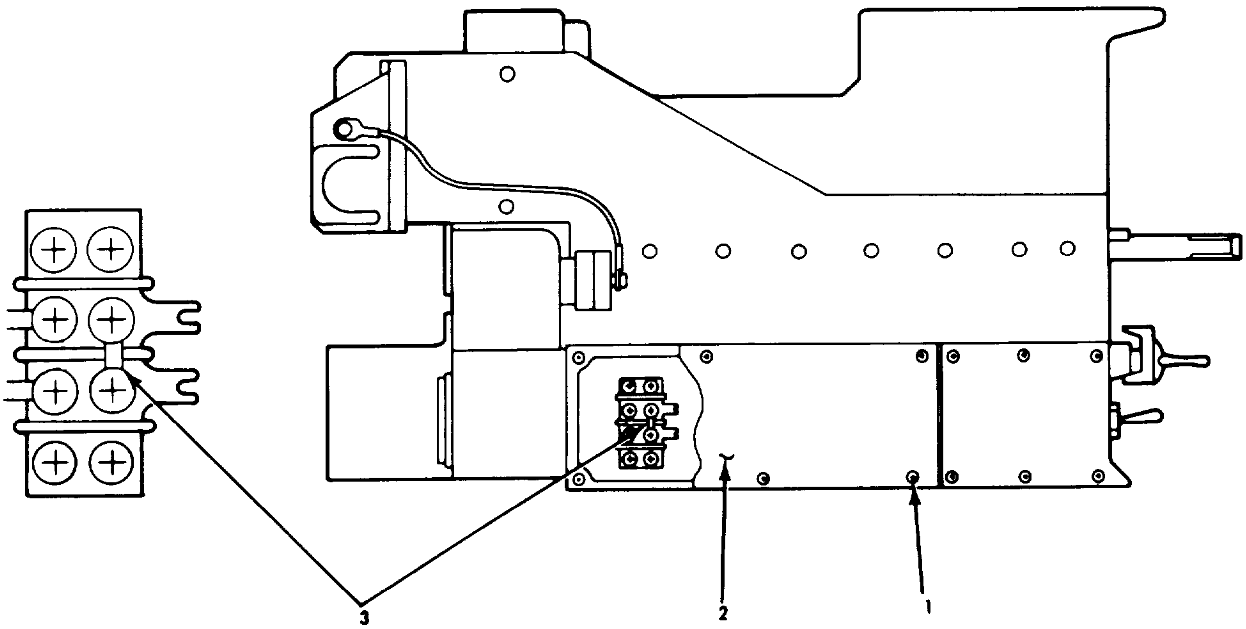


Figure 3-8. Shorting Bar Installation.

3-17. REPLACEMENT OF POWER SUPPLY (5A1).

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Mounting adapter	Set on work surface with back toward you.	
b. 17 captive screws	Fully loosen.	
c. Power supply (1)	Set power supply on work surface. See figure 3-9.	
d. Six screws on TB1 (2)	Loosen and remove.	
e. Power supply (1)	Remove.	

3-17. REPLACEMENT OF POWER SUPPLY (5A1). Continued

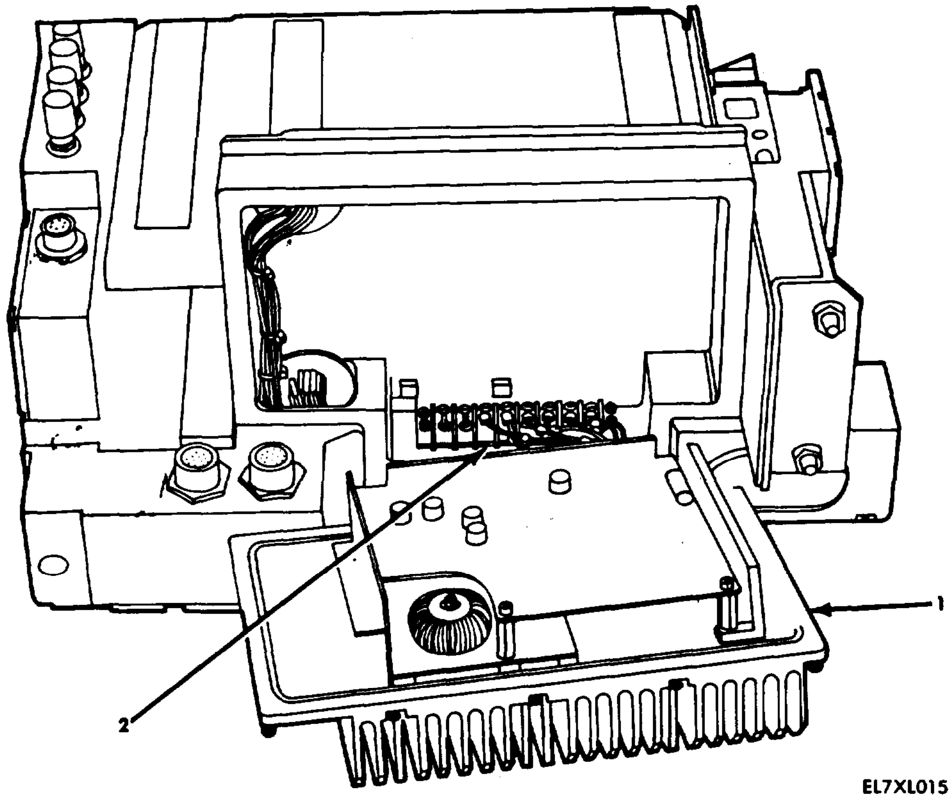


Figure 3-9. Power Supply Replacement.

ITEM	ACTION	REMARKS
INSTALLATION		
f. Power supply (1)	Set on work surface so that wires can be connected to TB1.	
g. Power supply wires	Connect to TB1 (2). Wire labeled "1" connects to TB1 position 1. Repeat for all six wires.	
h. Six screws on TB1 (2)	Tighten.	
i. HCP Power supply and 17 captive screws	Hold power supply in place on mounting adopter and tighten screws. Torque to 12 in-lb.	

3-18. REPLACEMENT OF AUDIO AMPLIFIER (5A2).

Tools:

Flat tip screwdriver
Cross tip screwdriver
Torque adapter
Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Mounting adapter	Set on work surface with right side toward you.	
b. 15 captive screws and access cover	Fully loosen screws. Remove access cover.	
C. 11 screws and washers (7)	loosen and remove screws and washers securing audio amplifier. See figure 3-10.	
d. Audio amplifier (8)	Pull out of mounting adapter enough to gain access to connectors P2 and P3.	
e. Connector P2 (1)	Unscrew and disconnect from J2.	
f. Connector P3 (2)	Unscrew and disconnect from J1.	
g. Audio amplifier	Remove.	
INSTALLATION		
h. Audio amplifier	Hold in place.	
i. Connector P3	Connect to J1 and tighten screws.	
j. Connector P2	Connect to J2 and tighten screws.	
k. Audio amplifier	Hold in place in mounting adapter.	
l. 11 screws and washers	Install and tighten.	These were removed in step c.
m. HCP Access cover	Hold in place and tighten 15 captive screws using torque screwdriver. Torque to 12 in-lb.	

3-18. REPLACEMENT OF AUDIO AMPLIFIER (5A2). Continued

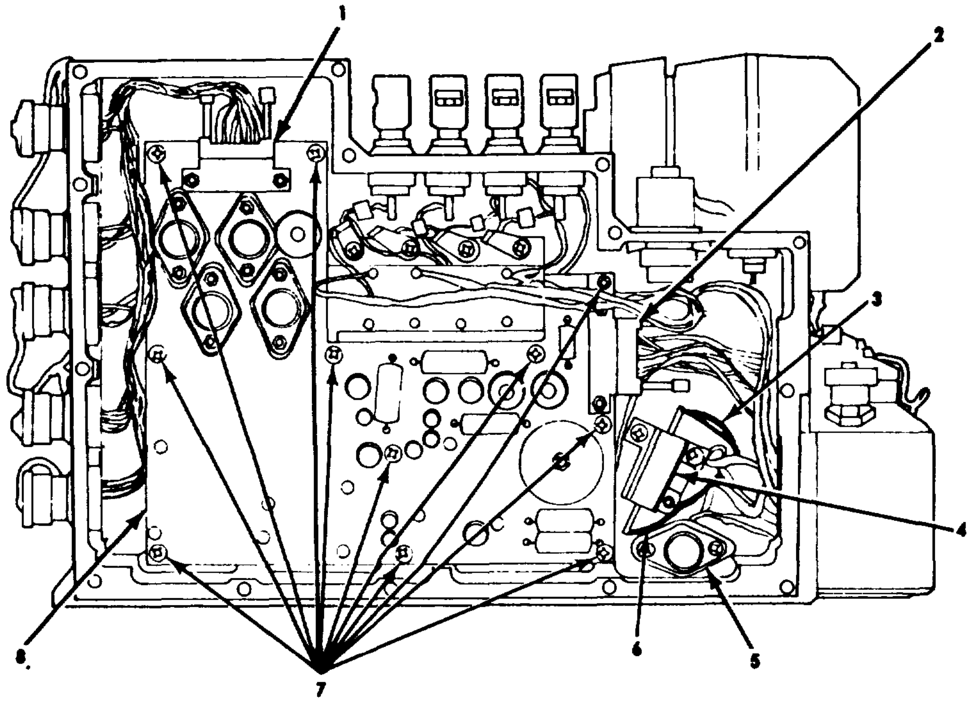


Figure 3-10. Audio Amplifier Replacement.

3-19. REPLACEMENT OF MOUNTING ADAPTER CHASSIS (5A3).

Tools:

Flat tip screwdriver
Cross tip screwdriver
Torque adapter
Torque wrench

REFERENCES:

Paragraph 3-17 for removal and installation of the power supply (5A1)
Paragraph 3-18 for removal and installation of the audio amplifier (5A2)

ITEM	ACTION	REMARKS
a. HCP Power supply (5A1)	Remove from faulty mounting adopter chassis. Install in good mounting adapter chassis.	
b. HCP Audio amplifier (5A2)	Remove from faulty mounting adapter chassis. Install in good mounting adapter chassis.	

3-20. TRANSISTOR 5A3Q1 REPLACEMENT.

Tools:

Flat tip screwdriver
Cross tip screwdriver
Torque adapter
Torque wrench
Soldering iron

Expendable Supplies:

Solder
Alcohol
Q-tips
Insulation sleeving

References:

Paragraph 3-18 for removal and installation of audio amplifier access cover.

ITEM	ACTION	REMARKS
REMOVAL		
a. Mounting adapter	Set on work surface with right side toward you.	
b. Audio amplifier access cover	Remove.	
c. Transistor Q1 (5)	loosen and remove two screws, washers, and terminal lug holding transistor Q1. See figure 3-10. Pull transistor Q1 free of mounting adapter.	
d. Transistor Q1.	Unsolder wires attached to Q1 after noting their orientation. Remove insulator bushing and inspect. Replace, If necessary. Remove insulator sleeves from both leads of Q1 and inspect. Replace, if necessary.	
INSTALLATION		
e. Transistor Q1 (5)	Install insulator sleeves and insulator bushing on good transistor. Solder wires onto transistor leads in same position as noted in step d. Place transistor in position over screw with correct orientation.	Before and after soldering, clean wires and leads with alcohol and Q-tip.
f. Two screws, washers, and terminal lug	Install and tighten screws.	These were removed in step c.
g. HCP Audio amplifier access cover	Hold in place and tighten 15 captive screws using torque screwdriver. Torque to 12 in-lb.	

3-21. RESISTOR 5A3R1 REPLACEMENT.

Tools:

Flat tip screwdriver
Cross tip screwdriver
Torque adapter
Torque wrench
Soldering iron

Expendable Supplies:

Solder
Alcohol
Q-tips
Insulation sleeving

References:

Paragraph 3-18 for removal and installation of audio amplifier access cover.

ITEM	ACTION	REMARKS
REMOVAL		
a. Mounting adapter	Set on work surface with right side toward you.	
b. Audio amplifier access cover	Fully loosen 15 captive screws on access cover. Remove access cover and seal.	
c. Resistor R1 (4)	Unsolder yellow wire (3) and black wire (6) connected to resistor R1. See figure 3-10.	
d. Resistor R1	Loosen and remove two screws holding resistor R1. Remove resistor R1.	
INSTALLATION		
e. Resistor R1	Hold in place and install two screws removed in step d. Tighten screws.	
f. Resistor R1	Solder yellow (3) and black (6) wires to resistor R1 removed in step c. See figure 3-10.	Before and after soldering clean leads and wires with alcohol and Q-tips.
g. HCP Audio amplifier access cover	Hold in place and tighten 14 captive screws using torque screwdriver. Torque to 12 in-lb.	

3-22. LAMP SOCKET FOR DS1 REPLACEMENT.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

Expendable supplies:

Solder
Q tips
Alcohol

ITEM	ACTION	REMARKS
REMOVAL		
a. Mounting adopter	Set on work surface with left side up.	
b. Access cover (guard)	loosen and remove four screws on access cover. Remove cover and seal.	
c. CB1	loosen nut and remove nut, lock washer, ON/OFF plate, locking ring, and CB1.	
d. Lamp socket	Unsolder wires connected to lamp socket.	
e. Nut	loosen and remove nut and lock washer.	
f. Lamp socket	Remove.	
INSTALLATION		
g. Lamp socket, lock washer, and nut	Set in place and tighten nut.	
h. Lamp socket	Solder wires to lamp socket. These were unsoldered in step c.	Before and after soldering, clean wires and leads with alcohol and Q-tips.
i. CB1	install CB1, lock ring, ON/OFF plate, lock washer, and nut. Tighten nut.	
j. HCP Access cover and six screws	Hold in place and tighten screws removed in step b. Torque to 12 in-lb.	

3-23. PA BRACKET REPLACEMENT.

Tools required:

Cross tip screwdriver
Flat tip screwdriver
Torque adapter
Torque wrench
Wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Power supply	Remove. Do not disconnect from TB1. Set on work bench.	
b. Bracket (6)	Pencil a line (8) on the mounting base along the front edge of the bracket. Remove two cross tip screws (1), flat washers (2), lock washers (3) and nuts (4). See figure 3-11.	
c. Guide pin (5) and dust cap holder (7)	Remove and replace as necessary.	
INSTALLATION		
d. Bracket	Thread screws with lock washers, flat washers, and nuts through mounting base and bracket.	
e. Bracket	Move forward until front edge is even with alinement line. Hold in place and tighten screws and nuts.	
f. HCP Power supply	Install	

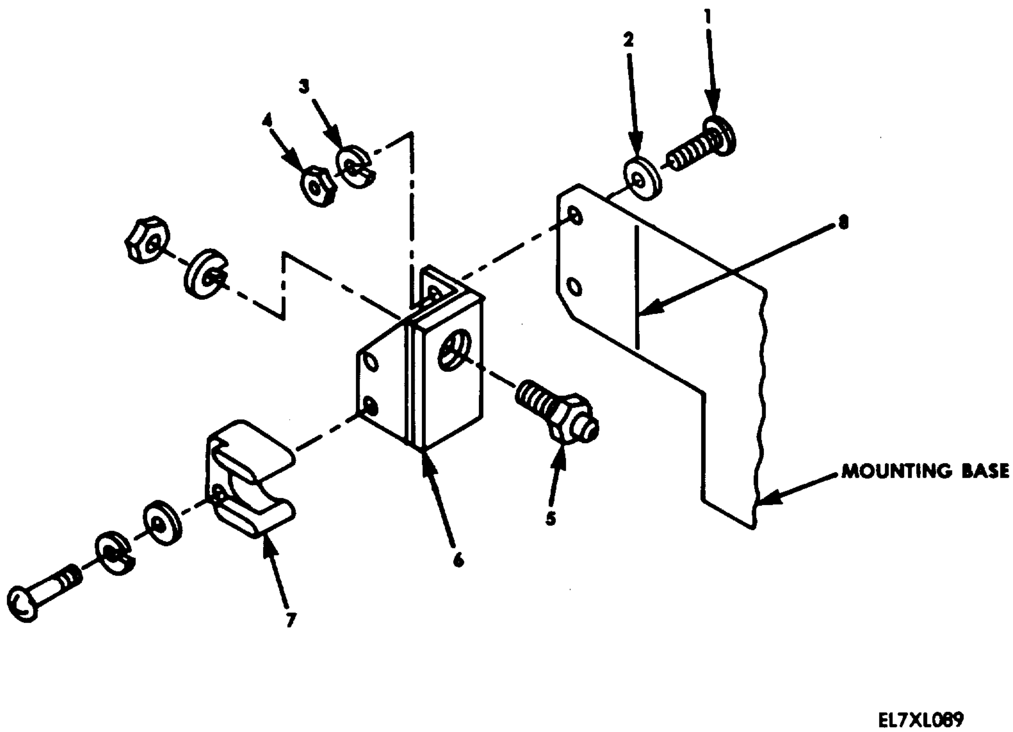


Figure 3-11. PA Bracket Replacement

Section V. PREPARATION FOR STORAGE OR SHIPMENT

3-24. GENERAL INFORMATION.

Pack the mounting adapter and any removed modules in approved shipping containers.

CHAPTER 4

AMPLIFIER, RADIO FREQUENCY AM-7238/VRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

The power amplifier increases the 4-W output of the rt to 50 W for long range communication. It has no controls or indicators. When properly installed in a vehicular radio, operation is automatic.

The power amplifier separates into three parts:

Case, Amplifier, RF 6A1 (power amplifier case)

Circuit Card Assembly, Decoder Control 6A2 (decoder control)

Electronic Component Assembly-Amplifier, Radio Frequency 6A3 (power amplifier heat sink)

The power amplifier case contains filters, electronic switches, and the three external connectors. The decoder control provides the signal interface to the rt. The power amplifier heat sink contains the rf amplifier that provides the rf gain.

4-2. OVERALL FUNCTIONAL DESCRIPTION.

'Figure 4-1 is a block diagram of the power amplifier. During high power transmit, the rf signal from the rt is input at connector J2. It is routed through an rt switcn to the amplifier. The amplifier increases the power level to 50 W. The amplified signal is routed through one of three filters to reduce harmonic and spurious signals. From there, it goes through a second rf switch and out to the ANT connector (J1).

During low power transmit, the rf signal is routed from J2 through the two rf switches to J1. During receive, the same path is followed in reverse.

Control signals from the rt identify the frequency band and the rf path required. The decoder control activates the high voltage switch drivers based on the control signals from the rt. The switch drivers select the switch positions that determine the rf path.

Feedback signals are provided during high power transmit. Internally, an automatic level control (ALC) signal is used to control the rf gain. If the VSWR is too high, the rf gain is reduced and the sidetone disable line to the rt is activated. The decoder control also drives the rt SIG display.

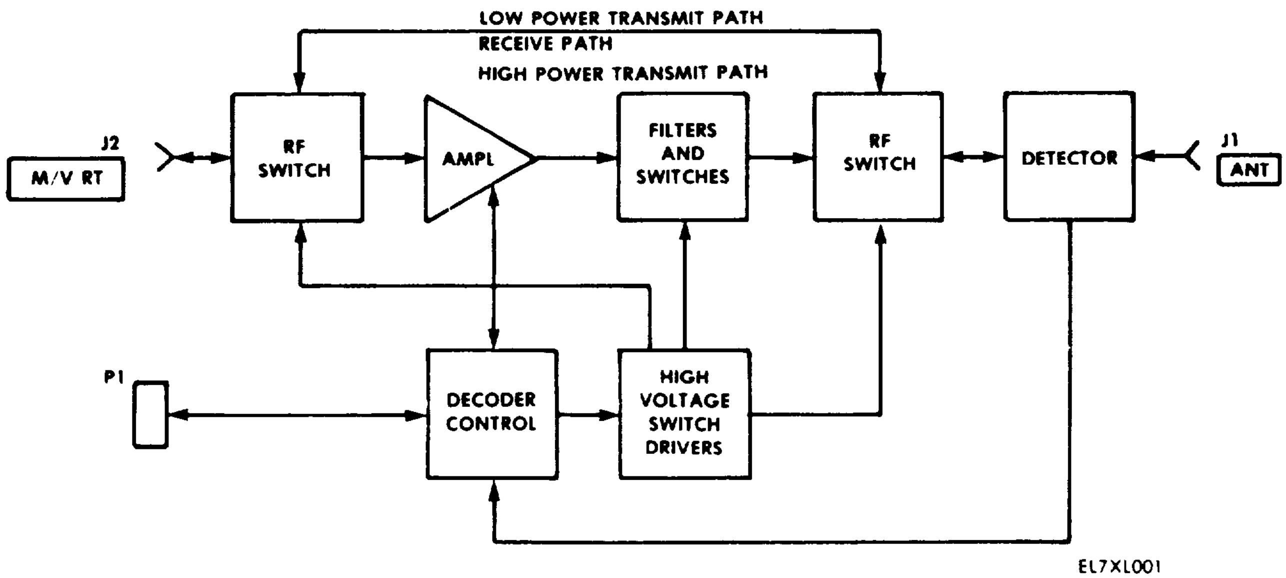


Figure 4-1. Power Amplifier Block Diagram.

4-3. INPUT CONTROL SIGNAL PATH.

The power amplifier requires four control signals from the rt. See FO-15. When the rt RF switch is set to PA, the HIGH POWER XMT line is set to logic 1. One of three filter lines will also be set to logic 1 depending on the frequency. The power amplifier frequency bands are as follows:

FREQUENCY BAND	FILTER
30 To 43 MHz	A
43 To 61.5 MHz	B
61.5 To 88 MHz	C

The decoder control (6A3) drives the switching FET. When the HIGH POWER XMT line is set to logic 1, the TRANSMIT output line is set to 13 V dc (12.5 to 13.5 V dc). The RECEIVE line is the opposite. When the HIGH POWER XMT line is at 0 V dc, the RECEIVE line is set to 13 V dc. When the gate (G) of a switching FET is at 13 V dc, current flows from the source (S) to the drain (D). In the power amplifier case (6A1). the drain of the FET is held at 200 V dc when the FET is not conducting. When the FET conducts, the voltage drop across the resistor in the decoder control increases. The voltage at the FET drain drops to near 0 V. The 0 V level sets the electronic switches in the input and output filter switches (6A1A2 and 6A1A1). The filters (all except FL14) ore used to isolate the rf energy.

The FILTER A, FILTER B, and FILTER C paths operate the some way. The logic level from the rt is converted to 0 or 13 V dc by the decoder control. The output of the decoder control drives the switching FET. The output from the FET sets the input and output filter switch.

4-4. RF SIGNAL PATHS.

a. High Power Transmit Path. When the HIGH POWER XMT control line is at logic 1, the control circuits set the rf switches in the output filter switch (6A1A1) to the XMT position. See FO-15. The rf signal is input at connector J2. It passes through El to the first rf switch. With the switch as shown in FO-15, the signal is output at E3. It travels through cables W1 and W3 to the power amplifier heat sink (6A3) at E1. The power amplifier heat sink provides 12 dB of rf gain. (1 dB is lost in the filters and switches.) It is a push-pull amplifier with input and output impedance matching. The output at ES goes through cables W4 and W2 into the input filter switch at E1. It switches the signal through one of three low-pass filters in filter FL14. The low-pass filter attenuates any harmonics or spurious signals outside the filter's frequency range. The output of the low-pass filter is routed to the second rf switch and out to connector J1 through the power detector. The power detector measures the output power level to provide an ALC feedback signal. It also measures the reflected power to provide a VSWR feedback signal.

b. Low Power Transmit Path and Receive Path. When the rt RF switch is set to LO, M, or HI, the HIGH POWER XMT input line is held at logic 0. The HIGH POWER XMT line will also be at logic 0 any time the radio is not transmitting. This causes the two electronic rf switches in the output filter switch (4A1A1) to be set to the RCV position. This basically connects connector J1 to connector J2 so that signals can pass between the rt and the antenna.

4-5. FEEDBACK AND OUTPUT SIGNAL PATHS.

The two main feedback signals originate at the power detector in the output filter switch (6A1A1). See FO-15. The forward power is checked and is used for the automatic level control (ALC) signal. The reverse or reflected power is checked and is used for the VSWR signal. Both of these are 0 to 4 V dc signals and are fed bock to the decoder control (6A2). The AK signal is used to provide the POWER LEVEL signal that goes back to the rt to drive the SIG display. It is also a 0 to 4 V dc signal. The VSWR and ALC signals are compared. If the VSWR is greater than 5:1, the SIDETONE DISABLE line is set to 6.5 V dc. Adjustments are provided on the decoder control to adjust the sidetone disable limits.

The power amplifier heat sink (6A3) uses the 27 V dc power from the constant current source circuit of 6A1Q1 and 6A1Q2. Most of the current is supplied from Q1 through filter FL1. It is used to regulate the rf gain of the power amplifier heat sink. The gain is reduced if any of the following occur.

The rf power output exceeds its maximum limit.

The VSWR exceeds 5:1.

The temperature of the power amplifier exceeds 71° C (160° F).

The temperature of the power amplifier is sensed by two thermistors in the power amplifier heat sink. They are connected in series between E4 and ground. The decoder control monitors the resistance at pin 24 of J1.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

4-6. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-7. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required for I(DS), see the maintenance allocation chart. It is Appendix B in TM 11-5828-898-28-1 or -2.

4-8. REPAIR PARTS.

Repairs parts ore listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering I(DS) maintenance for this equipment.

Section III. TROUBLESHOOTING

4-9. GENERAL.

This section provides the troubleshooting procedures used to fault isolate o defective power amplifier. The troubleshooting information is presented in the form of flow charts. They systematically get from a symptom to the bad module.

4-10. TROUBLESHOOTING.

Troubleshooting is done on a faulty power amplifier. To determine if a power amplifier is faulty, and the required troubleshooting steps, proceed as follows:

a. When an amplifier is received from unit maintenance, inspect it for damage. Repair any damage before proceeding with testing. See section IV if repairs are necessary.

b. Perform the operational check in section IV. This will direct you to the correct troubleshooting flow chart.

c. Troubleshoot the power amplifier using the flow chart. It will identify the defective module.

d. Replace the defective module. Follow the procedures in section IV.

e. Verify the repair. Perform the operational check in section IV that foiled. If it passes, then continue with the rest of the operational check. When the operational check is passed, the power amplifier can be returned for use.

4-11. TEST PRECAUTIONS AND NOTES.

WARNING

Set the test power supply to OFF before connecting or disconnecting a test setup. Current capacity is high enough to cause personal injury. Equipment con also be damaged if core is not token.

High voltage (200 V) is present at several places within the power amplifier. Use caution to ovoid personal injury.

High rf energy (50 watts) is present at J1 and several places within the power amplifier when the handset PTT switch is pressed. Use caution to ovoid personal injury.

CAUTION

Static electricity and stray voltages con damage the decoder control (6A2). Use on antistatic pad on the work surface and wear a grounded wrist strop when troubleshooting.

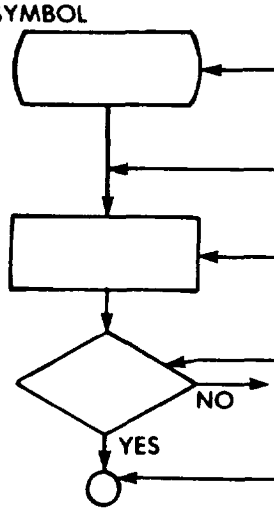
High voltage (200 V) and high rf energy (50 watts) is present in the power amplifier during testing. Do not disassemble with power applied to the power amplifier.

NOTE

The principles of operation section, functional block diagrams, and FO-15 con be used to fault isolate unusual problems not covered in the troubleshooting procedures.

4-12. EXPLANATION OF SYMBOLS AND NOTES.

SYMBOL



NOTES

EXPLANATION

Test Procedure Start: (Rectangle with rounded sides) Indicates start of the test procedure and contains a brief description of the symptom of trouble.

Test Procedure Flow Line: (Heavy line and arrowhead) Indicates direction of the procedure flow.

Test Procedure Instruction: (Rectangle) Provides instructions for doing a specific test.

Decision: (Diamond) Indicates that a decision must be made (YES or NO) in answer to a question about the previous test. Path token depends on the answer (YES or NO).

Connector: (Circle) Directs user to an entry point of another chart. Contains on entry number that is some as entry number of other chart and a sheet number (Sh. No.) that indicates the number of follow-on pages.

Notes Column: Presents additional information, such as: more specific instructions about how to do a test, cautions and warnings that must be observed when doing a test, and additional information about what to do after doing a test. Also provides references to appropriate circuit diagrams.

4-13. TROUBLESHOOTING FLOW CHARTS.

The following charts ore included:

Chart	Symptom
1	27 V dc overcurrent or low resistance at P1 pin D.
2	Rf power output too high or too low (88 MHz).
3	Rf power output too high or too low (55 MHz).
4	Rf power output too high or too low (33 MHz).
5	Receive output too low.
6	Sidetone disable faulty, sidetone absent.
7	Sidetone disable faulty, sidetone present.

Figures 4-2, 4-3, and 4-4 illustrate the test points used inside the power amplifier. The detailed procedures for disassembling the power amplifier for troubleshooting or repair ore provided in section IV.

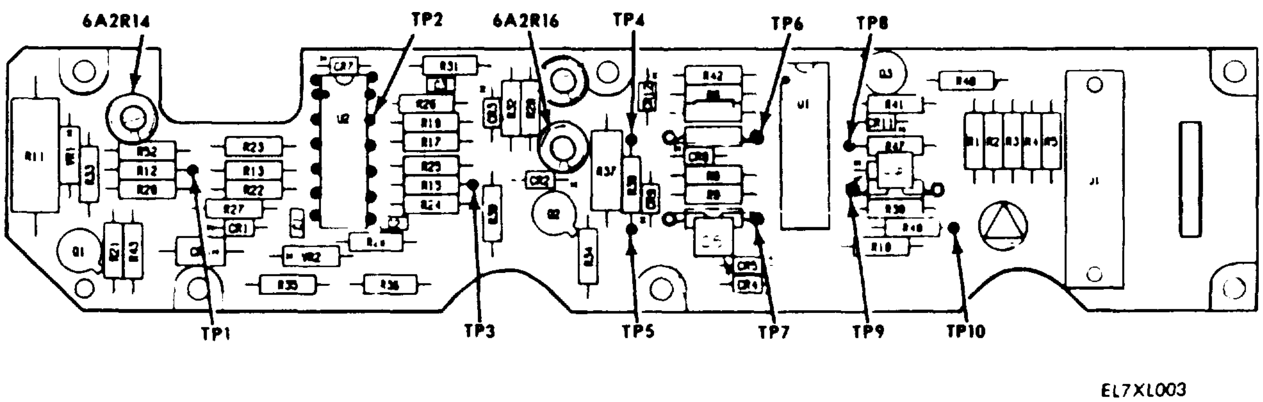


Figure 4-2. Test Point Locations for Decoder Control (6A2).

4-13. TROUBLESHOOTING FLOW CHARTS. Continued

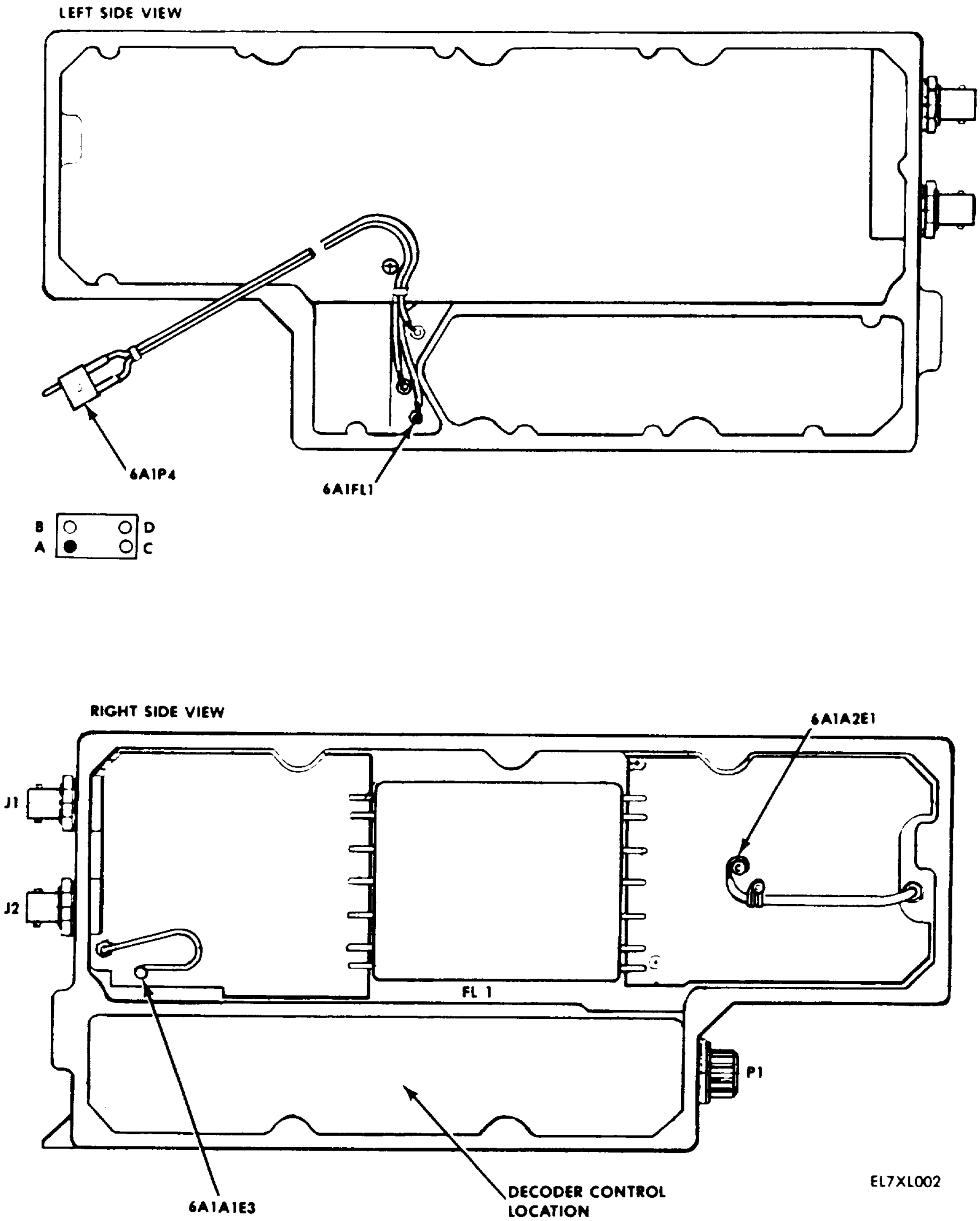


Figure 4-3. Test Point Locations in Power Amplifier Case (6A1)

4-13. TROUBLESHOOTING FLOW CHARTS. Continued

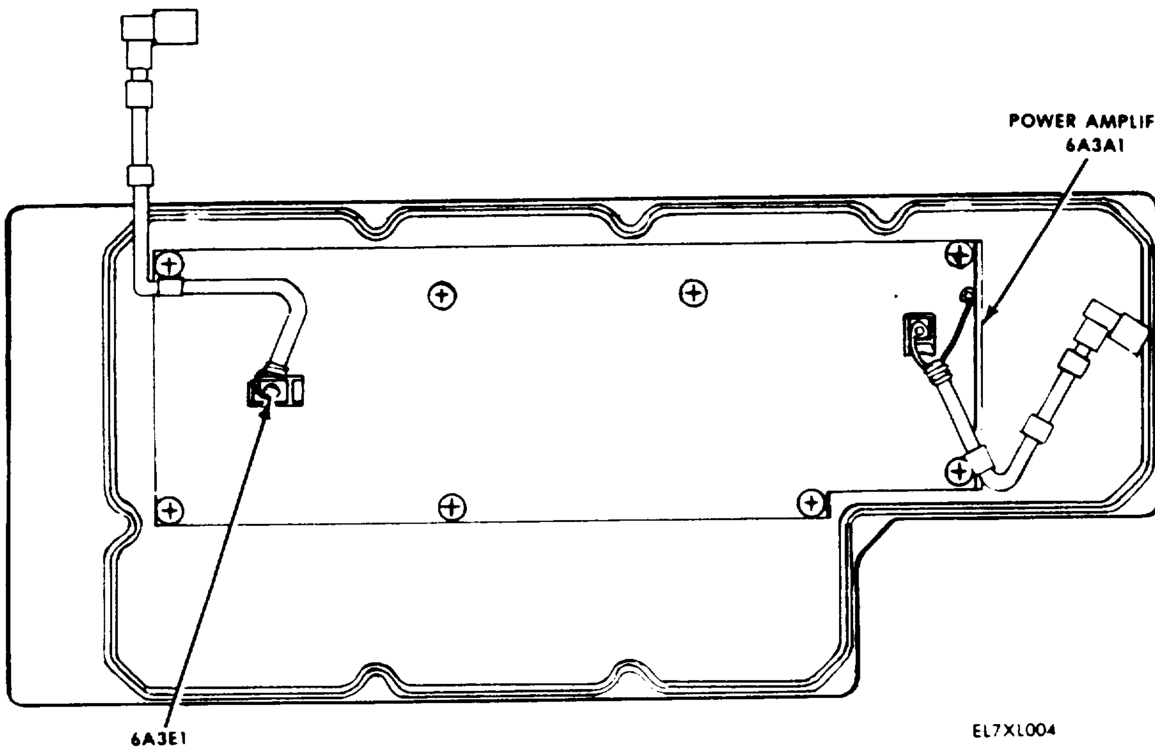
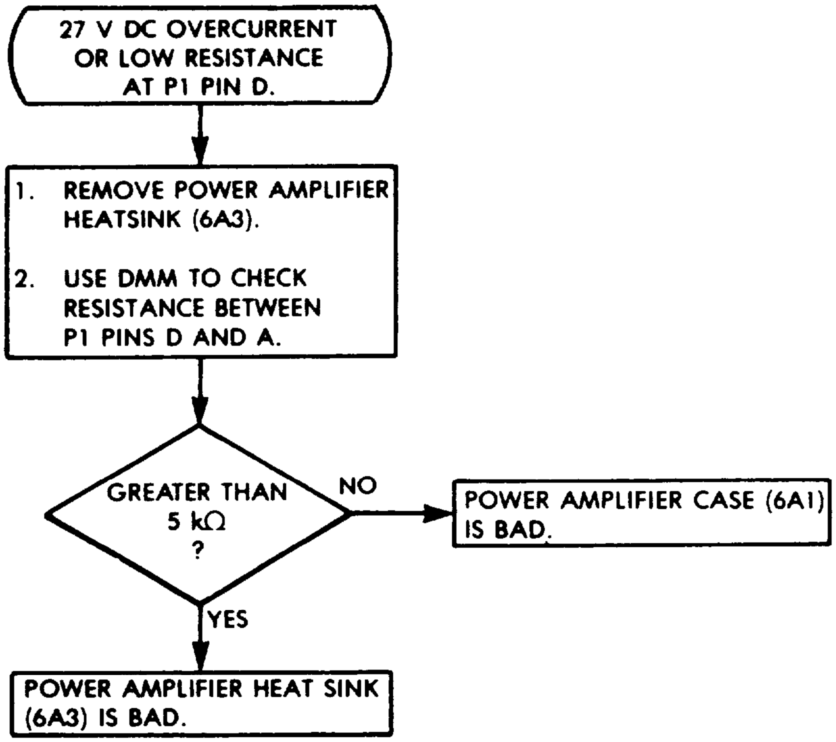


Figure 4-4. Test Point Locations for Power Amplifier Heat Sink (6A3)

4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 1

Troubleshoot Primary Power Overcurrent
(Sheet 1 of 1)



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

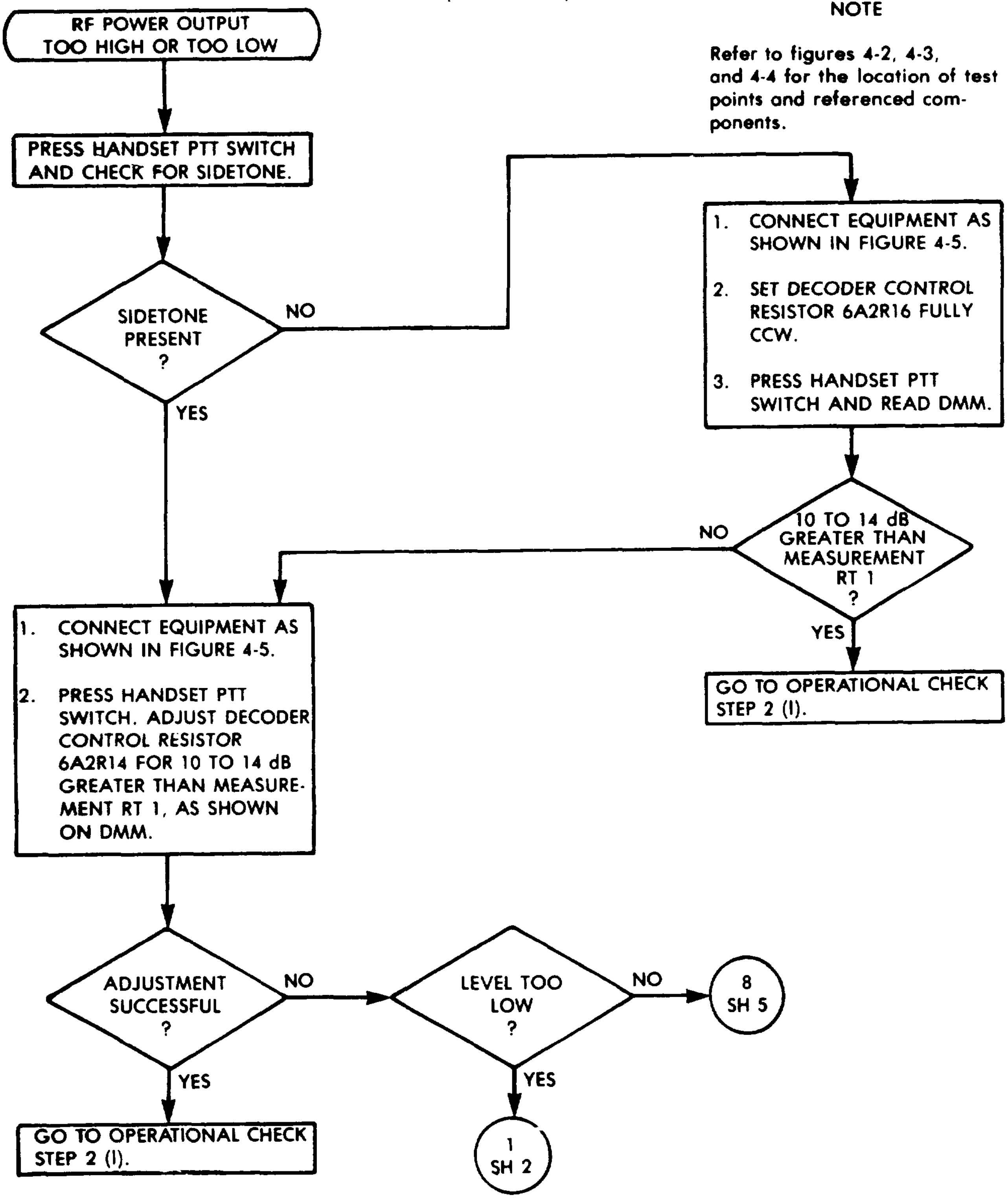
Chart 2

Troubleshoot RF Output At 88 MHz (Sheet 1 of 6)

(Sheet 1 of 6)

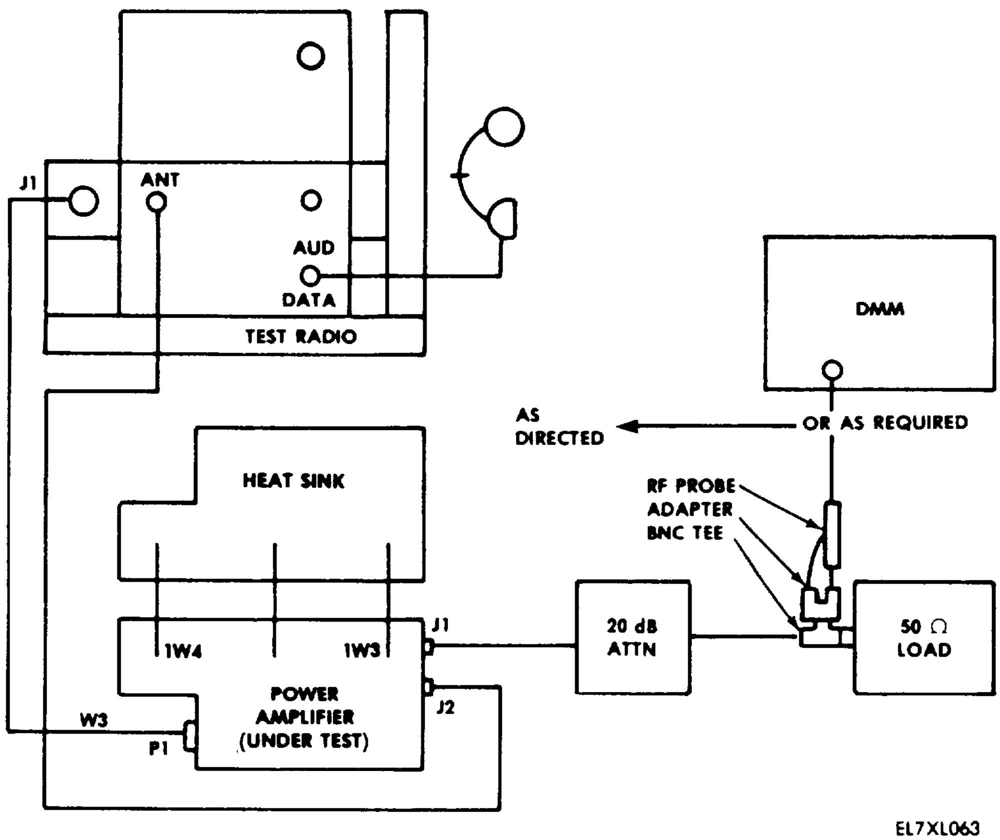
NOTE

Refer to figures 4-2, 4-3, and 4-4 for the location of test points and referenced components.



WARNING

HIGH VOLTAGE AND HIGH RF ENERGY IS PRESENT IN THE POWER AMPLIFIER AND THE TEST SETUP. USE CAUTION TO AVOID PERSONAL INJURY.



EQUIPMENT PRESETS

TEST RADIO:

CB1: ON
FCTN: SQ ON
MODE: SC
DATA: OFF
CHAN: DO NOT CHANGE FROM OPERATIONAL CHECK

DMM:

SET FOR dBm, 50 Ω REF

POWER AMPLIFIER:

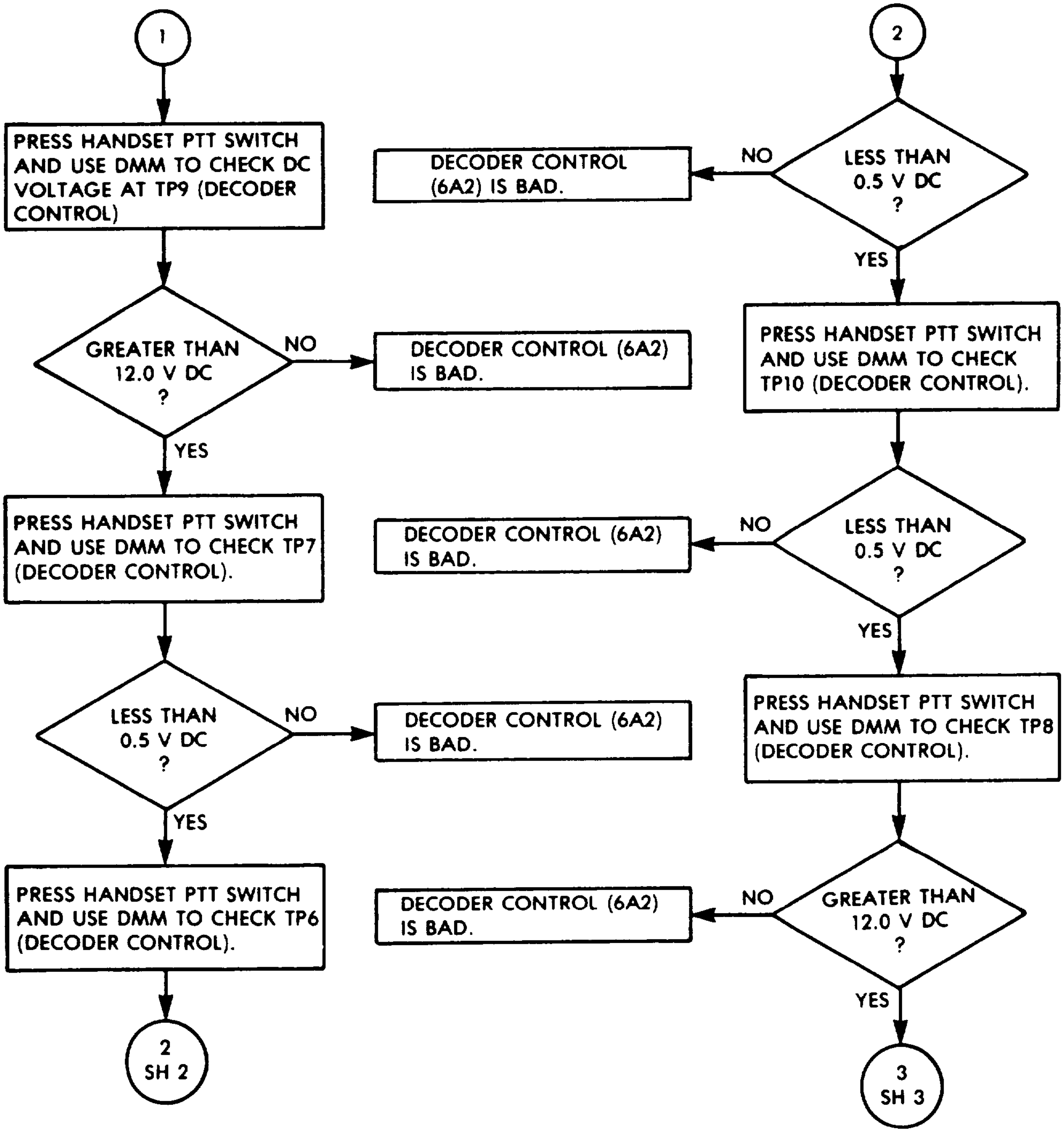
DISASSEMBLE TO GAIN ACCESS TO TEST POINTS. DO NOT DISCONNECT CABLES.

Figure 4-5. Troubleshooting Test Setup.

4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 2

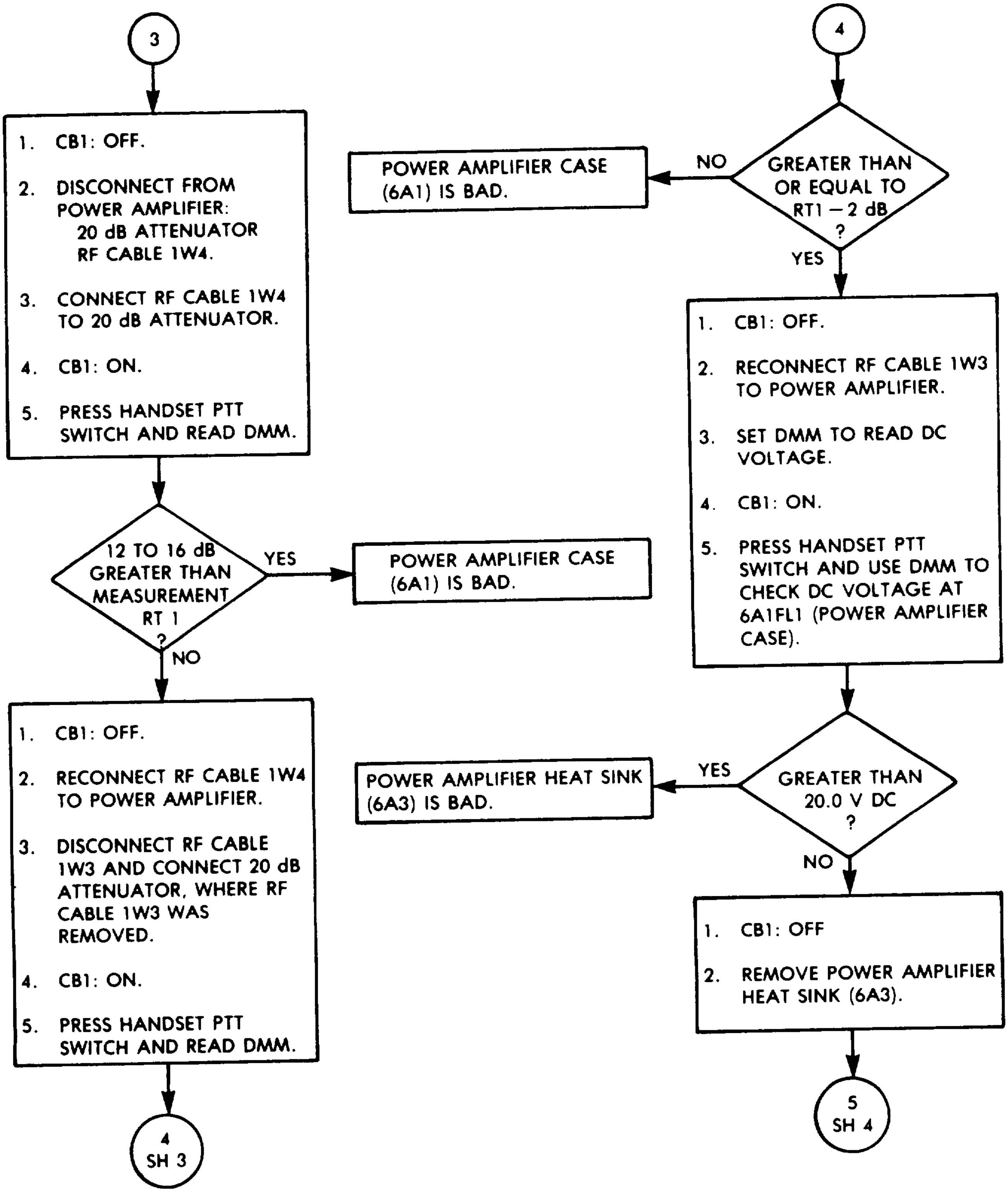
Troubleshoot RF Output At 88 MHz
(Sheet 2 of 6)



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 2

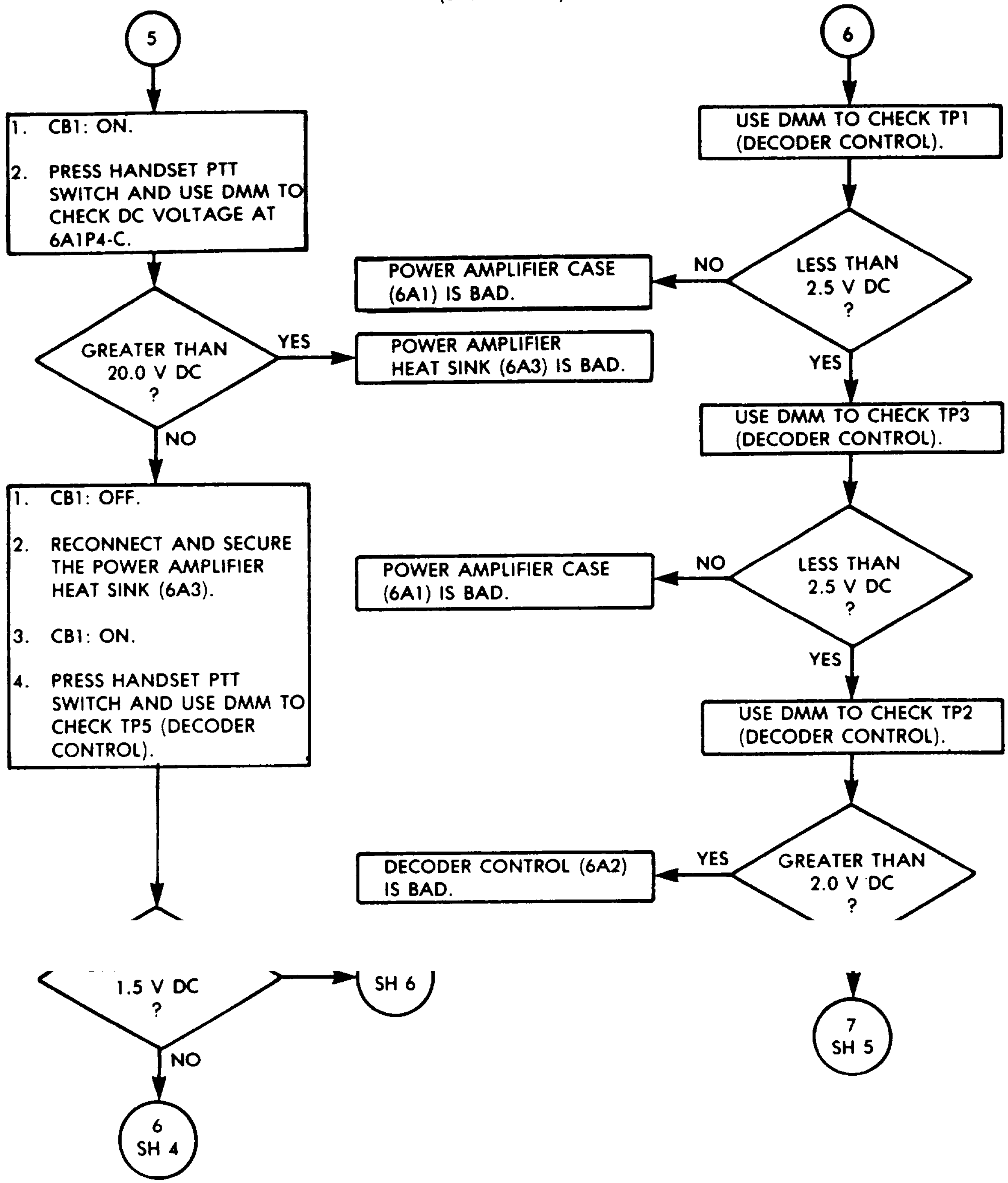
Troubleshooting RF Output At 88 MHz
(Sheet 3 of 6)



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 2

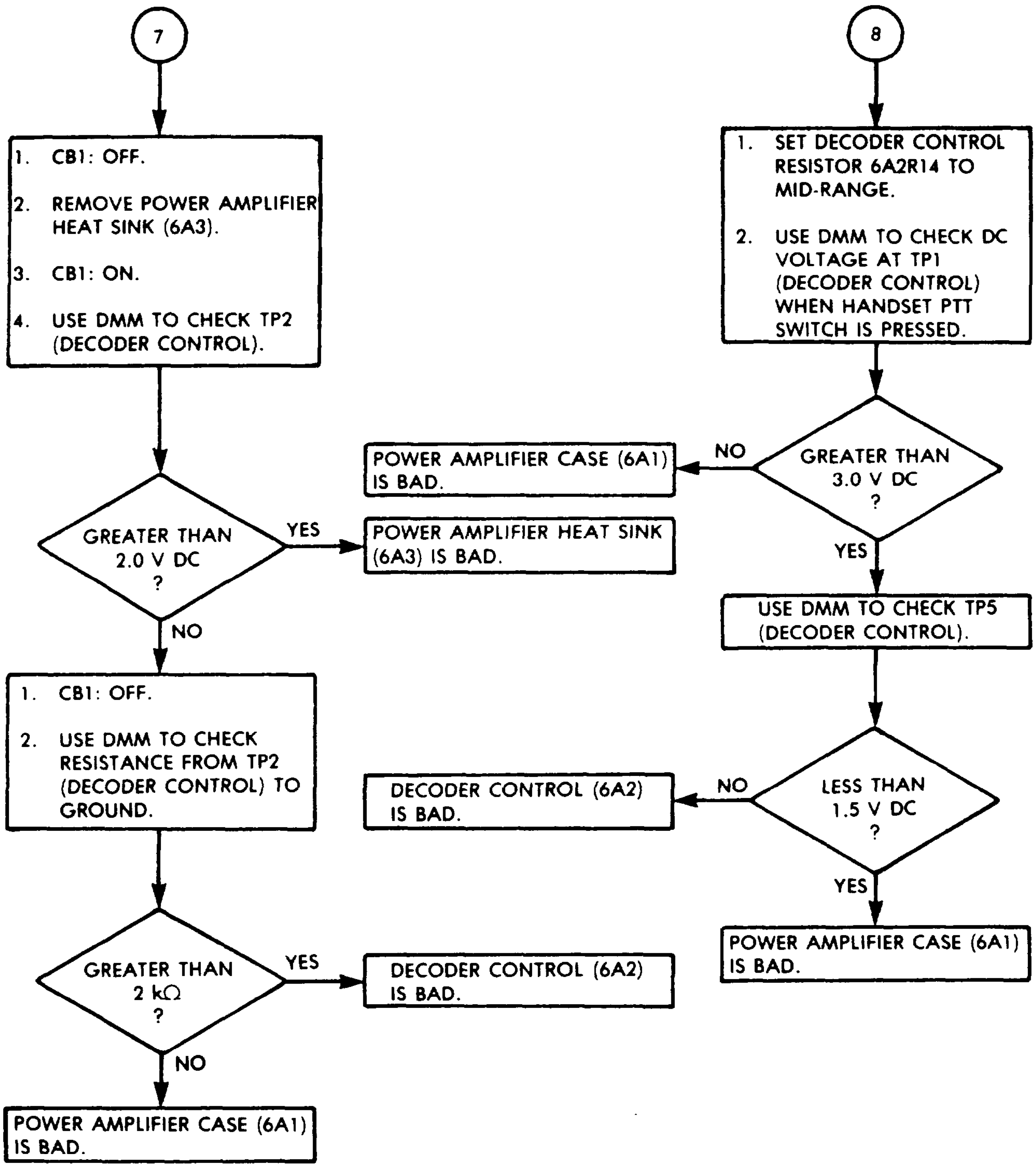
Troubleshooting RF Output At 88 MHz
(Sheet 4 of 6)



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 2

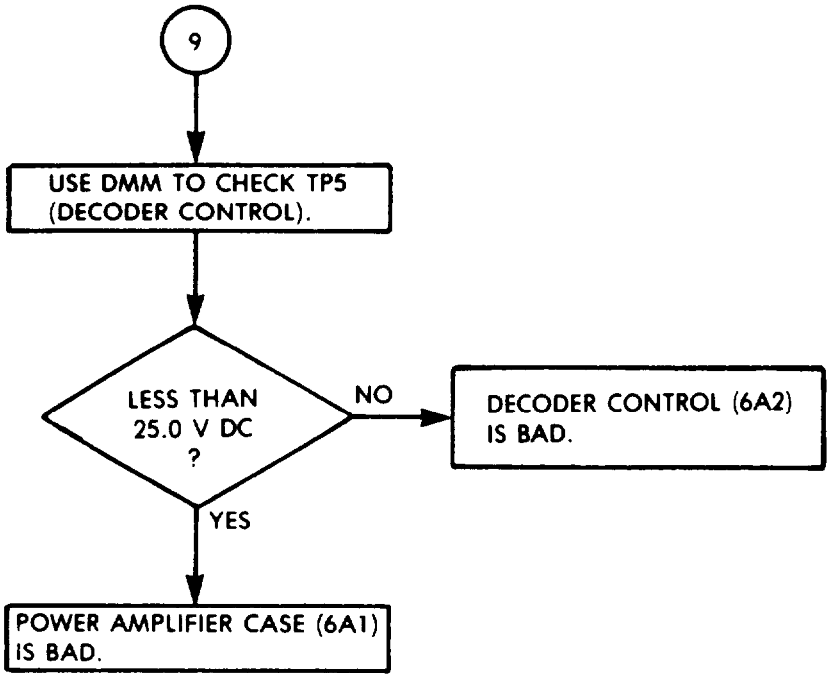
Troubleshooting RF Output At 88 MHz
(Sheet 5 of 6)



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 2

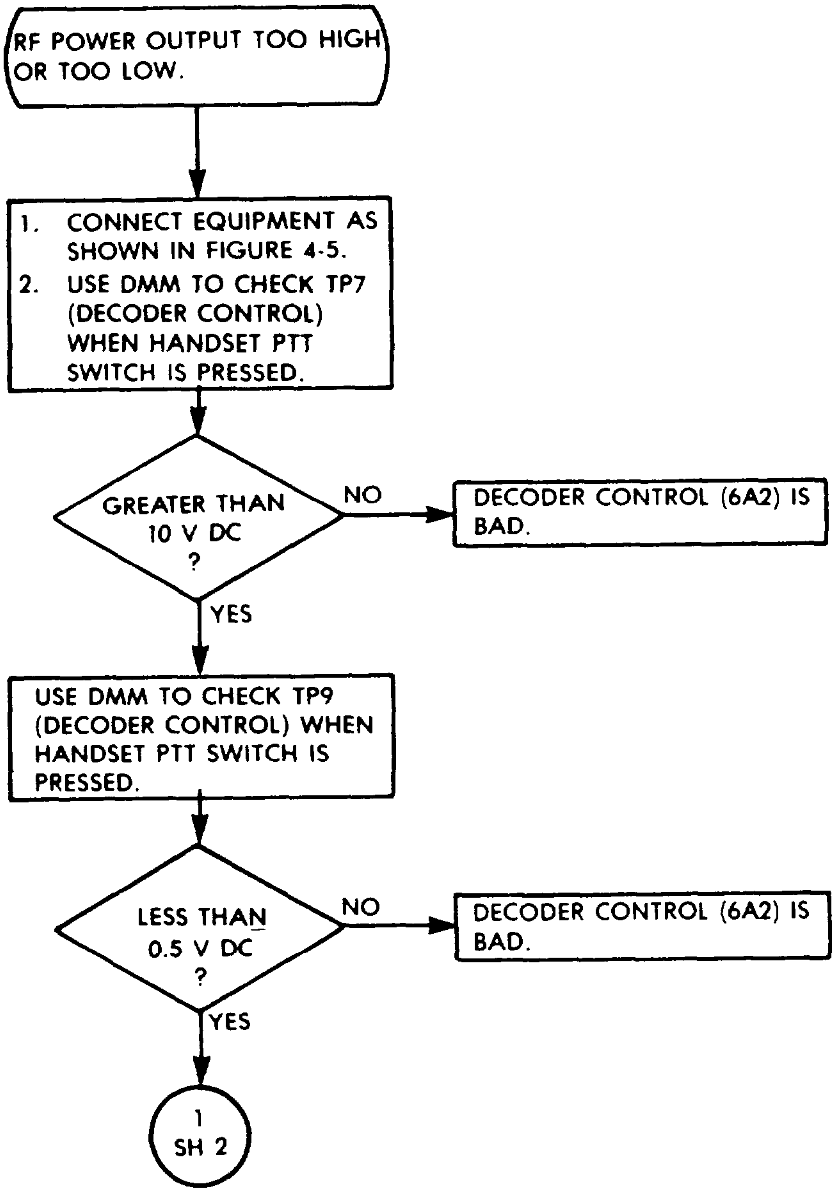
Troubleshooting RF Output At 88 MHz
(Sheet 6 of 6)



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 3

Troubleshoot RF Power Output at 55 MHz
(Sheet 1 of 2)



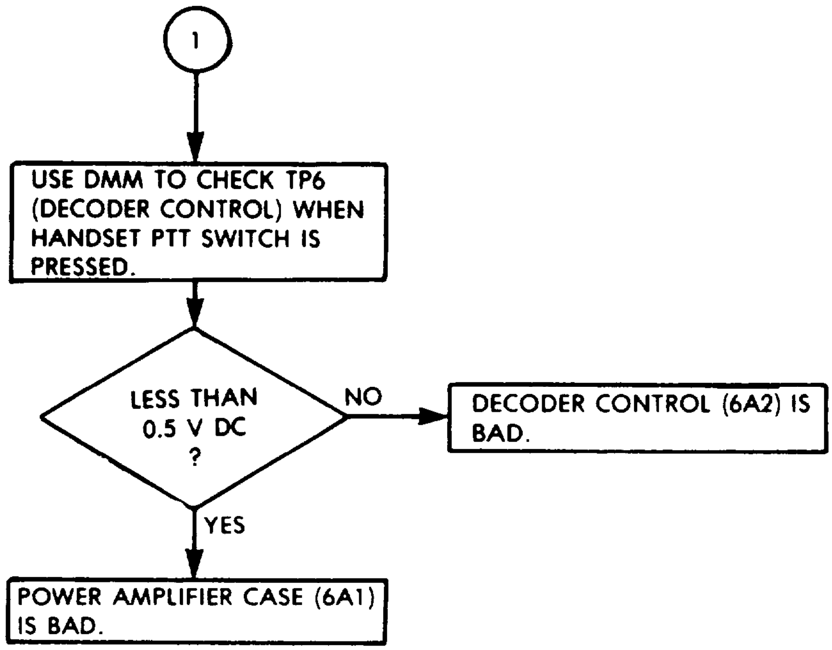
NOTE

Refer to figure 4-2 for the location of test points.

4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 3

Troubleshoot RF Power Output at 55 MHz
(Sheet 2 of 2)



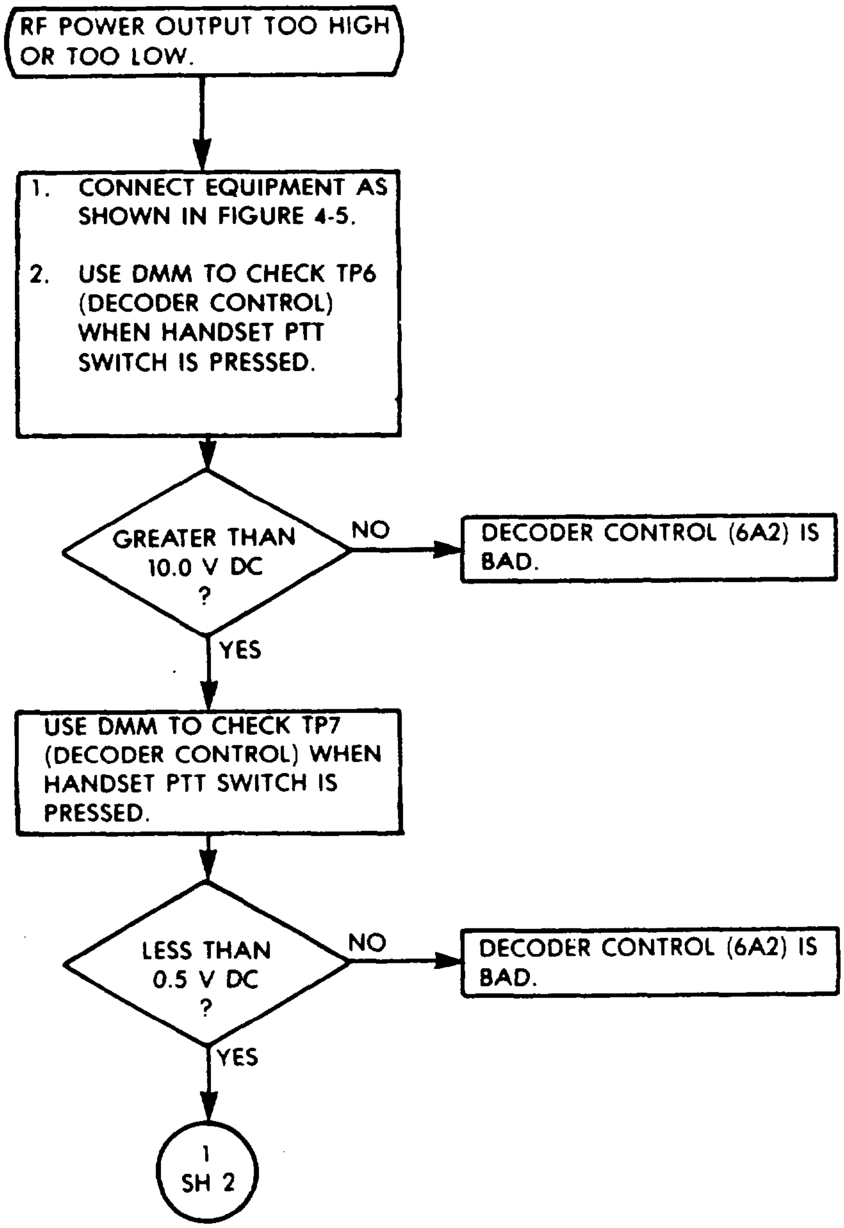
4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 4

Troubleshoot RF Power Output at 33 MHz
(Sheet 1 of 2)

NOTE

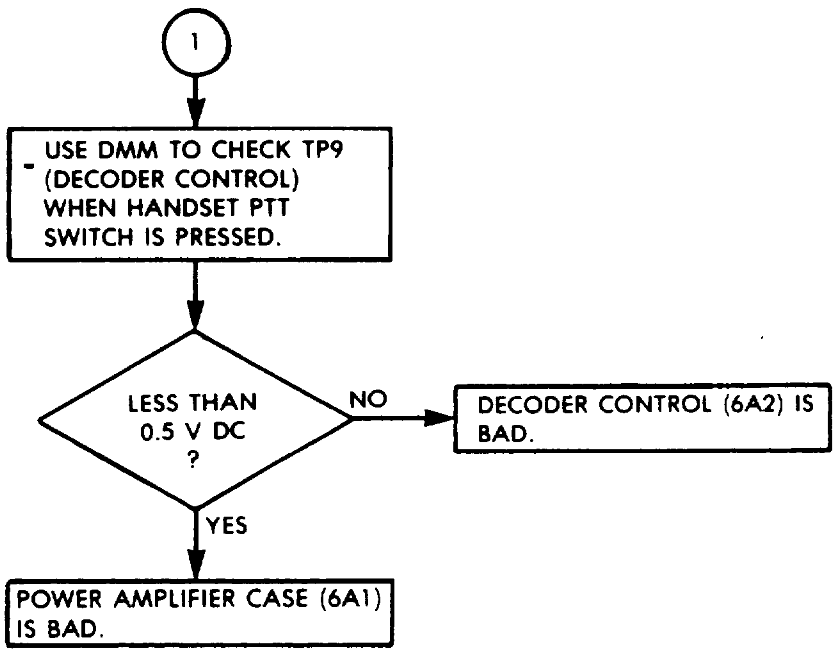
Refer to figure 4-2 for the location of test points.



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 4

Troubleshoot RF Power Output at 33 MHz
(Sheet 2 of 2)



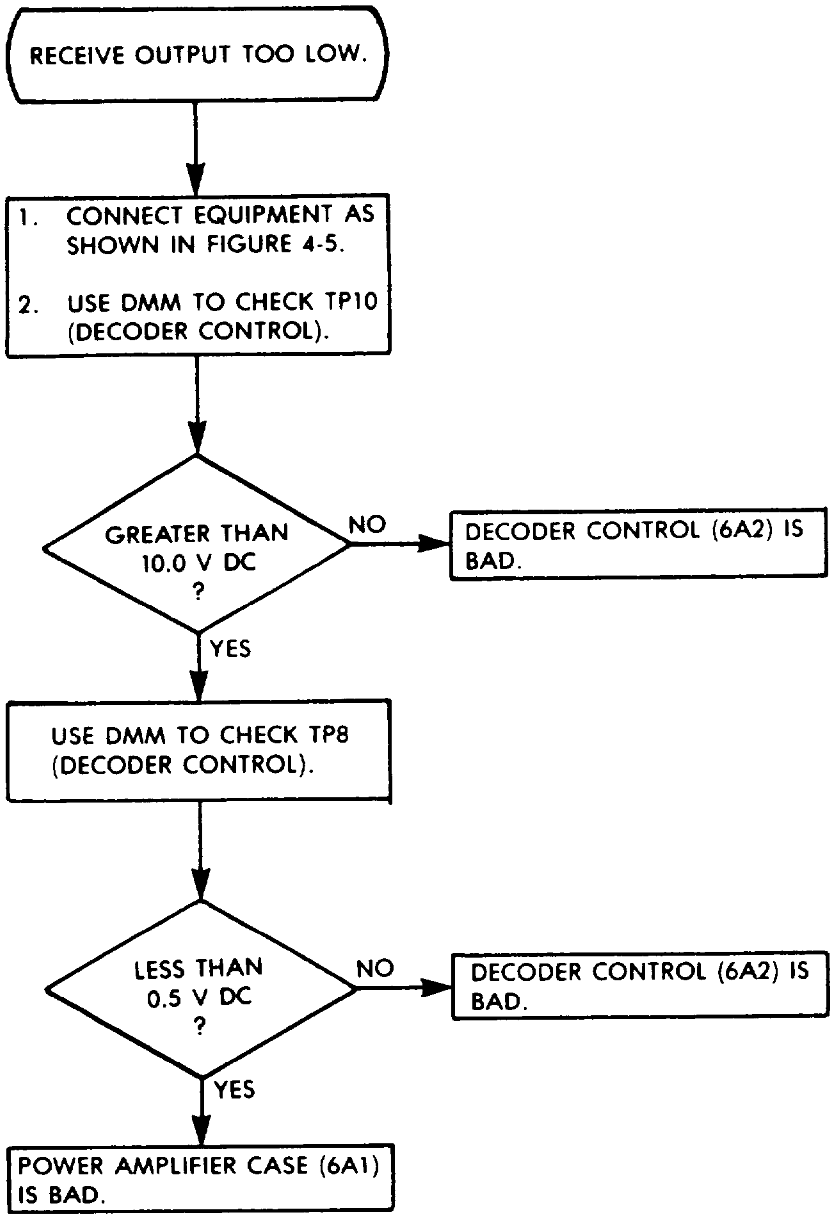
4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 5

Troubleshoot Receive Path
(Sheet 1 of 1)

NOTE

Refer to figure 4-2 for the location of test points.



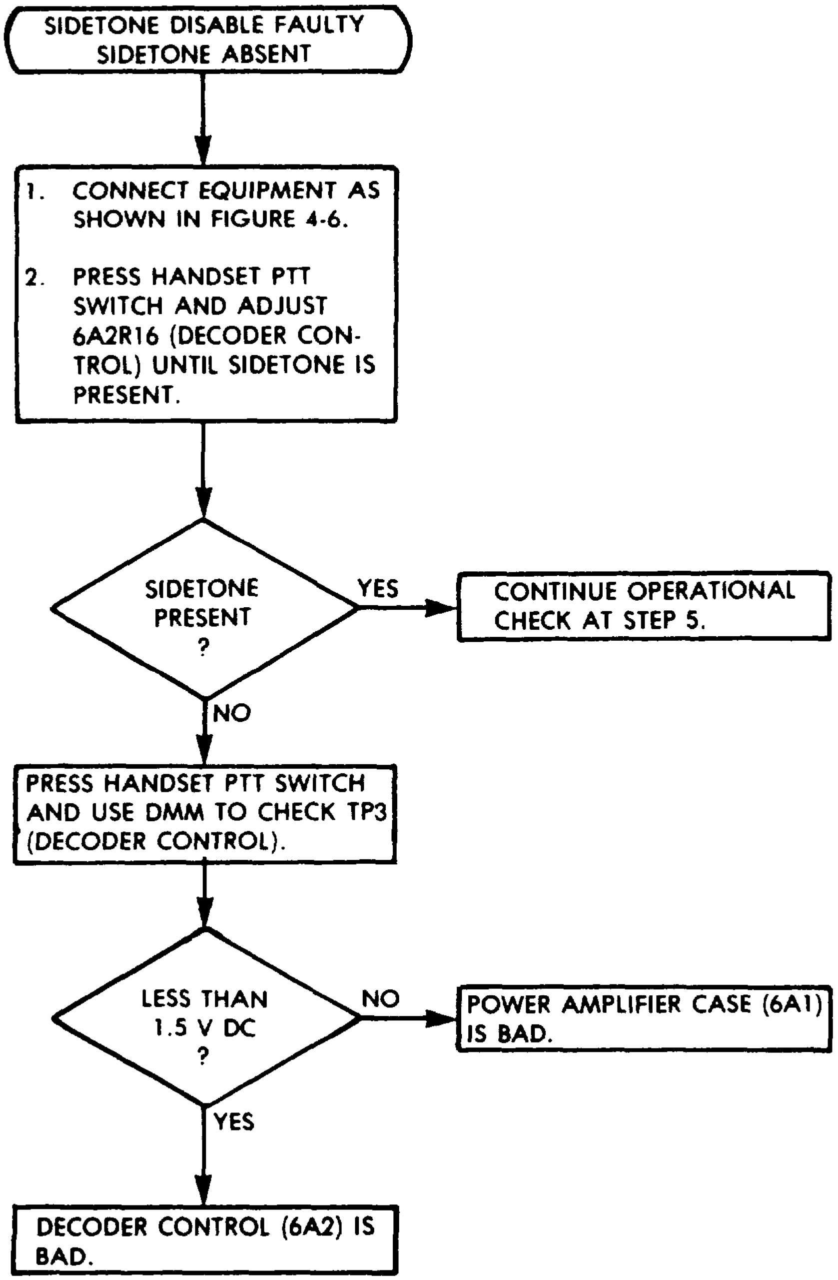
4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 6

Troubleshooting 5:1 VSWR Adjustment Circuit
(Sheet 1 of 1)

NOTE

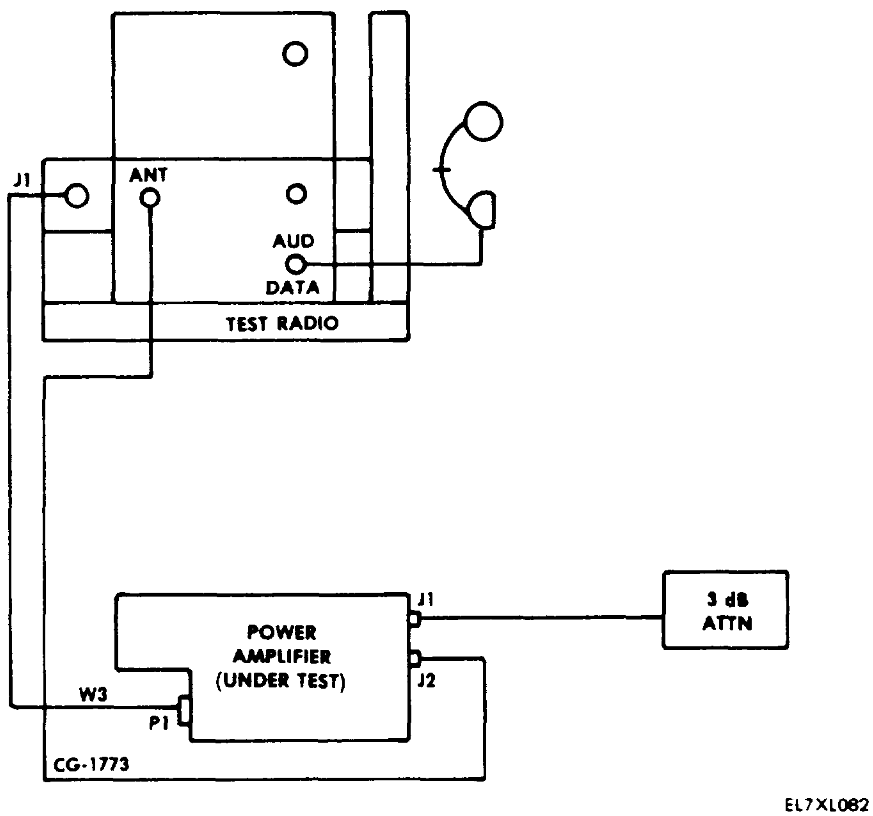
Refer to figure 4-2 for the location of test points and referenced components.



4-13. TROUBLESHOOTING FLOW CHARTS. Continued

WARNING

HIGH VOLTAGE AND HIGH RF ENERGY IS PRESENT IN THE POWER AMPLIFIER AND THE TEST SETUP. USE CAUTION TO AVOID PERSONAL INJURY.



EQUIPMENT PRESETS

TEST RADIO:

CB1: ON
FCTN: SQ ON
MODE: SC
RF: PA
DATA: OFF
CHAN: DO NOT CHANGE FROM OPERATIONAL CHECK

DMM:

SET FOR dBm, 50 Ω REF

POWER AMPLIFIER:

DISASSEMBLE TO GAIN ACCESS TO TEST POINTS. DO NOT DISCONNECT CABLES.

Figure 4-6. VSWR Adjustment Troubleshooting Test Setup.

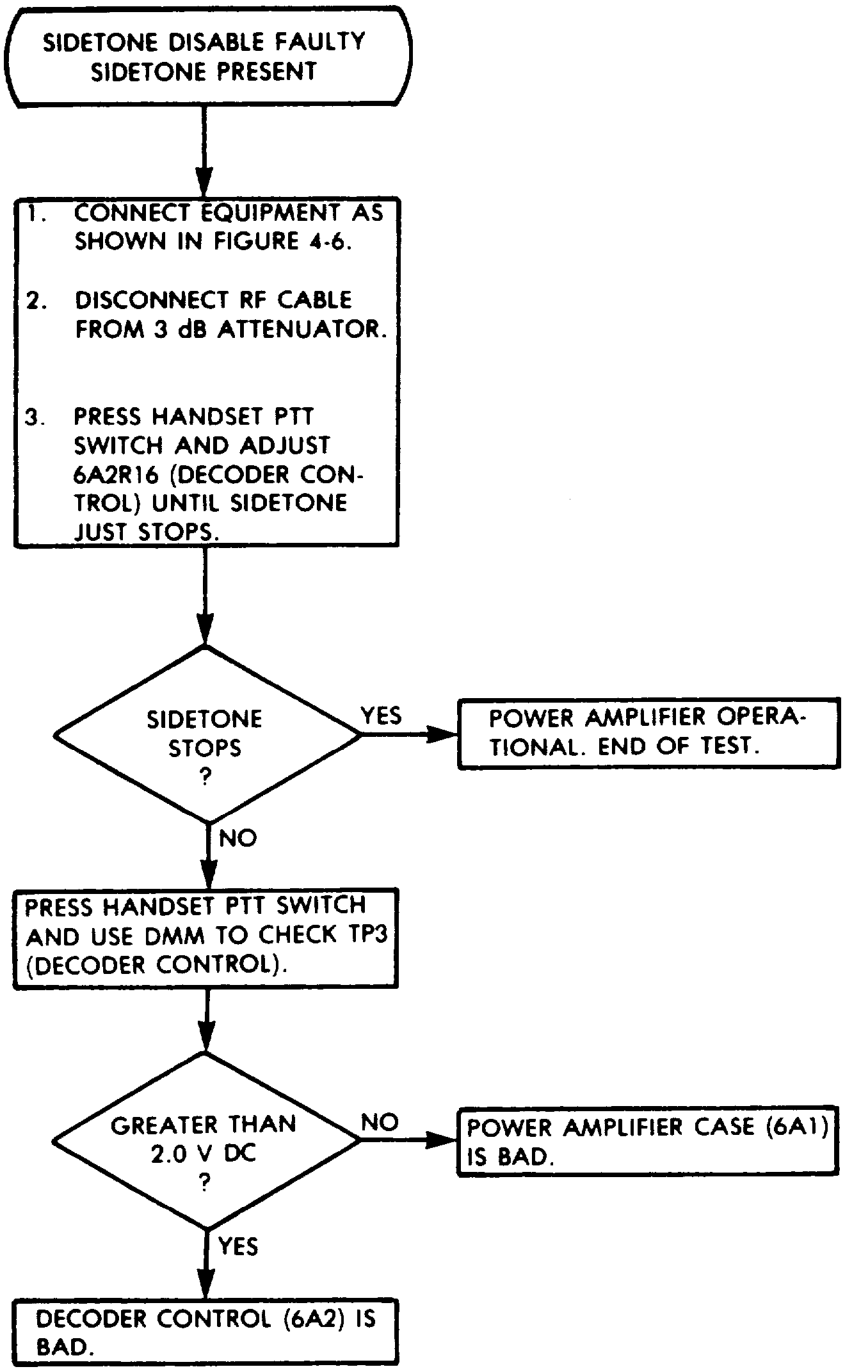
4-13. TROUBLESHOOTING FLOW CHARTS. Continued

Chart 7

Troubleshoot 5:1 VSWR Adjustment Circuit
(Sheet 1 of 1)

NOTE

Refer to figure 4-2 for the location of test points and referenced components.



Section IV. MAINTENANCE PROCEDURES

4-14. GENERAL.

This section includes the operational check and the repair procedures. The operational check is used to verify the operation of a repaired power amplifier. It is also used to verify the symptom of a faulty power amplifier. It will identify the troubleshooting chart to be used. When a bad module is identified, replace it using the procedure in this section.

4-15. OPERATIONAL CHECK.

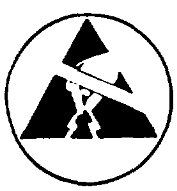
The operational check provides a step-by-step procedure for evaluating a power amplifier. If the operational check is passed, the power amplifier can be returned to service. If it does not pass, the bad module or the troubleshooting chart to be used will be identified. The troubleshooting procedures are in section III.

The operational check is divided into steps. Each step verifies a particular function. Follow the instruction in the "Action" column. Check for the result(s) in the "Response" column. If the response is correct, proceed with the next lettered action. When a "Step" has been successfully completed, proceed with the next Step. A "no response" in the "Response" column means that any response is not of interest.

The switch settings for the test equipment are given in the "EQUIPMENT PRESETS" section of each test setup figure.

WARNING

Connect the test setups only when directed, and with the power supply or CB1 set to OFF. The large current capacity of the test power supply can cause personal injury. Verify the test setup before turning the power supply on.



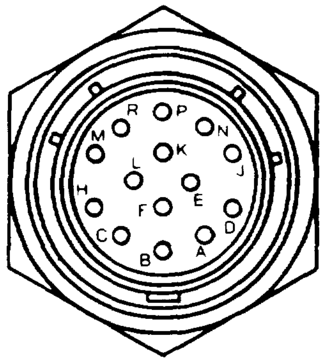
CAUTION

Static electricity and stray voltages can damage the decoder control (6A2). Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting.

High voltage (200 V) and high rf energy (50 watts) is present in the power amplifier during testing. Do not disassemble with power applied to the power amplifier.

4-15. OPERATIONAL CHECK. Continued

Step 1. SAFE TO TURN ON CHECK



P1

EL7XL141

Action	Response
a. Use DMM to check resistance between P1 pins B and A.	a. DMM reading is greater than 2 kΩ. If not, power amplifier case (6A1) is bad.
b. Use DMM to check resistance between P1 pins C and A.	b. DMM reading is greater than 2 kΩ. If not, decoder control (6A2) is bad.
c. Use DMM to check resistance between P1 pins D and A.	c. DMM reading is greater than 5 kΩ. If not, go to chart 1.
d. Use DMM to check resistance between P1 pins F and A.	d. DMM reading is greater than 50 kΩ. If not, decoder control (6A2) is bad.

Step 2. RF OUTPUT CHECK

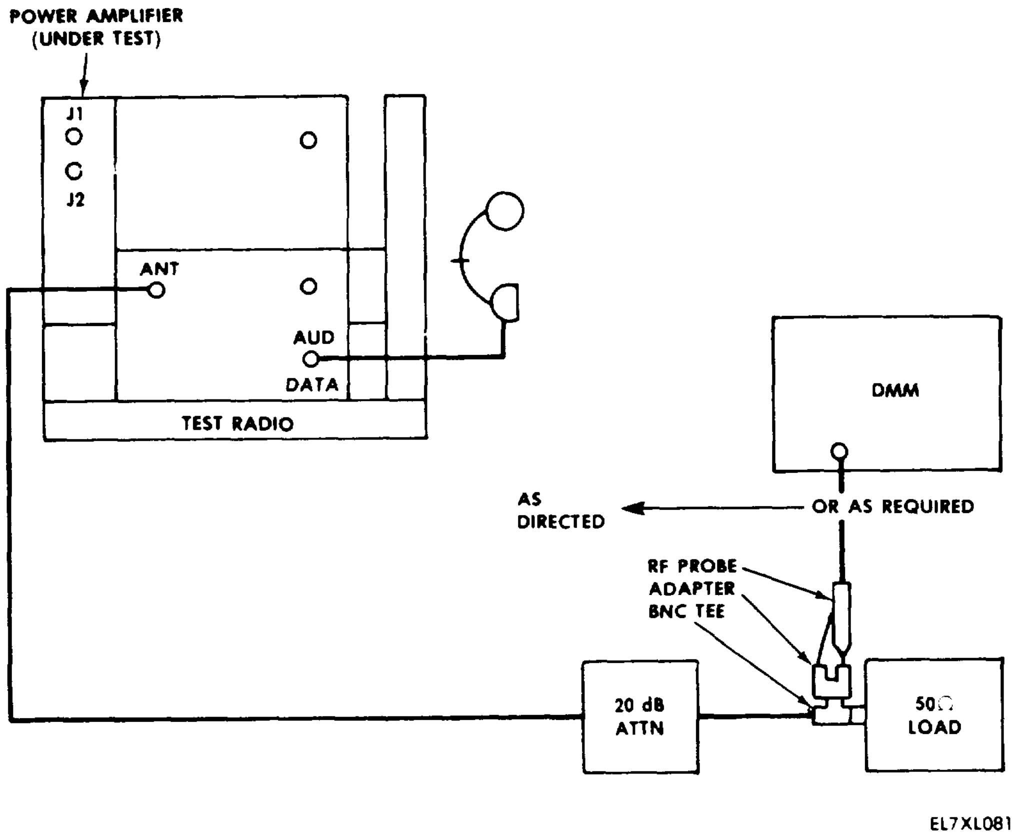
Action	Response
a. Connect equipment as shown in figure 4-7.	a. No response.
b. Load the following frequencies into the rt:	b. No response.

CHAN	FREQUENCY
1	87.975
2	55.000
3	33.000

4-15. OPERATIONAL CHECK Continued

WARNING

HIGH VOLTAGE AND HIGH RF ENERGY IS PRESENT IN THE POWER AMPLIFIER AND THE TEST SETUP. USE CAUTION TO AVOID PERSONAL INJURY.



EQUIPMENT PRESETS

TEST RADIO:

CB1: ON
FCTN: SQ ON
MODE: SC
RF: HI
DATA: OFF

DMM
SET FOR dBm, 50 Ω REFERENCE

Figure 4-7. Reference RF Output Test Setup.

4-15. OPERATIONAL CHECK. Continued

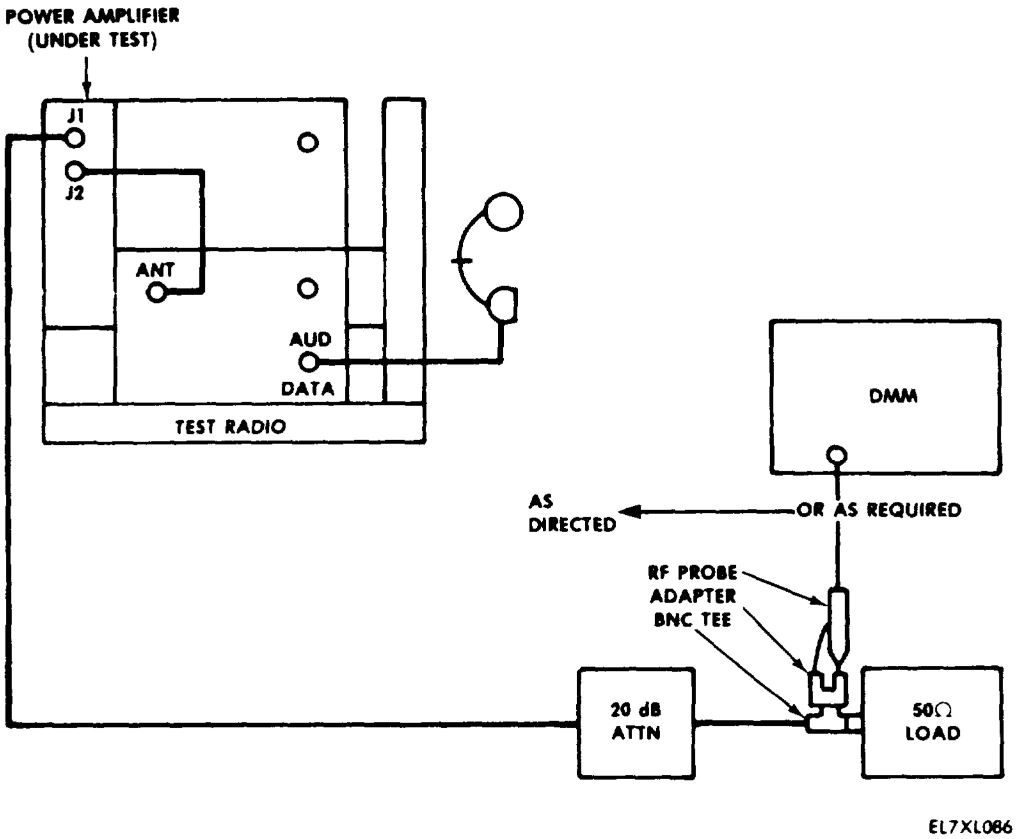
Step 2. RF OUTPUT CHECK Continued

Action	Response
c. Rt CHAN: 1.	c. No response.
d. Press handset PTT switch. Read and record level shown on DMM.	d. Recorded DMM reading is rt channel 1 rf power (RT1).
e. Rt CHAN: 2.	e. No response.
f. Press handset PTT switch. Read and record level shown on DMM.	f. Recorded DMM reading is rt channel 2 rf power (RT 2).
g. Rt CHAN: 3.	g. No response.
h. Press handset PTT switch. Read and record level shown on DMM.	h. Recorded DMM reading is rt channel 3 rf power (RT 3).
i. Connect equipment as shown in figure 4-8.	i. No response.
j. Rt: CHAN: 1.	j. No response.
k. Press handset PTT switch and read DMM.	k. DMM reading is 10 to 14 dB greater than measurement RT 1. tf not, go to chart 2.
l. Rt: CHAN: 2.	l. No response.
m. Press handset PTT switch and read DMM.	m. DMM reading Is 10 to 14 dB greater than measurement RT 2. If not, go to chart 3.
n. Rt: CHAN: 3.	n. No response.
o. Press handset PTT switch and read DMM.	o. DMM reading is 10 to 14 dB greater than measurement RT 3. If not, go to chart 4.
p. Decrease test power supply output voltage to 22.0 V dc.	p. No response.
q. Press handset PTT switch and read DMM.	q. DMM reading is 8 to 12 dB greater than measurement RT 3. If not, power amplifier heat sink (6A3) is bad.
r. Increase test power supply output voltage to 31.0 V dc.	r. No response.
s. Press handset PTT switch and read DMM.	s. DMM reading is 10 to 14 dB greater than measurement RT 3. If not, power amplifier heat sink is bad.
t. Decrease test power supply output voltage to 27.5 V dc.	t. No response.

4-15. OPERATIONAL CHECK Continued

WARNING

HIGH VOLTAGE AND HIGH RF ENERGY IS PRESENT IN THE POWER AMPLIFIER AND THE TEST SETUP. USE CAUTION TO AVOID PERSONAL INJURY.



EQUIPMENT PRESETS

TEST RADIO:

CB1: ON
FCTN: SQ ON
MODE: SC
RF: PA
DATA: OFF

POWER AMPLIFIER:
MOUNT IN TEST RADIO

DMM:
dBm, 50 Ω REFERENCE

Figure 4-8. RF Output Test Setup.

4-15. OPERATIONAL CHECK. Continued

Step 3. RECEIVE PATH LOSS CHECK

Action	Response
a. Rt RF: HI.	a. No response.
b. Press handset PTT switch and read DMM.	b. DMM reading is not more than 1.5 dB below measurement RT 3. If it is, go to chart 5.

Step 4. SIGNAL STRENGTH CHECK

Action	Response
a. RT RF: PA.	a. No response.
b. Press handset PTT switch and read rt SIG display.	b. SIG display reading is 8 or 9. If not, decoder control (6A2) is bad.

Step 5. VSWR PROTECTION AND SIDETONE CHECKS

Action	Response
a. Press the handset PTT switch and check for sidetone.	a. Sidetone present. If not, decoder control (6A2) is bad.
b. Disconnect rf cable from 20 dB attenuator input and connect it to 3 dB attenuator. Do not terminate 3 dB attenuator output.	b. No response.
c. Press the handset PTT switch and check for sidetone.	c. Sidetone is present. If not, go to chart 6.
d. Disconnect rf cable from 3 dB attenuator input.	d. No response.
e. Press the handset PTT switch and check for sidetone.	e. Sidetone is not present. If it is present, go to chart 7.
f. Operational check complete.	

4-16. REPAIR PROCEDURES.

Repair of the power amplifier consists of replacing a bad module. A module is replaced by removing it and installing a good one. Procedures for doing this follow:

a. General Instructions. The following instructions apply to all repair tasks.

1. Remove all cables connected to the power amplifier.
2. Inspect the power amplifier for damage. Repair any obvious physical damage.
3. Handle all modules carefully.
4. Before installing a module, check the connectors or terminals for bent or broken pins. Do not install if damaged.
5. After the repair, perform the operational check.

b. Repair Precautions.

CAUTION

Static electricity can damage the decoder control (6A2). Ground the power amplifier and all tools before removing the decoder control. Use a grounded wrist strop when handling the decoder control.

4-17. DISASSEMBLY FOR TROUBLESHOOTING.

The power amplifier must be disassembled to gain access to the test points. Figures 4-2, 4-3, and 4-4 identify the test points inside the power amplifier.

Tools:

Flat tip screwdriver

ITEM	ACTION	REMARK5

WARNING

High voltage (200 V) and high rf energy (50 W) is present in the power amplifier during testing. Do not disassemble with power applied to the power amplifier.

a. Test radio	Set CB1 to OFF.	
b. Power amplifier	Set on work surface with heat sink side down. See figure 4-9.	
c. Cover (1)	Fully loosen 12 captive screws and remove cover.	
d. Power amplifier	Set on work surface with heat sink side up.	
e. Power amplifier	Fully loosen 12 captive screws that secure the power amplifier heat sink (2) to the power amplifier case (3).	
f. Power amplifier	Separate the power amplifier heat sink from the power amplifier case but do not disconnect any of the cables. Set on the work surface with access to the desired test points.	
g. Seal screw (13)	Remove and inspect. If seal or screw is bad, replace. Thread and tighten.	

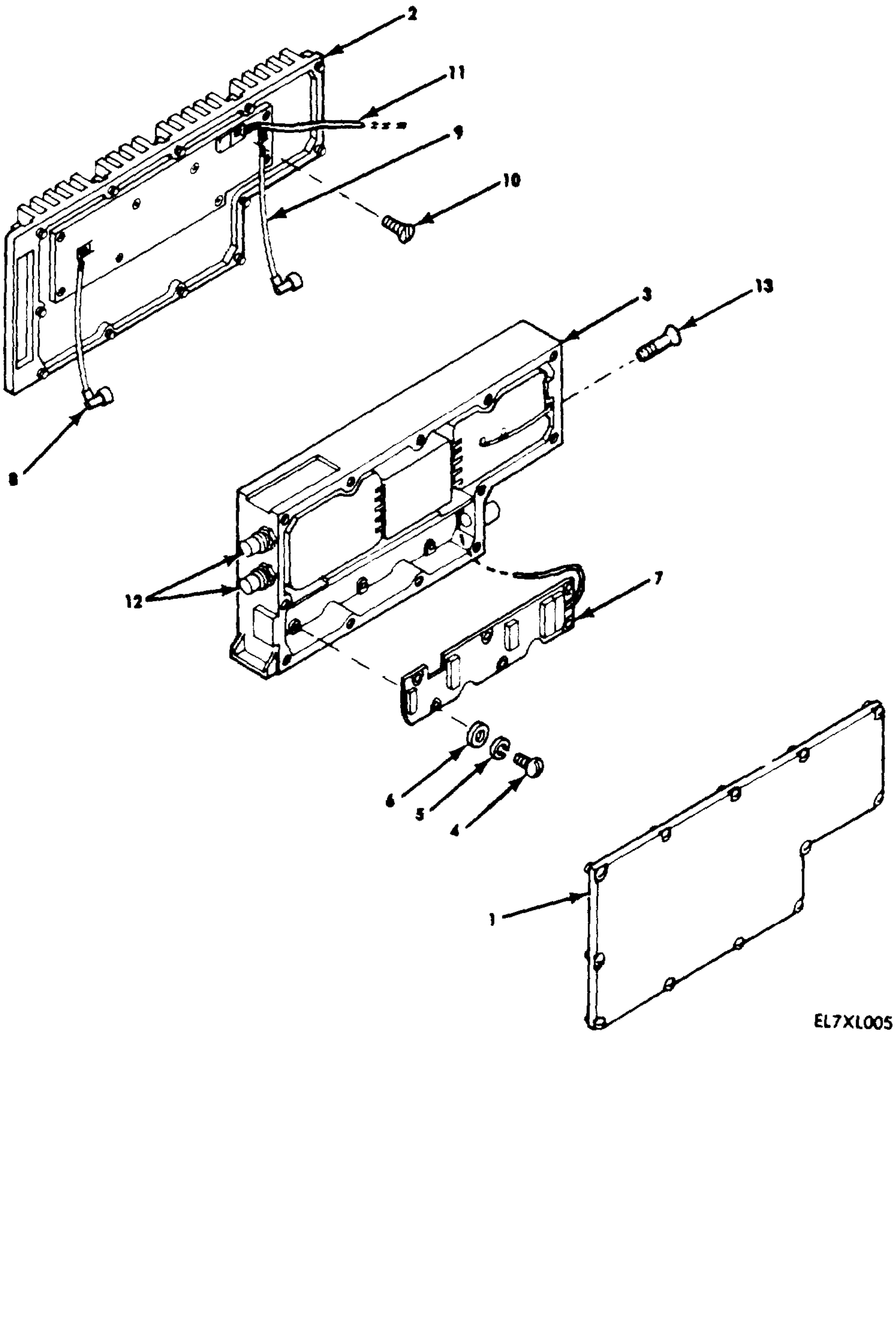


Figure 4-9. Power Amplifier Exploded View.

4-18. REPLACEMENT OF POWER AMPLIFIER COVER.

Tools:

- Flat tip screwdriver
- Torque adapter
- Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Power amplifier	Set on work surface with heat sink side down. See figure 4-9.	
b. Cover (1)	Fully loosen 12 captive screws and remove cover.	
INSTALLATION		
c. Cover (1)	Inspect for damage to gasket. Replace cover if damaged.	
d. HCP Cover (1)	Set in place on power amplifier. Start screws. Torque screws to 9 inch-pounds.	

4-19. REPLACEMENT OF DECODER CONTROL (6A2).

Tools:

- Cross tip screwdriver
- Flat tip screwdriver
- Torque adapter
- Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Power amplifier	Set on work surface with heat sink side down. See figure 4-9.	
b. Cover (1)	Fully loosen 12 captive screws and remove cover.	
c. Six screws (4), lock washers (5), and washers (6)	Loosen and remove.	
d. Decoder control (7)	Pull free from power amplifier case (3) and disconnect wiring harness from decoder control connector J1.	
INSTALLATION		
e. Decoder control (7)	Connect wiring harness to decoder control connector J1. Set decoder control in place in power amplifier case (3).	
f. Six screws (4), lock washers (5), and washers (6)	Set in place and tighten.	

4-19. REPLACEMENT OF DECODER CONTROL (6A2). Continued

ITEM	ACTION	REMARKS

INSTALLATION Continued

NOTE

Three variable resistors on the decoder control may need to be adjusted. Perform operational check prior to installing cover.

g. HCP Cover (1)	Set in place on power amplifier. Start screws. Torque to 9 inch-pounds.	

4-20. REPLACEMENT OF POWER AMPLIFIER HEAT SINK (6A3).

Tools:

Cross tip screwdriver
Fiat tip screwdriver
Torque adapter
Torque wrench
Round nose pliers

Expendable Supplies:

Sealing compound: Grade H

ITEM	ACTION	REMARKS
REMOVAL		
a. Power amplifier	Set on work surface with heat sink side up. See figure 4-9.	
b. Power amplifier heat sink (2)	Fully loosen 12 captive screws securing power amplifier heat sink to power amplifier case (3).	
c. Power amplifier heat sink (2)	Lift from power amplifier case (3). Do not strain cables connecting power amplifier heat sink to power amplifier case. Set on work surface.	
d. Cable W3 (8)	Disconnect from power amplifier case (3). Use round-nose pliers.	
e. Cable W4 (9)	Disconnect from power amplifier case (3). Use round-nose pliers.	
f. Screw (10)	Loosen and remove from connector 6A1W1P4.	
g. Cable W1 (11)	Loosen and remove from power amplifier heat sink (2).	

4-20. REPLACEMENT OF POWER AMPLIFIER HEAT SINK (6A3). Continued

ITEM	ACTION	REMARKS
INSTALLATION		
h. Power amplifier heat sink (2).	Set on work surface close to power amplifier case (3).	
i. Cable W1 (11)	Connect to amplifier heat sink (2) connector 6A3A1J1.	
j. Screw (10)	Use sealing compound on threads and install in connector 6A1W1P4.	
k. Cable W4 (9)	Connect to connector 6A1A2W2J3.	
l. Cable W3 (8)	Connect to connector 6A1A2W1J4.	
m. HCP Power amplifier heat sink (2)	Set in place on power amplifier case (3). Start screws and torque to 9 inch-pounds.	

4-21. REPLACEMENT OF POWER AMPLIFIER CASE (6A1).

Tools:

Cross tip screwdriver
Flat tip screwdriver
Torque adapter
Torque wrench
Round-nose pliers

Expendable Supplies:

Sealing compound: Grade H

References:

Paragraph 4-19 for replacement of decoder control (6A2).
Paragraph 4-20 for replacement of power amplifier heat sink (6A3)

ITEM	ACTION	REMARKS
REMOVAL		
a. Decoder control (6A2)	Remove from power amplifier case. See paragraph 4-19.	
b. Power amplifier heat sink (6A3)	Remove from power amplifier case. See paragraph 4-20.	
INSTALLATION		
c. Power amplifier heat sink (6A3)	Install on power amplifier case. See paragraph 4-20.	
d. Decoder control (6A2)	Install in power amplifier case. See paragraph 4-19.	

Section V. PREPARATION FOR STORAGE OR SHIPMENT

4-22. GENERAL INFORMATION.

a. Pack the power amplifier and modules in approved shipping containers.

b. The decoder control must be shipped enclosed in material that provides protection from static electricity. See the following paragraph.

4-23. PACKING STATIC SENSITIVE MODULES.

The following steps should be followed when packing a static sensitive module for storage or shipment.

CAUTION

To avoid damaging static sensitive modules, use on antistatic pad on the work surface and wear a grounded wrist strap when handling the module.

ITEM	ACTION	REMARKS
a. Module (1)	Place inside antistatic bag (2) or inside antistatic wrapping material (3). See figure 4-10.	
b. Antistatic package (4)	Seal with adhesive tape. Attach "sensitive electronic device" unit pack label (5).	
c. Antistatic package (4)	Place inside approved shipping container (6). Attach "sensitive electronic device" intermediate pack label (7).	

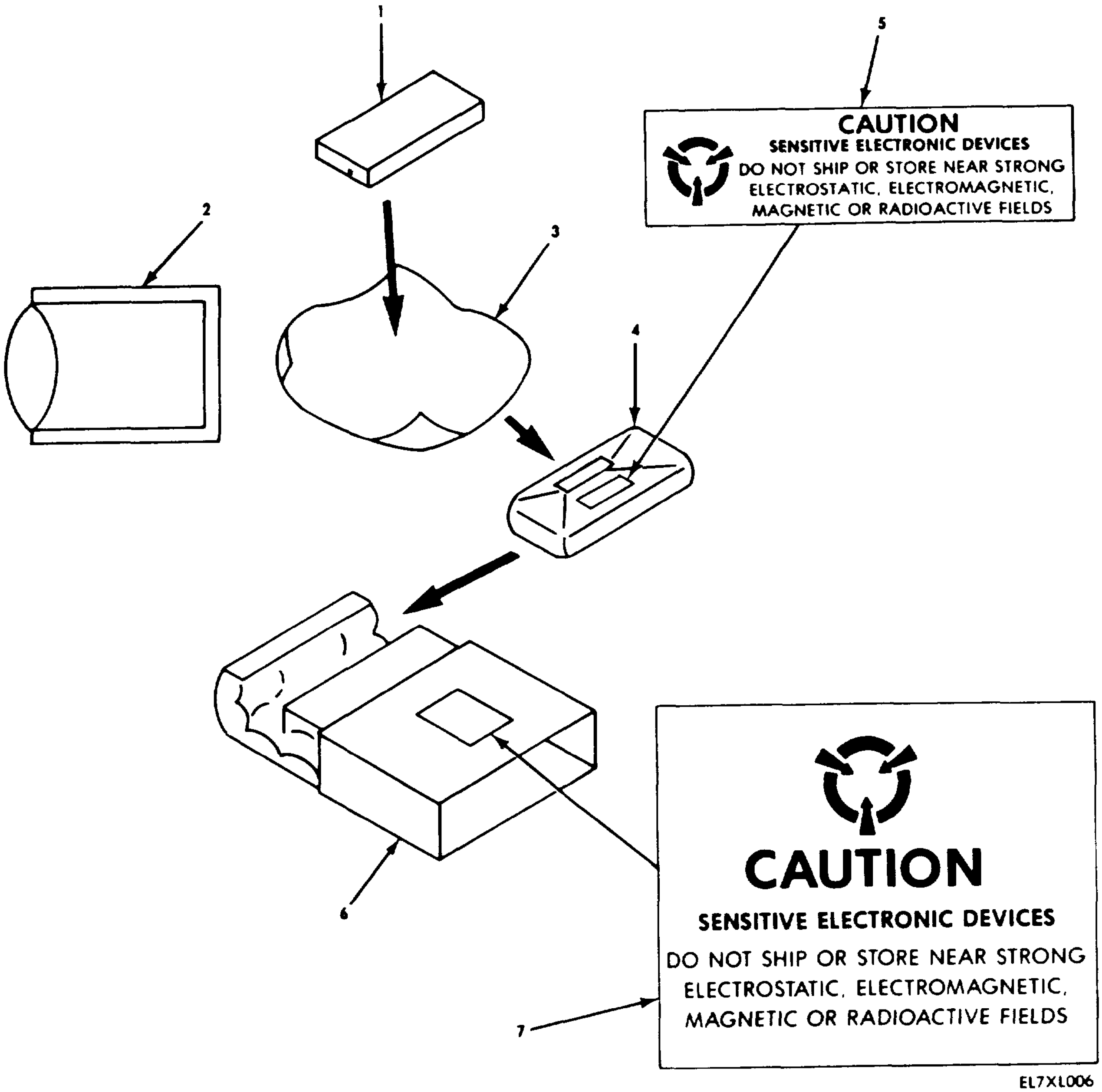


Figure 4-10. Packing Static Sensitive Module.

CHAPTER 5

CONTROL-MONITOR C-11291/VRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

5-l. INTRODUCTION.

The control-monitor receives status signals and transmits control signals to one, two, or three rt. It can also operate in tandem with another control-monitor. In the MAIN mode, it con monitor and change the RF, RT MODE, and CHAN of the rt selected. In the STANDBY mode, it con monitor the RF, RT MODE, and CHAN of the rt selected. A control-monitor in STANDBY con request a change to MAIN.

Figure 5-1 is a block diagram of the control-monitor. It is mode up of four modules and the chassis. They are:

Control-Monitor Panel-Case 7A1 (control-monitor chassis)

Circuit Card Assembly, Microcontroller 7A2 (microcontroller)

Circuit Cord Assembly, Decoder/Timer 7A3 (decoder/timer)

Circuit Card Assembly, Analog 7A4 (analog module)

Circuit Cord Assembly, Power Supply 7A5 (power supply)

The control-monitor has three connectors. Two are for the rt status and control signals. A 2880-Hz FSK carrier is used with ones and zeros at 2560 and 3200 Hz. Normal output level is 600 mV p-p. Primary power is also supplied from the radio to connector J1.

The third connector is for the tandem control-monitor. A 640-Hz serial digital data format is used between control-monitors. The tandem control-monitor receives primary power at connector J3.

The decoder/timer reads the front panel switch settings. This information is provided to the microcontroller. The microcontroller responds to received data, generates data to be transmitted, and writes to the front panel displays. The analog module detects received FSK signals. It routes received FSK and digital data to the microcontroller. Transmitted data starts with the microcontroller and goes through the decoder/timer and analog module.

5-1. INTRODUCTION. Continued

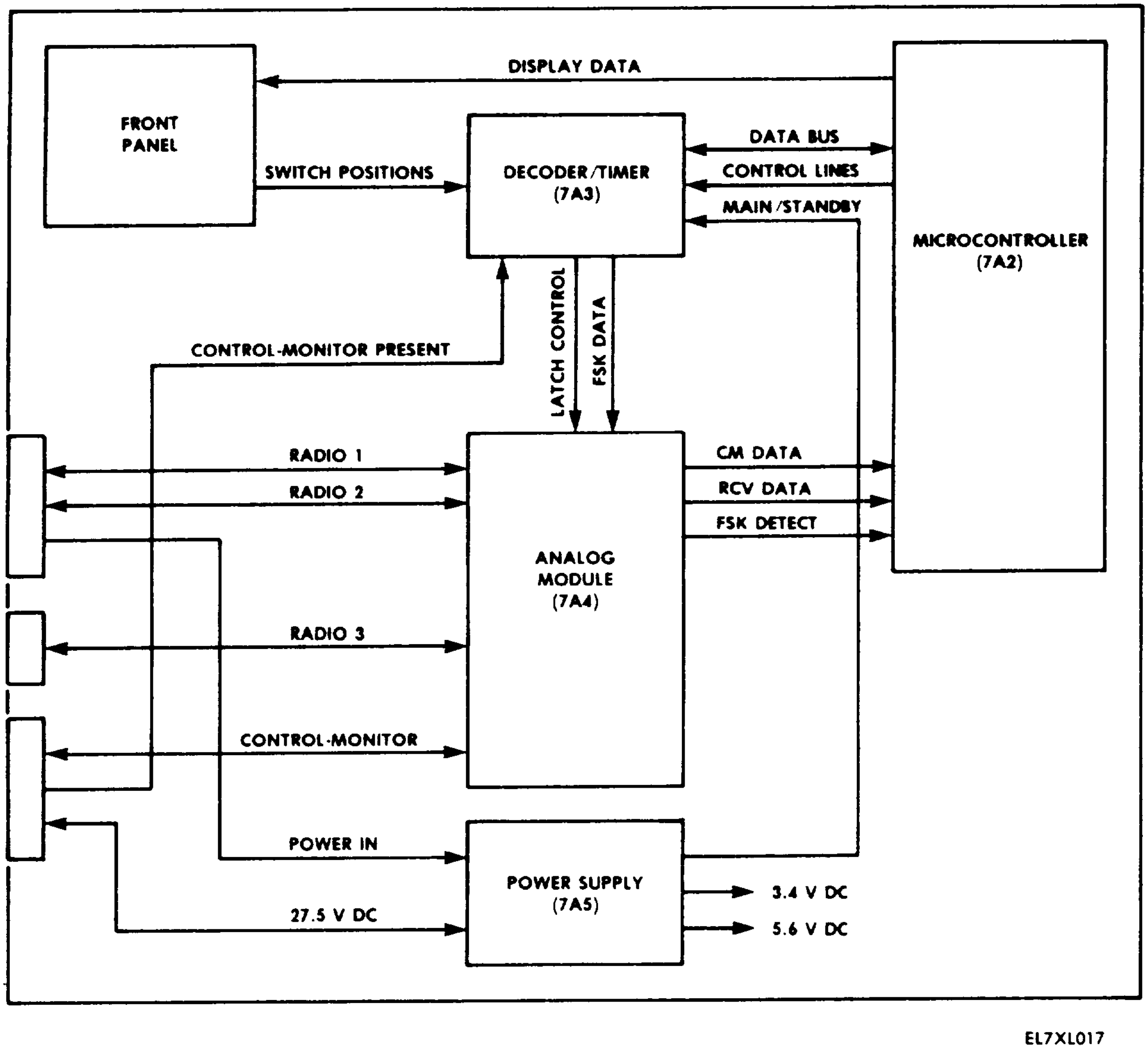


Figure 5-1. Control-Monitor Functional Block Diagram.

Control-monitor logic levels are as follows:

logic 1 = 5.1 to 6.1 V dc

logic 0 = 0.0 to 1.0 V dc

All clocking signals are square waves with logic 0 and logic 1 levels. FSK frequencies are:

logic 1 = 2560 Hz

logic 0 = 3200 Hz

A description of each of the modules follows.

5-2. CONTROL-MONITOR CHASSIS (7A1).

The control-monitor chassis includes the front panel, case, and backplane assembly (parent board). The front panel has the operator controls and displays. The case has the connectors used to interconnect the control-monitor to the other units in the system. The parent board provides the module interconnections. See FO-16. Most of the test points used for troubleshooting are on the parent board. See FO-17.

The display board requires two inputs from the microcontroller. DISPLAY DATA is a serial data stream that controls the display. DISPLAY CLK is a 320-kHz clock signal that provides timing for the data. The front panel switches are read by the decoder/timer.

5-3. MICROCONTROLLER (7A2).

The microcontroller contains a microprocessor, memory, and interface circuits. It controls the operation of the control-monitor by:

Generating control signals that operate I/O latches.

Monitors and translates received data.

Generates data for transmission.

Monitors the front panel switches.

Writes to front panel displays.

Figure 5-2 is a block diagram of the microcontroller.

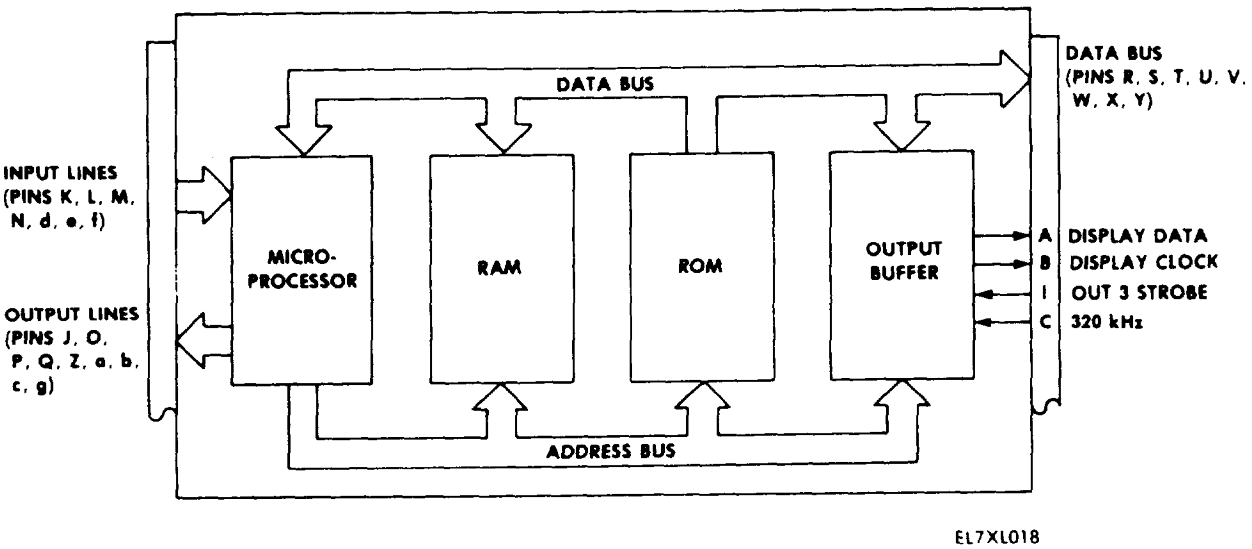


Figure 5-2. Microcontroller Functional Block Diagram.

The inputs required by the microcontroller are as follows:

SIGNAL	PIN	DESCRIPTION
CM DATA	K	Data received from other control-monitor. Serial data format, 640 Hz. From analog module.
RCV DATA	L	Data received from rt. Serial data format, 640 Hz. From analog module.

5-3. MICROCONTROLLER (7A2). Continued

SIGNAL	PIN	DESCRIPTION
2880 DET-N	M	Control line from analog module. Goes to logic 0 when data received from rt.
640 Hz	N	Digital clock signal from decoder/timer.
320 kHz	C	Digital clock signal from decoder/timer.
1.92 MHZ	e	Digital clock signal from decoder/timer.
CLR-N	d	Normally logic 1. Goes to logic 0 for 1 second at turn-on. From decoder/timer.
DMA-OUT-N	f	1.5 µs logic 0 pulse every 1.56 ms from decoder/timer.
OUT 3 STROBE	I	1.5 µs logic 1 pulse from decoder/timer.

The outputs provided by the microcontroller are as follows:

SIGNAL	PIN	DESCRIPTION
DISPLAY DATA	A	320-kHz digital data stream. Directs displays.
DISPLAY CLK	B	320-kHz clock. Provides display data timing.
PROCESSOR Q	c	Goes to logic 1 when FSK data is to be transmitted.
MEM REQ DATA-N	Z	Logic 0 pulse train for 3.4 µs when active.
TIMING PULSE A and B	g J	Timing pulse train, logic 1 for 0.5 µs.
N0, N1, and N2	0 P Q	Logic 1 far 1.5 µs.
STATE CODE 0	a	Logic 1 or 0 for 8.3 µs
STATE CODE 1	b	Logic 1 for 8.3 µs every 1.56 ms.

Information is passed between the microcontroller and the decoder/timer on the data bus. This is the microprocessor DATA BUS B0 through DATA BUS B7 lines (microcontroller pins R,S,T,U,V,W,X, and Y). Data transfers both ways on the bus.

Data from the rt is input on the RCV DATA line. Data to be sent to the rt is sent to the decoder/timer on the data bus.

Data from the other control-monitor is input on the CM DATA line. Data to be sent to the other control-monitor is sent on the PROCESSOR Q line.

5-4. DECODER/TIMER (7A3).

The decoder timer performs several functions:

It generates all required clock signals.

It decodes microcontroller outputs.

It provides an I/O interface between the microcontroller and the other modules.

5-4. DECODER/TIMER (7A3). Continued

Figure 5-3 is o block diagram of the decoder/timer.

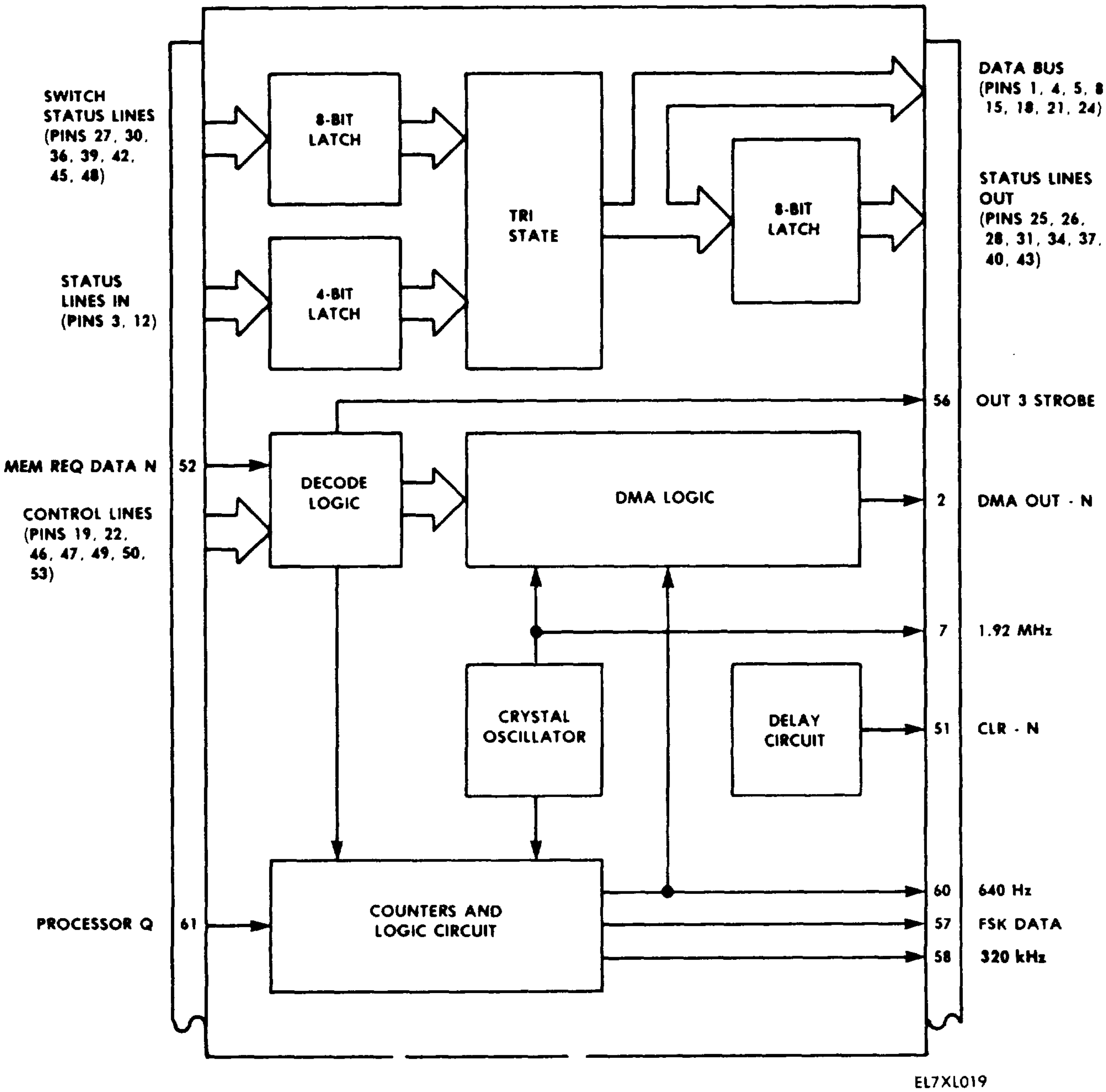


Figure 5-3. Decoder/Timer Functional Block Diagram.

The SWITCH STATUS, MAIN/STANDBY, and CM PRES lines are checked and the information provided to the microcontroller on the DATA BUS. The STATUS LINES OUT are latched as directed by the microcontroller.

A crystal oscillator on the decoder/timer provides several clock frequencies. A 3.84-MHz crystal output is divided by two to get 1.92 MHz. It is used by the microcontroller and logic circuits on the decoder/timer. It is divided further to produce 640 Hz and 320 kHz. These are also used by the microcontroller.

5-4. DECODER/TIMER (7A3). Continued

A delay circuit holds the CLR-N line at logic 0 for about 1 second when the control-monitor is turned on. After that, it is held at logic 1. It is used to reset the microcontroller and start the initialization routine.

Logic circuits convert the PROCESSOR Q signal into FSK DATA. Several control lines from the microcontroller are required to accomplish this. See figure 5-3 and FO-16. The FSK DATA signal is a 2560/3200-Hz square wave. 2560 Hz is a logic 1. 3200 Hz is a logic 0.

OUT 3 STROBE and DMA OUT-N are also generated for use by the microcontroller.

5-5. ANALOG MODULE (7A4).

The analog module performs receive and transmit functions. See figure 5-4. Three radio channels are available for receive and transmit. A channel is selected by the radio switch. The transmit circuit shapes and buffers the FSK square wave signal from the decoder/timer. The receive circuit converts the analog FSK signal into a digital data stream.

The three transmit channels are identical except for the input control signal. For radio 1, RADIO 1 XMT line goes to logic 1. This closes the appropriate transmit switch. The FSK DATA signal is from the decoder/timer. It is a 2560/3200-Hz square wave. The shaper/filter circuit converts it into a sine wave. This FSK analog signal is routed through the transmit switch to a buffer amplifier. It isolates the outgoing signals from the incoming signals. The signal is transformer coupled to the radio. Radio 2 and radio 3 paths operate the some as radio 1.

The receive path is selected that corresponds to the transmit path. For radio 1, RADIO 1 RCV line goes to logic 1. This closes the appropriate receive switch. The received signal is transformer coupled to the receive switch. It is routed to a buffer amplifier. The buffered FSK signal is demodulated. The analog data signal is converted into a digital data signal (RCV DATA). The RCV DATA signal is sent to the microcontroller. Radio 2 and radio 3 paths operate the same as radio 1.

When the FSK demodulator circuit detects a carrier, the 2880 DET-N line is pulled to logic 0. The RCV DATA signal is fed back into the analog module. It is used to maintain the frequency accuracy of the VCO and tracking of the received analog signal.

The receive and transmit signals to a second control-monitor are also routed through the analog module. During transmit, the CM XMT line goes to logic 1. This closes the control-monitor transmit switch. The signal transmitted is the microcontroller PROCESSOR Q signal. It is a 640-Hz digital data stream. It is routed through the transmit switch to a current driver. The current driver increases the current to the level required to drive the CM OUT line. A signal from the second control-monitor is input on the CM IN line. It is also routed through a current driver. The CM DATA signal is output to the microcontroller.

5-6. POWER SUPPLY (7A5).

The control-monitor operates using the switched 27.5 V dc from the mounting adapter. It will operate with an input voltage between 18.5 and 32 V dc. It requires no more than 1 A. Its outputs are 5.43 to 5.77 V dc (5.6 V dc nominal) and 2.9 to 3.9 V dc (3.4 V dc nominal). Both outputs are overcurrent protected.

The power supply can receive its input power from either pin I or pin H. See figure 5-5. When the control-monitor is connected to the radio, 27.5 V dc is present at connector J1 pin F. See FO-16. It is routed to pin I of the power supply. The voltage source detection circuit pulls the MAIN/STANDBY line to logic 1. The 27.5 V dc is output through pin H to connector J3 pin F. When the control-monitor is the second one in the system. It receives power at connector J3 pin F. It is input into the power supply at pin H. This causes the voltage source detection circuit to pull the MAIN/STANDBY line to logic 0.

The power supply operates as a switching voltage regulator. The output of the switching circuit is compared to a reference voltage. The output voltage regulator circuit uses the difference in the two voltages to set the switching rate. This rate is adjusted until there is no difference between the reference voltage and the sampled output voltage.

Overcurrent protection is also provided. If 100 mA on the 5.6 V line or 400 mA on the 3.4 V line is exceeded, the power supply reduces both outputs to 0 V.

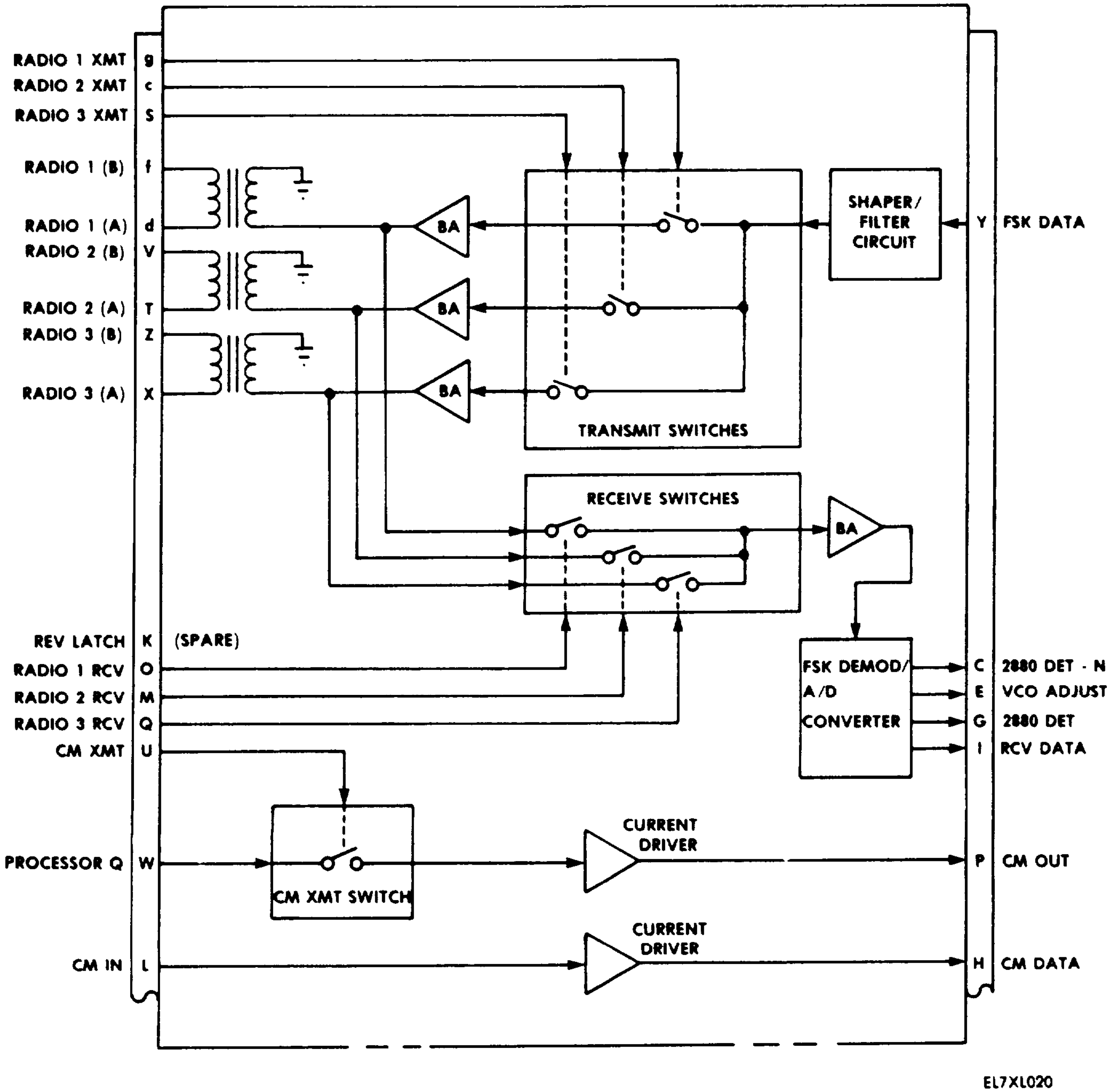


Figure 5-4. Analog Module Functional Block Diagram.

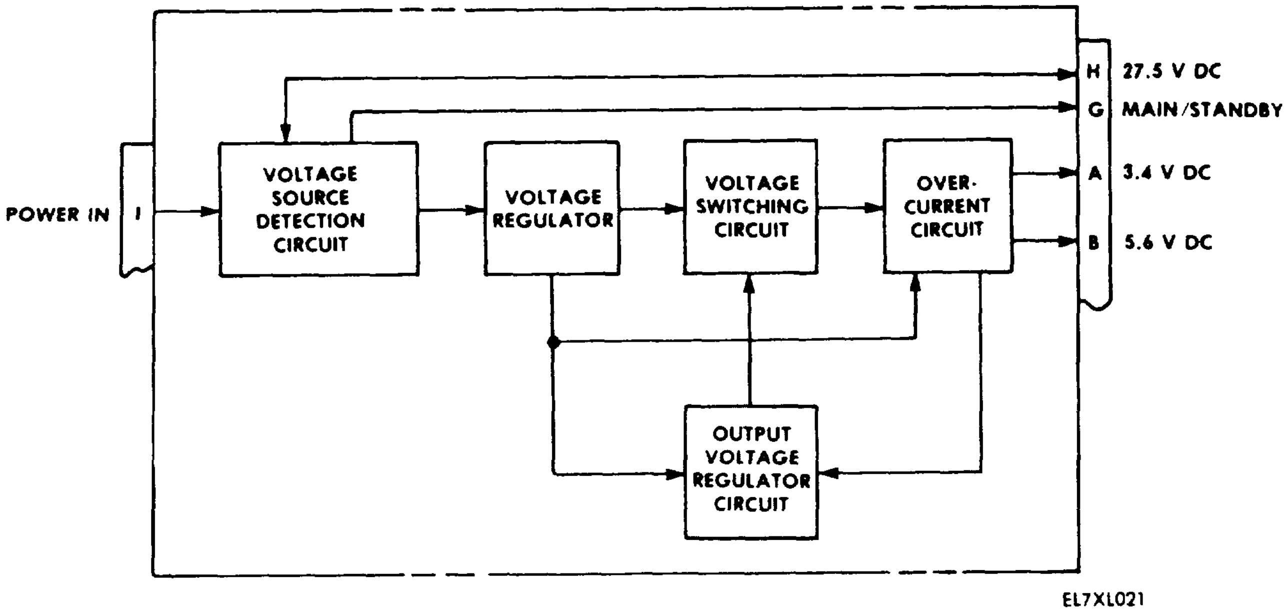


Figure 5-5. Power Supply Functional Block Diagram.

5-7. SELF-TEST.

The self-test function checks the following:

Front panel displays

Microcontroller RAM and ROM

Analog channel operation

Several displays are generated to indicate the results of the test. They are

All display segments are lit to check display operation.

"Gd" display indicates self-test was passed.

"F1" display indicates a microcontroller failure.

"F2" display indicates an analog channel failure.

Self-test is always executed an turn-on. It will repeat the self-test as long as the FCTN switch is set to TEST.

The front panel displays are lit first. A series of ones are sent on the DISPLAY DATA line to light all of the display segments. This pattern is sent twice. The display segments are lit for about 3 seconds.

Next, the microcontroller ROM is checked. It is checked by summing all of the bytes in ROM except the last two and comparing the sum to the last two bytes in ROM. If they are the same, the ROM code, address bus, data bus, and access lines are verified, Self-test continues with the next check. If not, "F1" is displayed.

If the ROM check passes, the RAM is checked. All RAM addresses are checked by writing and reading a value at each address. When checked at turn-on, all RAM values are set to zero. When the FCTN switch is set to TEST, the values in RAM are retained and restored. If the RAM check passes, the RAM, address bus, data bus, and access lines are verified. If any RAM address fails, "F1" is displayed.

The analog channel operation is checked next. All three radio transmit/receive paths are checked. Radio channel 3 is checked first, followed by radio channel 2, then radio channel 1. The channels are tested by sending a carrier signal on the FSK DATA line and changing its frequency from 3200 Hz to 2560 Hz. The 2880 DET-N line should stay at logic 0. The RCV DATA line should change logic states with each frequency change.

5-7. SELF-TEST. Continued

A channel test is started by setting the PROCESSOR Q line to logic 1. See figure 5-6. The test is delayed until there is no activity on the selected channel and a negative 640-Hz clock edge is detected (1). This insures that the PROCESSOR Q line is set to logic 1 (3200 Hz). The carrier is turned on (2). After two clock periods (3). about 3 ms. the first check is made (4). The 2880 DET-N line should be at logic 0. The RCV DATA line should be at logic 0. If both pass, the PROCESSOR Q line is set to logic 0 (2560 Hz). After a second delay (5) and two clock periods (6), the checks are repeated (7). The 2880 DET-N line should be at logic 0. The RCV DATA line should be at logic 1. If both pass, the carrier is turned-off and the next channel is checked. If any failures are detected, "F2" is displayed.

If all self-test checks are passed, "Gd" is displayed.

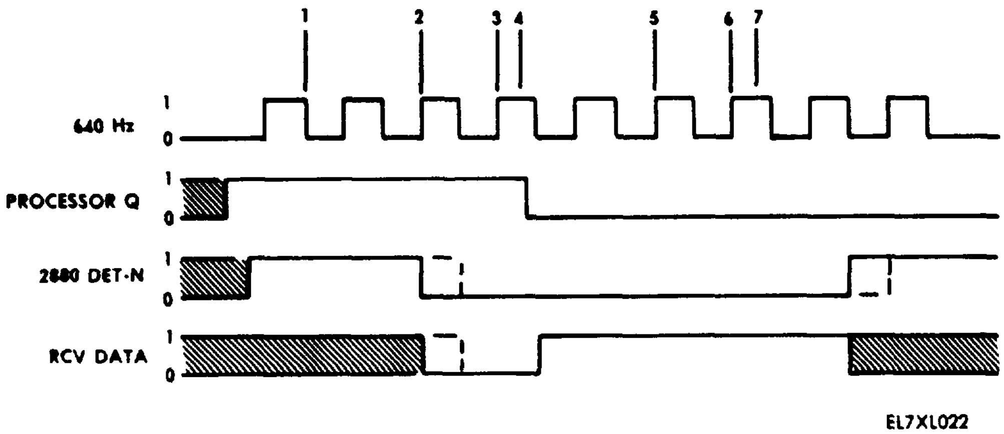


Figure 5-6. Analog Check Timing.

5-8. INTERFACE FAULTS AND ERRORS.

When the control-monitor requests a status update, the other unit responds. The rt echoes the control signals. If the rt does not respond, the control-monitor will display "F7". If a second control-monitor is involved and it does not respond, "Fr" for failed response is displayed.

If the operator makes an error, "Er" will be displayed. This can happen several ways. If no radio is connected to the radio 3 channel and an update request is made with the RADIO switch set to 3, "Er" will be displayed.

A blinking CHAN display indicates a problem at the rt. This could be caused by selecting an unloaded channel.

Section II. REPAIR PART,SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

5-9. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

5-10. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required for I(DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

5-11. REPAIR PARTS.

Repair parts are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering I(DS) maintenance for this equipment.

Section III. TROUBLESHOOTING

5-12. GENERAL.

This section provides the troubleshooting procedures used to fault isolate a defective control-monitor. The troubleshooting information is presented in the form of flow charts. They systematically get from a symptom to the bad module.

5-13. TROUBLESHOOTING.

Troubleshooting is done on a faulty control-monitor. The steps to determine if a control-monitor is faulty and how to troubleshoot it are as follows:

a. When a control-monitor is received from unit maintenance, inspect it for damage. Repair any damage before proceeding with testing. See section IV if repairs ore necessary.

b. Verify the symptom. Perform the operational check in section IV. This will direct you to to the correct troubleshooting flow chart.

c. Troubleshoot the control-monitor using the flow chart. It will identify the defective module.

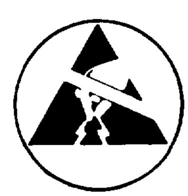
d. Replace the defective module. Follow the procedures in section IV.

e. Verify the repair. Perform the operational check in section IV that foiled. If it passes, then continue with the rest of the operational check. When the operational check is passed, the control-monitor can be returned for use.

5-14. TEST PRECAUTIONS AND NOTES.

WARNING

Set the test power supply to OFF before connecting or disconnecting a test setup. Current capacities are large enough to cause personal injury. Equipment con also be damaged if care is not token.



CAUTION

Static electricity and stray voltages con damage the control-monitor modules. Use on antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting.

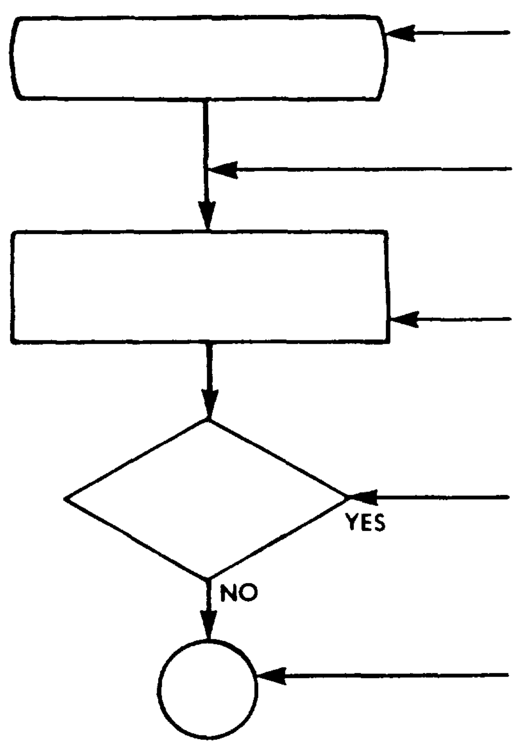
5-14. TEST PRECAUTIONS AND NOTES. Continued

NOTE

The Principles of Operation section, functional block diagrams, and FO-16 can be used to fault isolate any unusual problems that might not be covered in the troubleshooting procedures.

5-15 EXPLANATION OF SYMBOLS AND NOTES.

SYMBOL | EXPLANATION



Test Procedure Start: (Rectangle with rounded corners) Indicates a start of the test procedure and contains a brief description of the symptom of trouble.

Test Procedure Flow line: (Heavy line and arrowhead) Indicates direction of the procedure flow.

Test Procedure Instruction: (Rectangle) Provides instructions for doing a specific test.

Decision: (Diamond) Indicates that a decision must be made (YES or NO) in answer to a question about the previous test. Path taken depends on the answer (YES or NO).

Connector: (Circle) Directs user to an entry point of another chart. Contains on entry number that is same as entry number of other chart and a sheet number (Sh No.) that indicates the number of follow-on pages.

NOTES ⟵ Notes Column: Presents additional information, such as: more specific instructions about how to do a test, cautions and warnings that must be observed when doing a test, and additional information about what to do after doing a test. Also provides references to appropriate circuit diagrams.

5-16. TROUBLESHOOTING FLOW CHARTS.

Chart	Symptom
1	Incorrect self-test displays
2	Self-test "F2" display
3	CONTROL M display lit incorrectly
4	CONTROL S display segment not lit
5	No digital data output
6	No analog data output
7	Control-monitor will not control rt
8	Power supply output absent

5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

Troubleshooting Display Circuit (Sheet 1 of 4)

INCORRECT SELF-TEST DISPLAYS.

1. REMOVE CONTROL-MONITOR FRONT PANEL. DO NOT DISCONNECT FROM PARENT BOARD.
2. CONNECT EQUIPMENT AS SHOWN IN FIGURE 5-7.

ANY DISPLAYS LIT ?

YES → 5 SH 3

NO ↓

1. USE DMM TO CHECK XA5P1-I WHEN DISPLAY OFF.
2. RECORD MEASURED VOLTAGE.(VM1)
3. USE DMM TO CHECK XA5P1-H.

MEASURES GREATER THAN (VM1-1V) ?

NO → POWER SUPPLY (7A5) IS BAD

YES ↓

USE DMM TO CHECK XA5P1-A AND XA5P1-B.
A. 2.7 TO 4.2 V DC
B. 5.0 TO 6.0 V DC
SEE NOTE 4.

BOTH VOLTAGES CORRECT ?

YES → 1 SH 2

NO → ONE VOLTAGE CORRECT ?

NO → GO TO CHART 8.

YES → POWER SUPPLY (7A5) IS BAD.

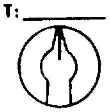
NOTES

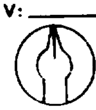
1. This is a short duration pulse that is only present when updating the display. Set scope horizontal base for 50 μs to see group. Set for 2 to 5 μs to see pulses.

2. Refer to FO-16 and FO-17.

3. Presets for the scope are given for difficult readings. They are time and voltage base settings.

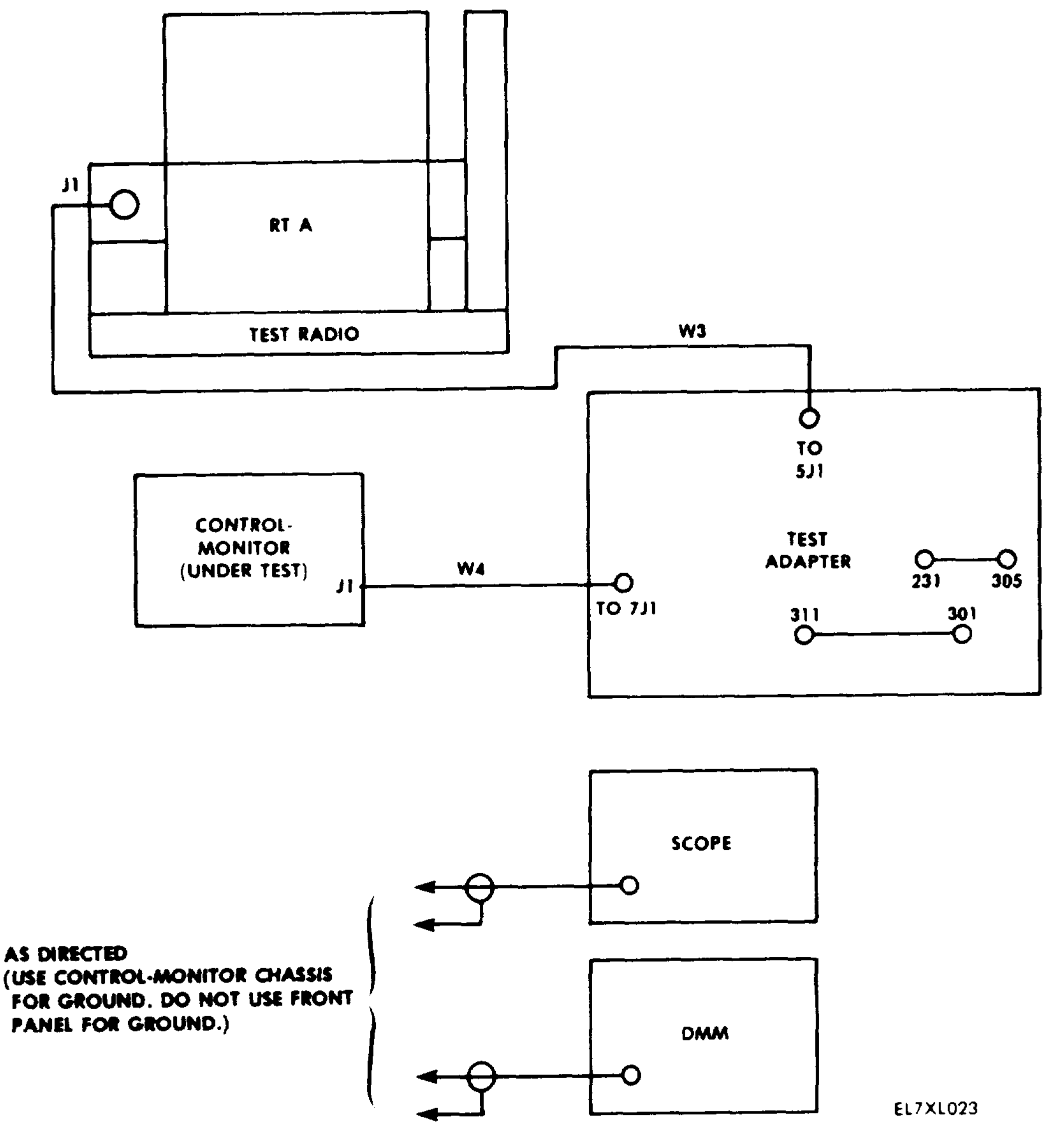
T: ______ V: ______





4. Readings on XA5P1-A may be high when a faulty module is present. These readings should be judged as correct if they are not greater than the levels given for XA5P1-B. Retest these voltages after replacement of a faulty module.

5. When the entire display is not functioning, the test responses should be present as described even though the display appears to be OFF.



EQUIPMENT PRESETS

CONTROL-MONITOR:
FCTN: TEST
RADIO: 1

SCOPE:
MODE: NORM
TRIGGER: INT

DMM:
FUNCTION: VOLTS DC
SCALE: 200V

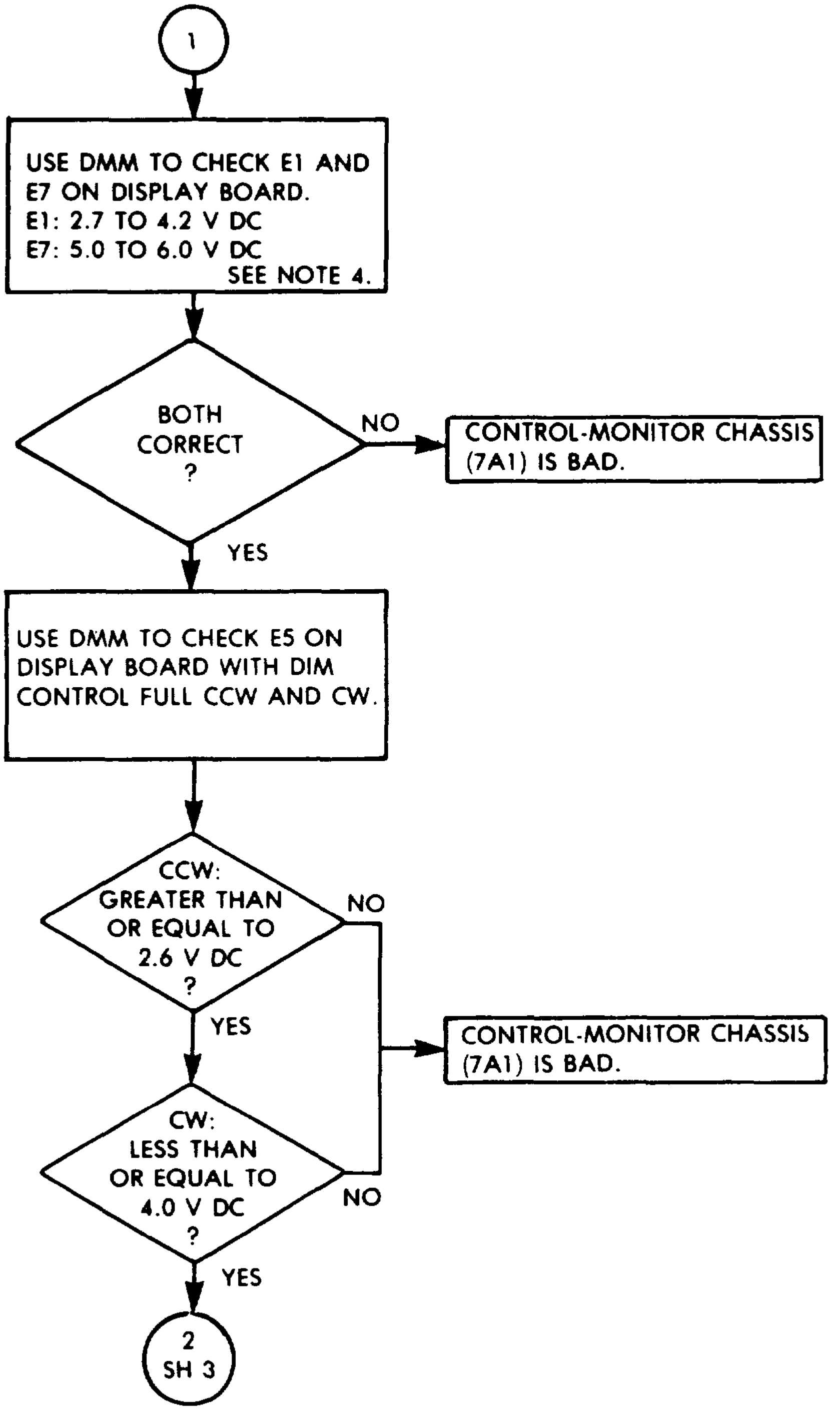
TEST RADIO:
CB1: ON
RT A FCTN: OFF

Figure 5-7. Troubleshooting Test Setup.

5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

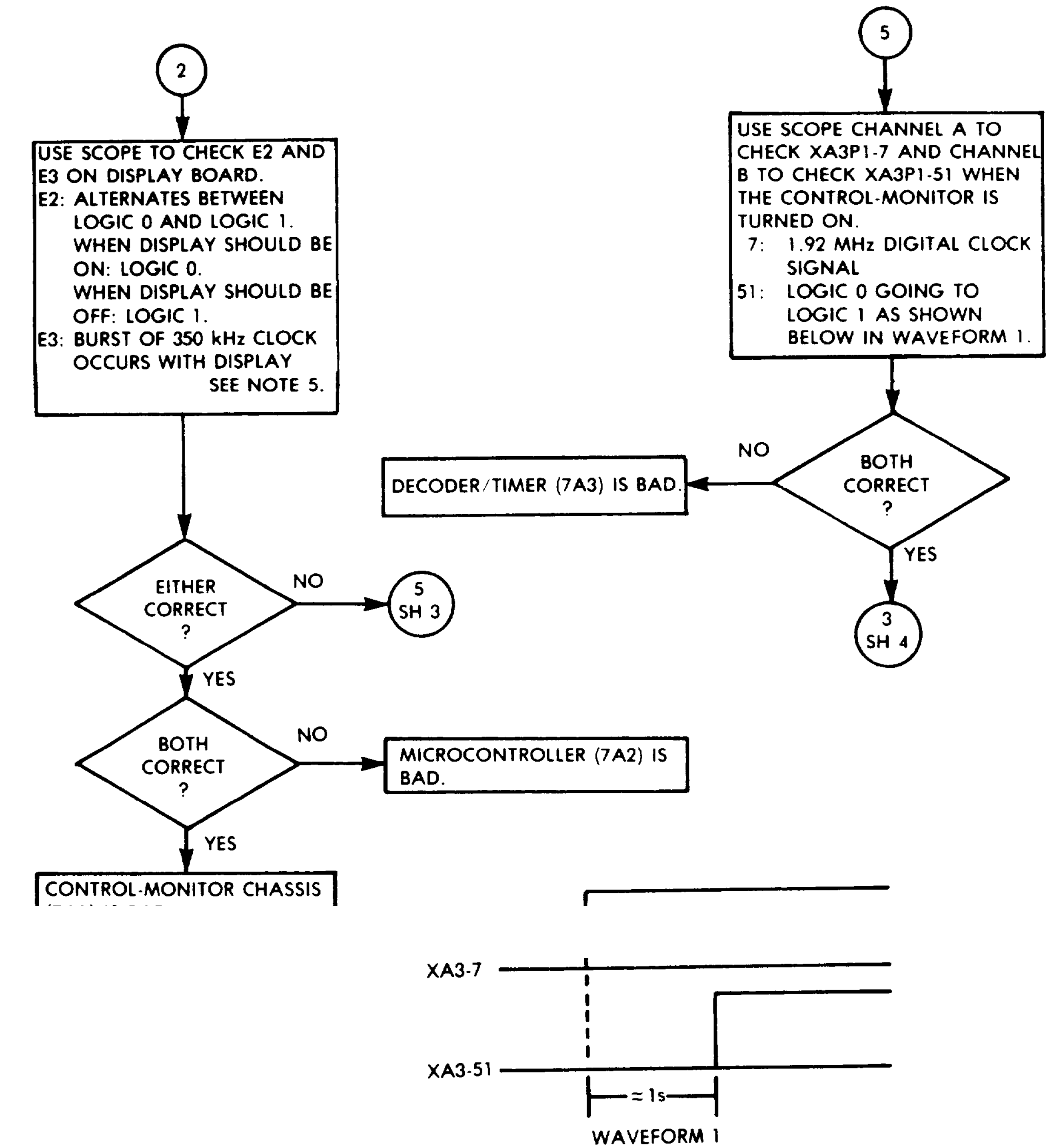
Troubleshooting Display Circuit (Sheet 2 of 4)



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

Troubleshooting Display Circuit (Sheet 3 of 4)

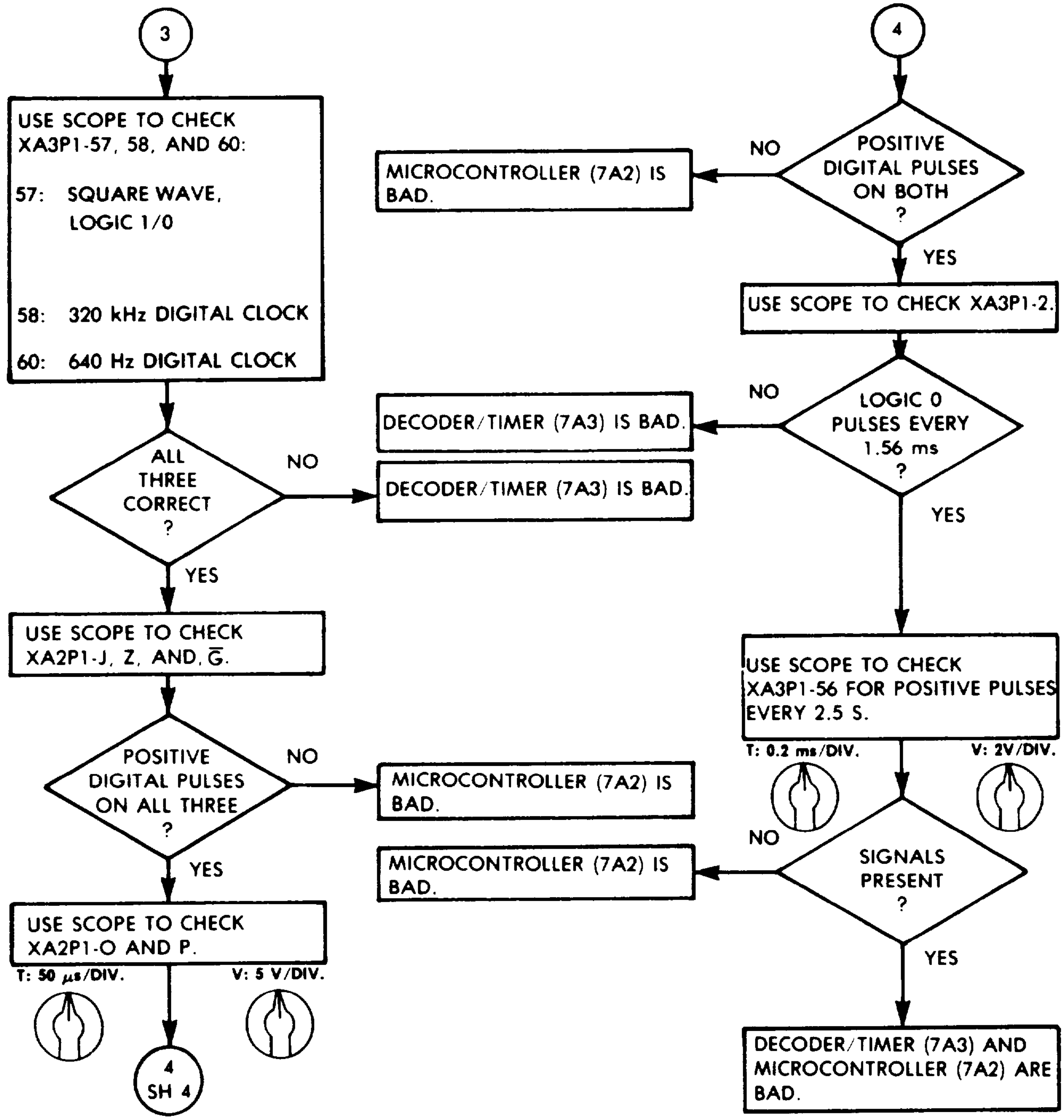


EL7XL140

5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

Troubleshooting Display Circuit (Sheet 4 of 4)



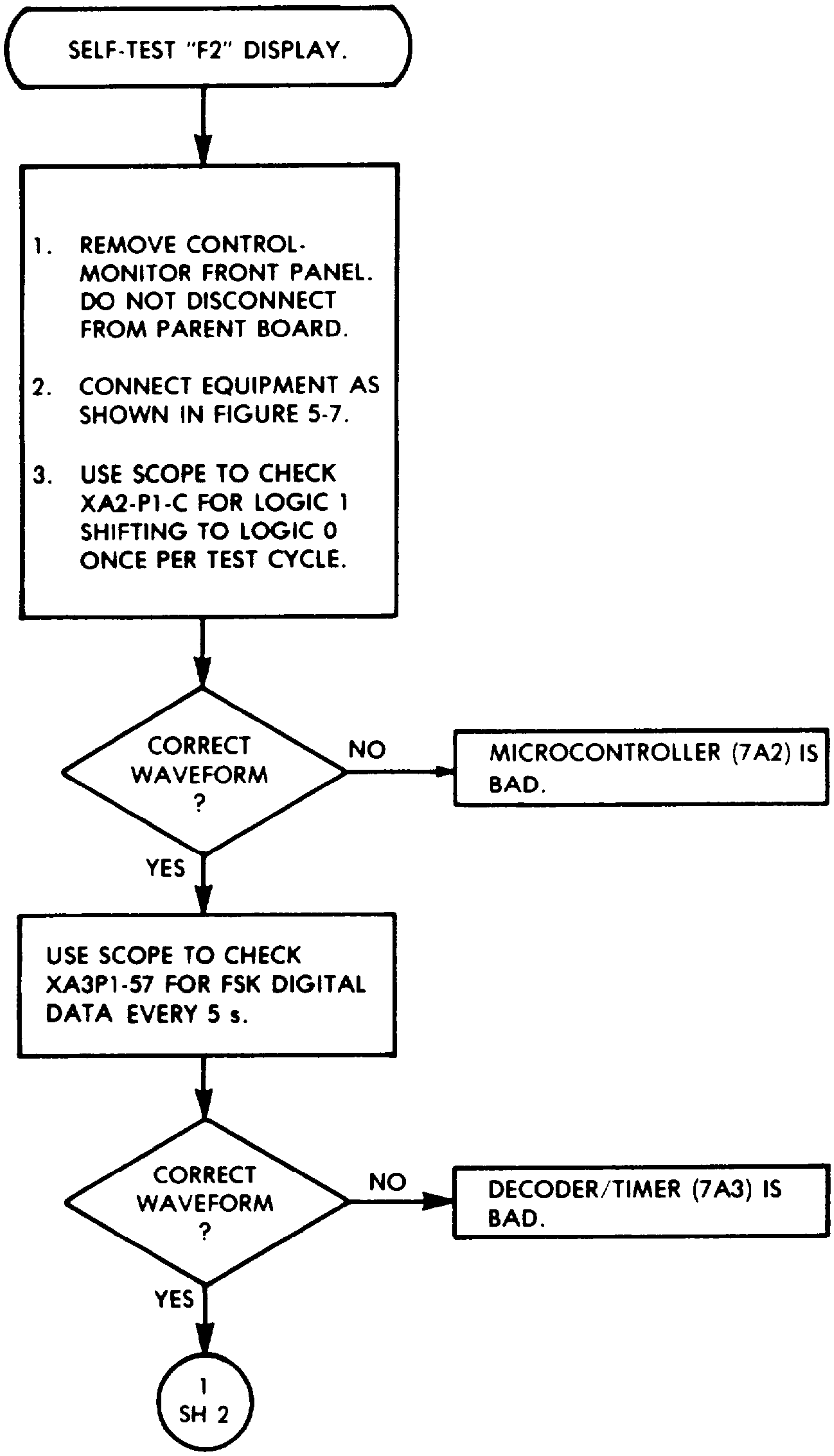
5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

Troubleshooting "F2" Display (Sheet 1 of 2)

NOTE

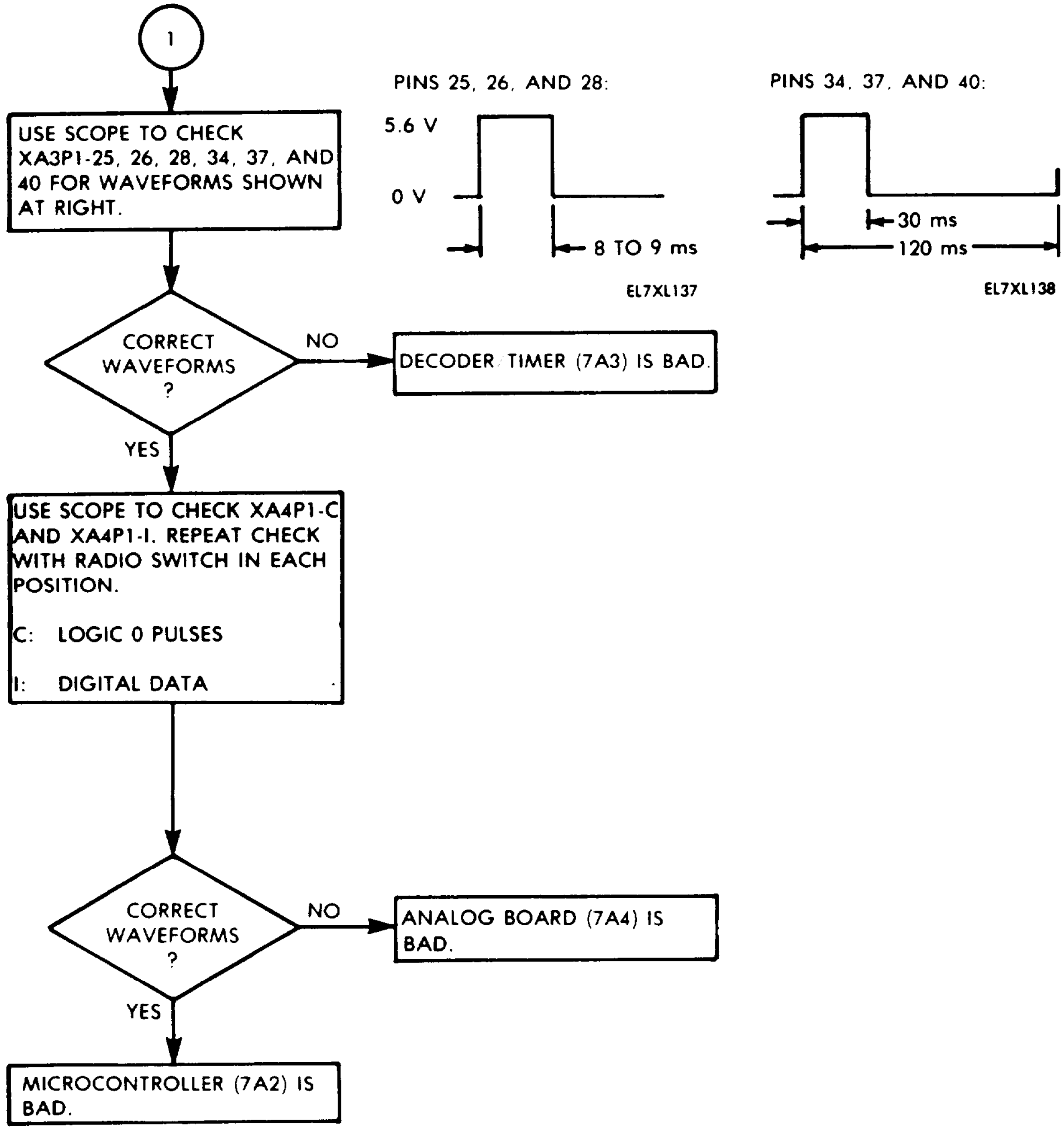
Refer to FO-16 and FO-17.



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

Troubleshooting "F2" Display (Sheet 2 of 2)



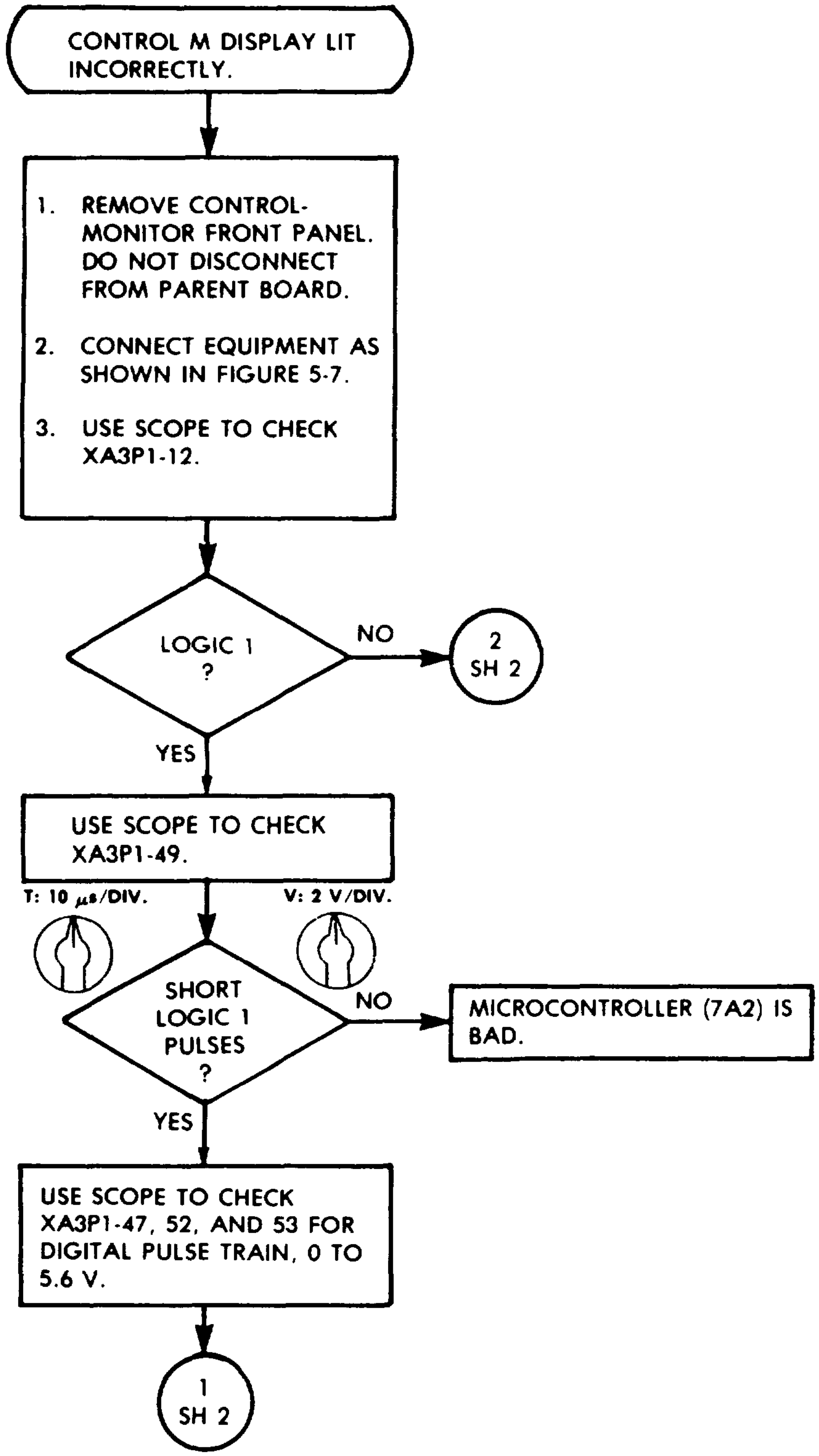
5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 3

Troubleshooting Incorrect CONTROL M Display (Sheet 1 of 2)

NOTE

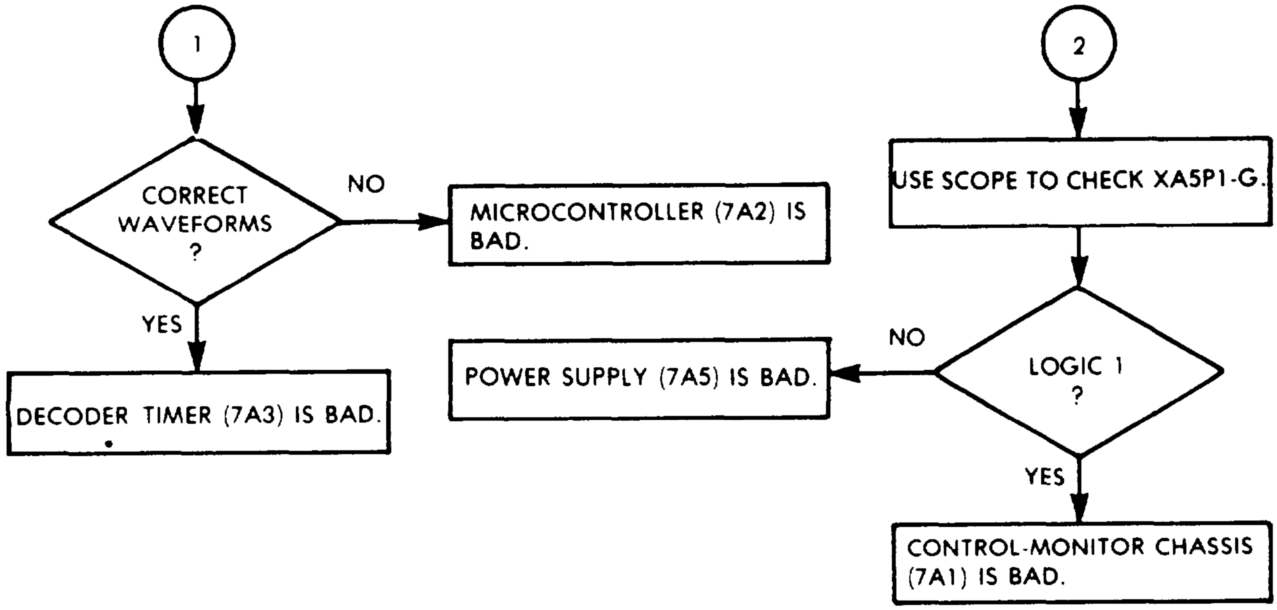
Refer to FO-16 and FO-17.



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 3

Troubleshooting Incorrect CONTROL M Display (Sheet 2 of 2)



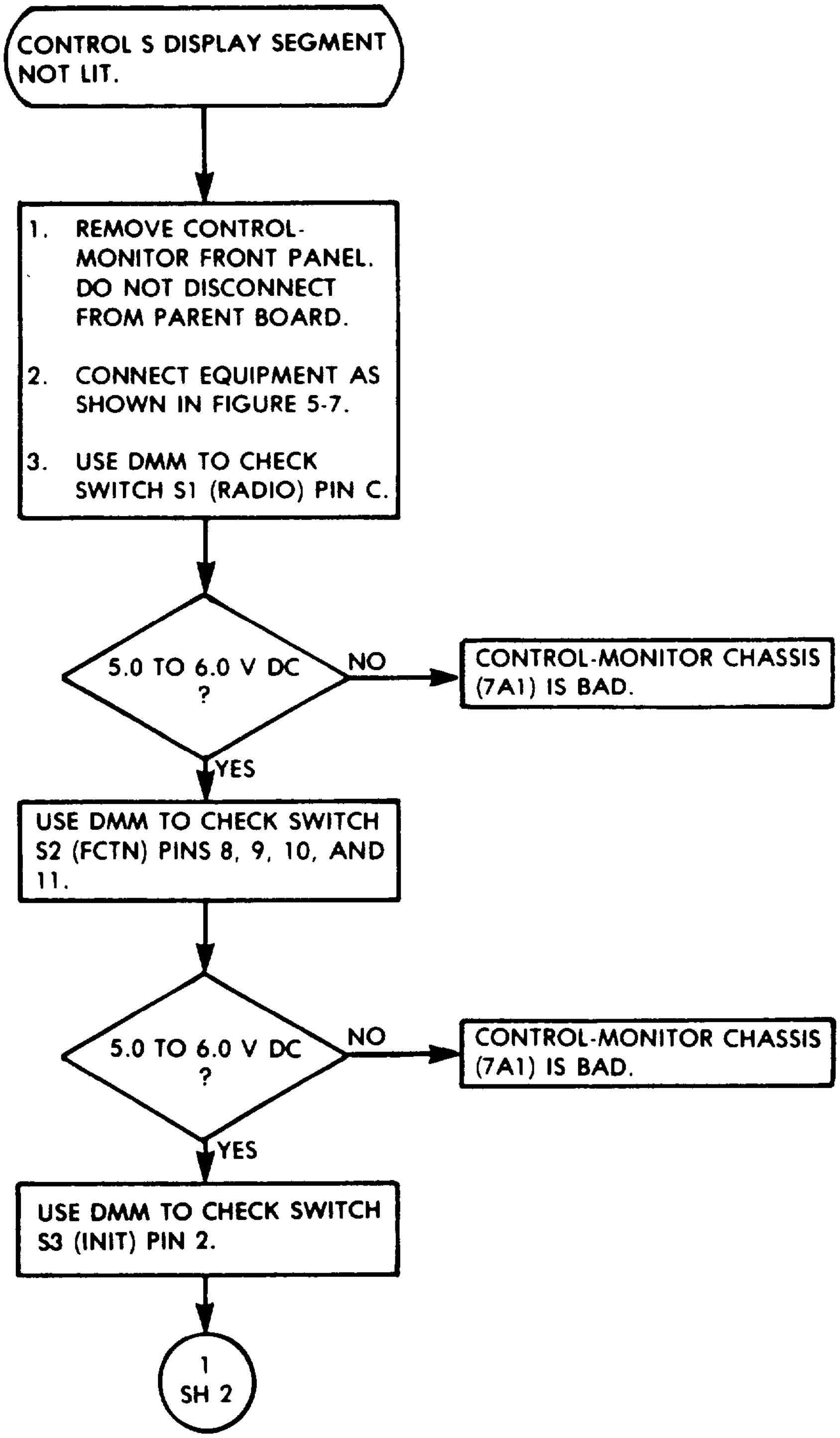
5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 4

Troubleshooting Incorrect CONTROL S Display (Sheet 1 of 3)

NOTE

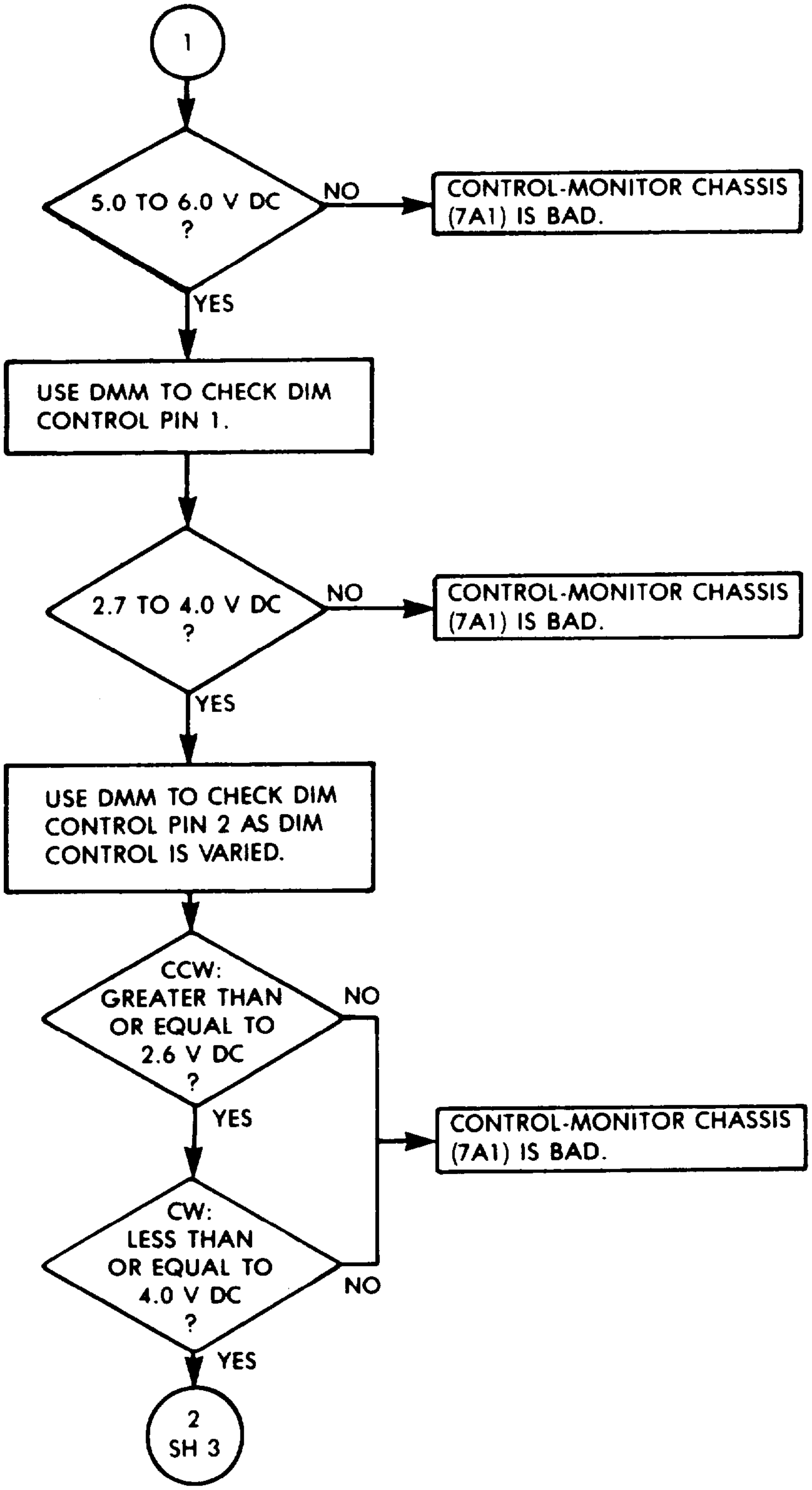
Refer to FO-16 and FO-17.



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 4

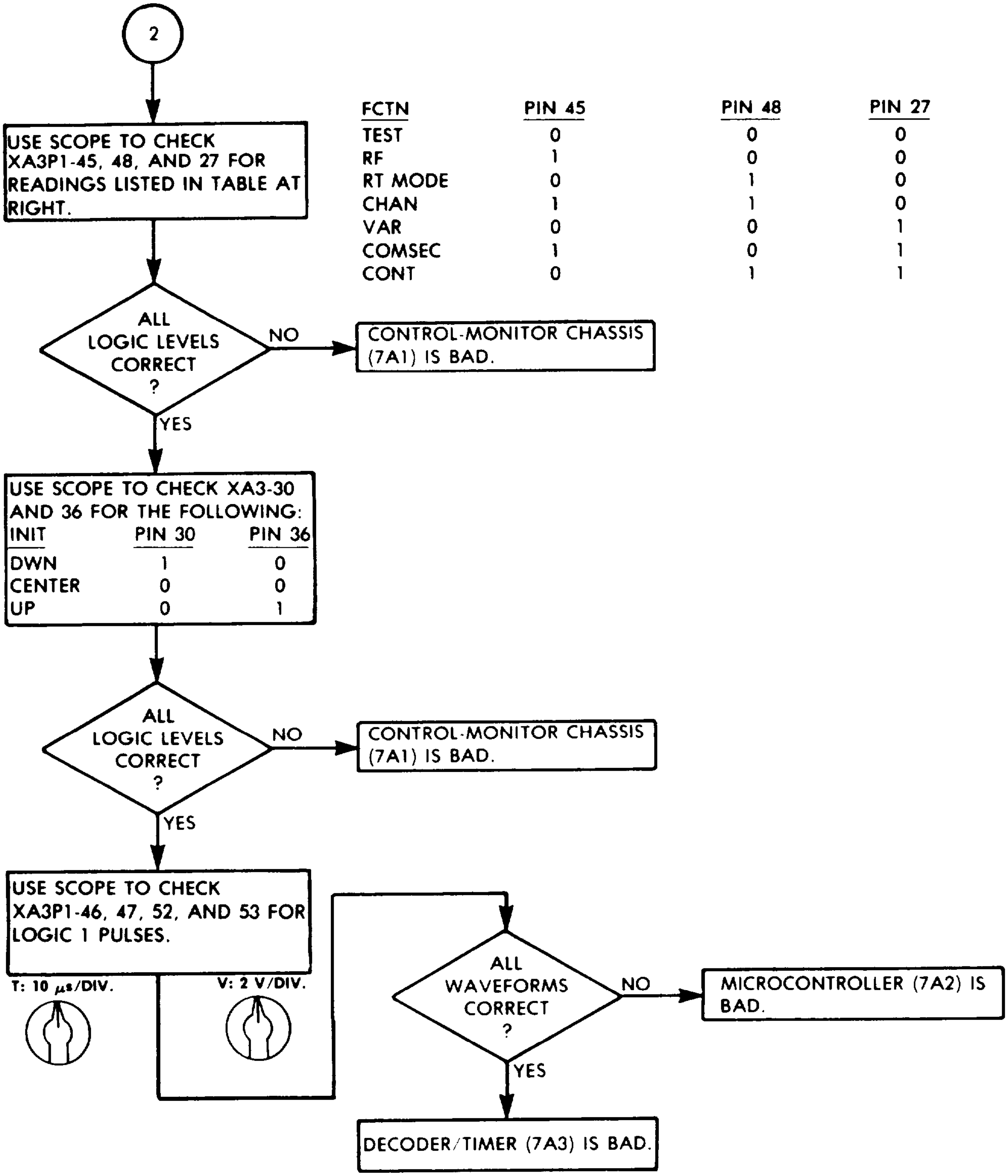
Troubleshooting Incorrect CONTROL S Display (Sheet 2 of 3)



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 4

Troubleshooting Incorrect CONTROL S Display (Sheet 3 of 3)



FCTN	PIN 45	PIN 48	PIN 27
TEST	0	0	0
RF	1	0	0
RT MODE	0	1	0
CHAN	1	1	0
VAR	0	0	1
COMSEC	1	0	1
CONT	0	1	1

INIT	PIN 30	PIN 36
DWN	1	0
CENTER	0	0
UP	0	1

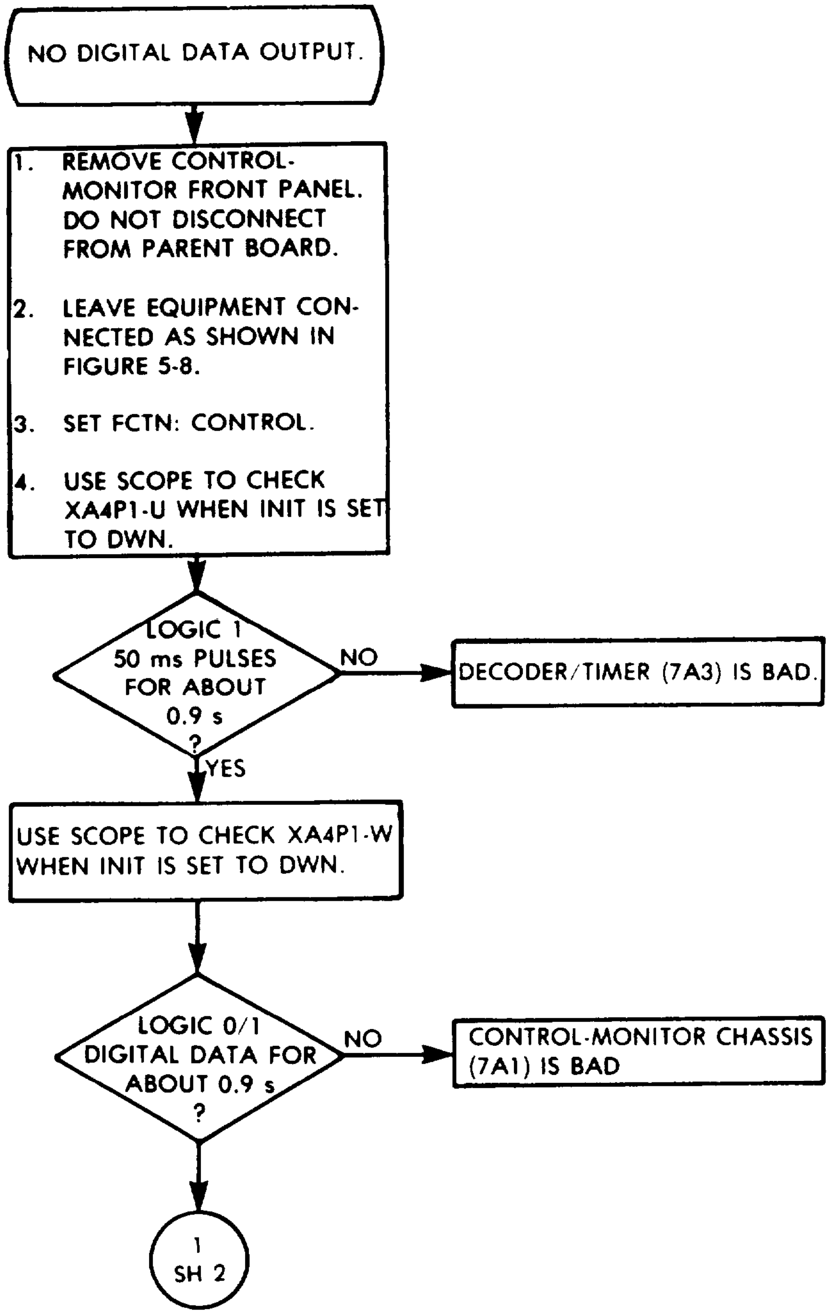
5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

Troubleshooting Digital Output Circuit (Sheet 1 of 2)

NOTE

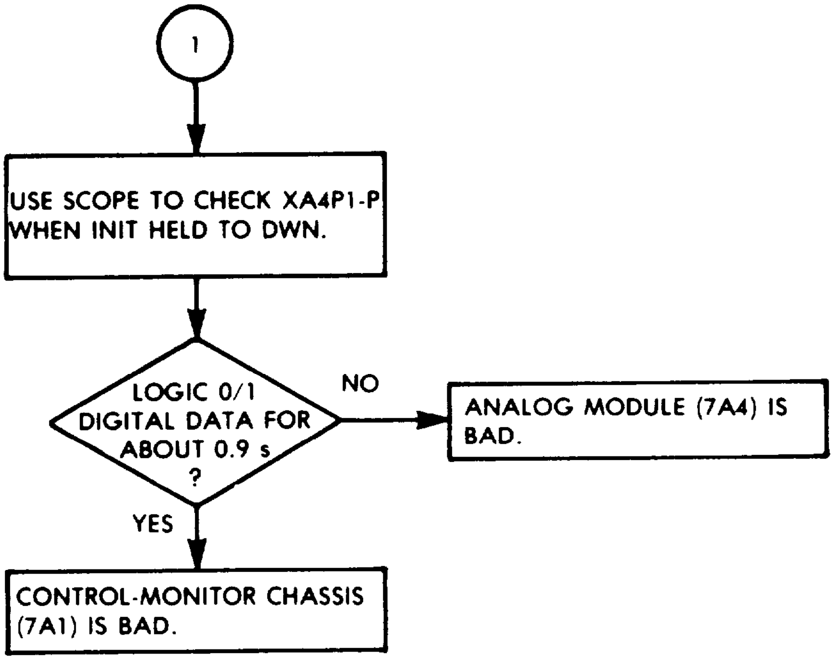
Refer to FO-16 and FO-17.



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

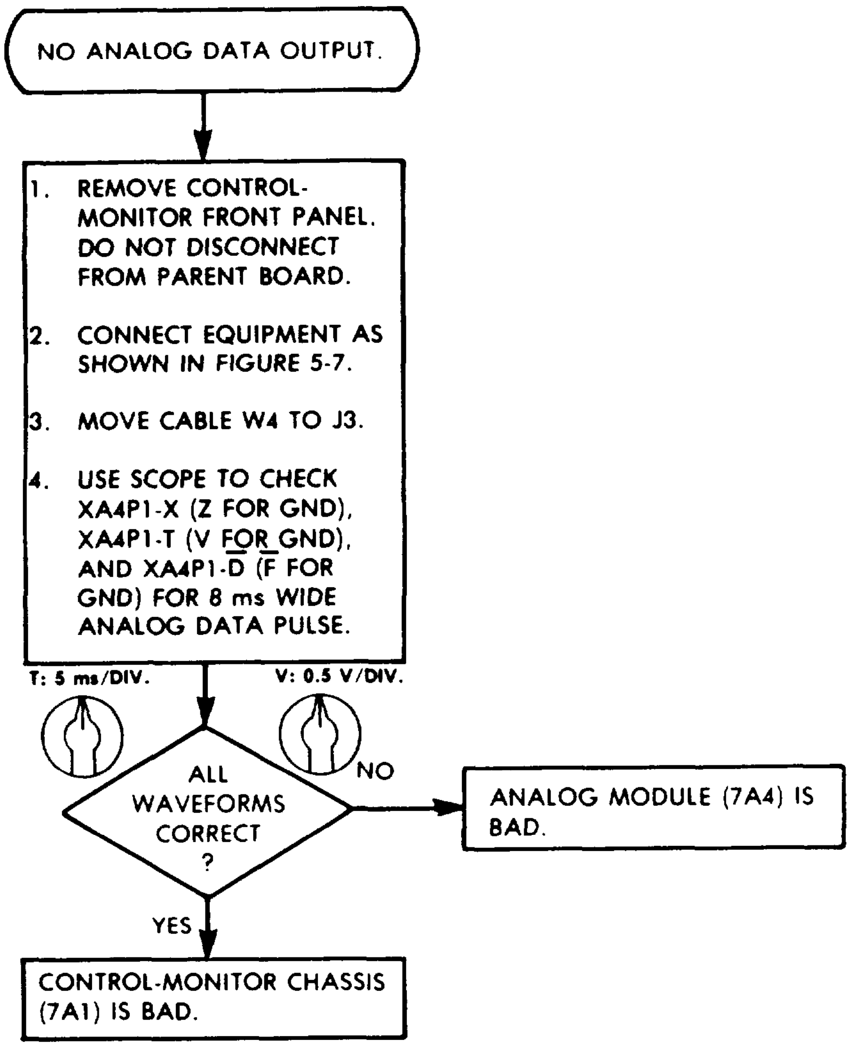
Troubleshooting Digital Output Circuit (Sheet 2 of 2)



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 6

Troubleshooting Analog Data Output (Sheet 1 of 1)



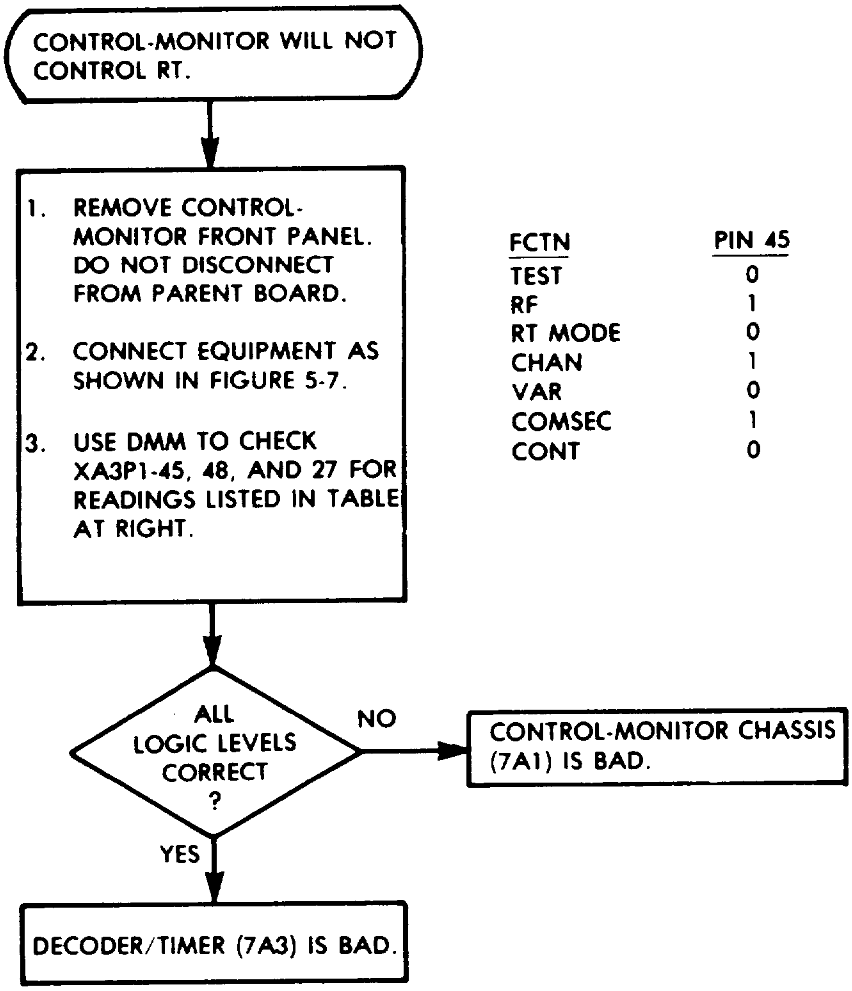
NOTE

Refer to FO-16 and FO-17.

5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 7

Troubleshooting RT Interface Circuit (Sheet 1 of 1)



NOTE

Refer to FO-16 and FO-17.

FCTN	PIN 45	PIN 48	PIN 27
TEST	0	0	0
RF	1	0	0
RT MODE	0	1	0
CHAN	1	1	0
VAR	0	0	1
COMSEC	1	0	1
CONT	0	1	1

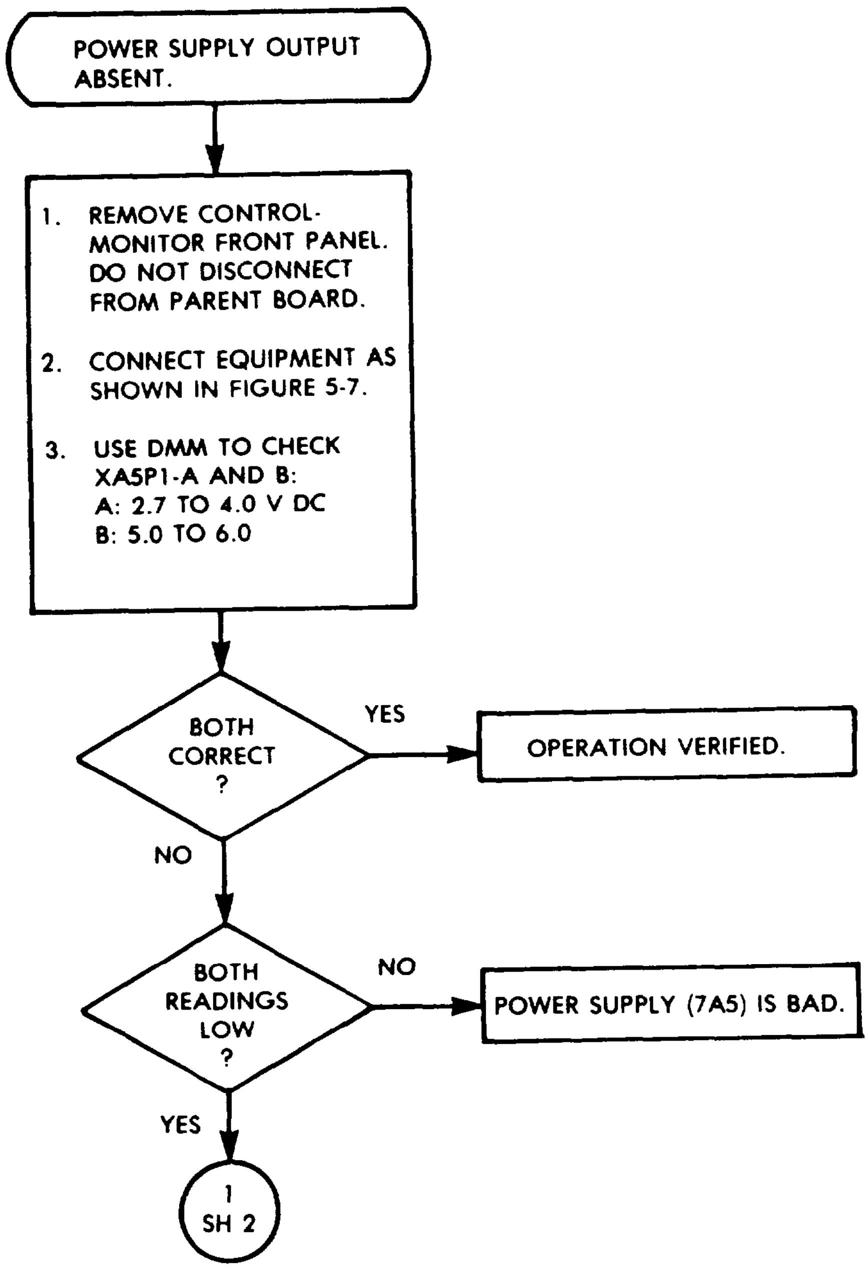
5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 8

Troubleshooting Power Supply (Sheet 1 of 3)

NOTE

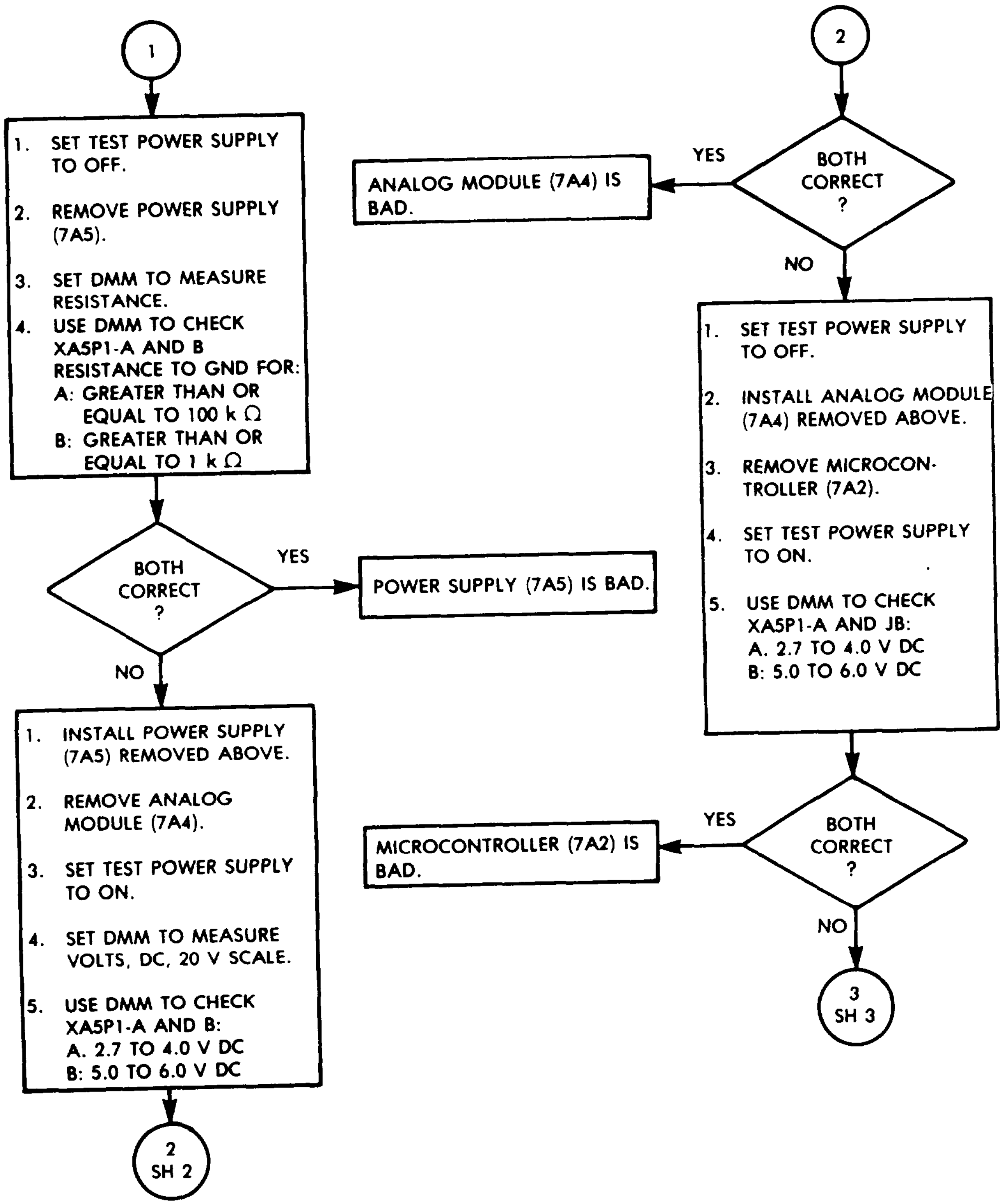
Refer to FO-16 and FO-17.



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 8

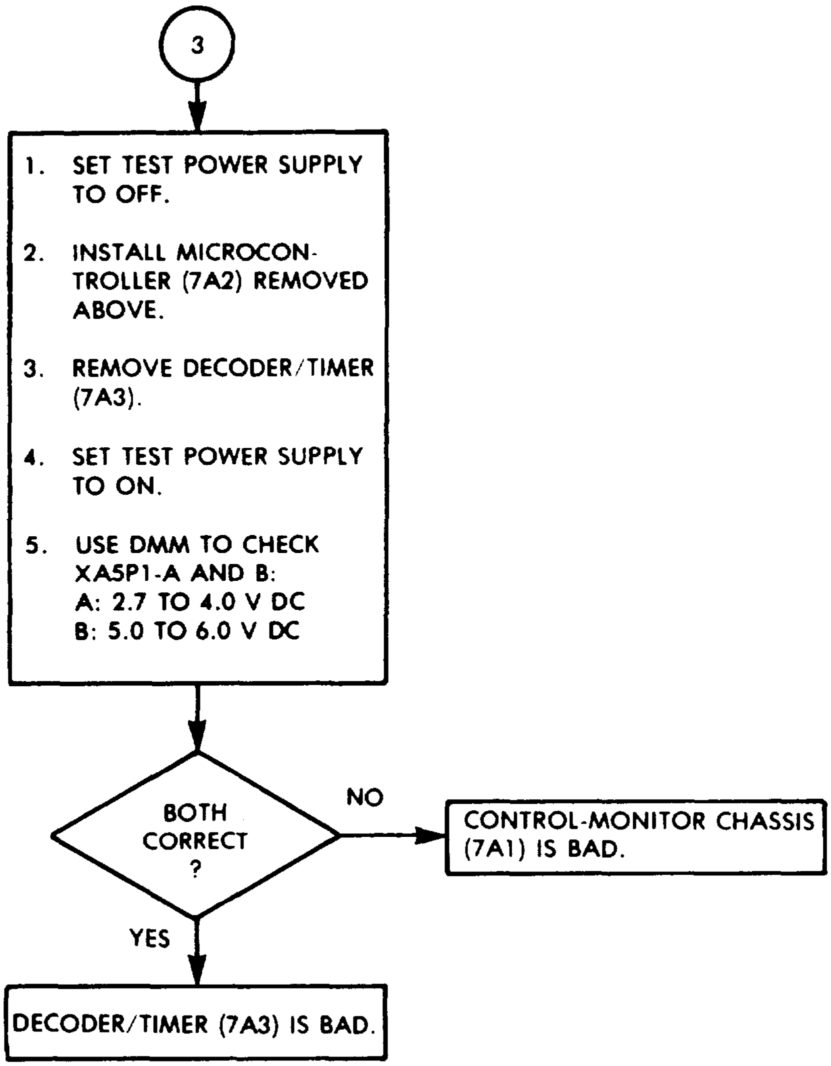
Troubleshooting Power Supply (Sheet 2 of 3)



5-16. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 8

Troubleshooting Power Supply (Sheet 3 of 3)



Section IV. MAINTENANCE PROCEDURES

5-17. GENERAL.

This section includes the operational check and the repair procedures. The operational check is used to verify the operation of a repaired control-monitor. It is also used to verify the symptom of a faulty control-monitor. It will identify the troubleshooting chart to be used. When a bad module is identified, replace it using the procedure in this section.

5-18. OPERATIONAL CHECK.

The operational check provides a step-by-step procedure for evaluating a control-monitor. If the operational check is passed, the control-monitor con be returned to service. If it does not, the bad module or troubleshooting chart to be used will be identified. The troubleshooting procedures are in section III.

The operational check is broken into steps. Each step verifies a particular function. Follow the instructions in the "Action" column. Check the response. If the response is correct, proceed with the next lettered step. When a STEP has been completed, proceed with the next STEP. A "no response" in the "Response" column means that any response is not of interest.

The switch settings for the test equipment are given in the "EQUIPMENT PRESETS" section of each test setup figure.

WARNING

Connect the test setups only when directed and with the power supply set to OFF. The large current capacity of the test power supply can cause personal injury. Verify the test setup before turning the power supply on.

CAUTION

Static electricity and stray voltages con damage the control-monitor modules. Use on antistatic pad an the work surface and wear a grounded wrist strap when testing.

NOTE

CB1 should be turned OFF whenever the control-monitor is being connected to the test radio. if the control-monitor does not turn on properly when power is applied, try turning CB1 OFF and back ON a few times until it does.

5-18. OPERATIONAL CHECK. Continued

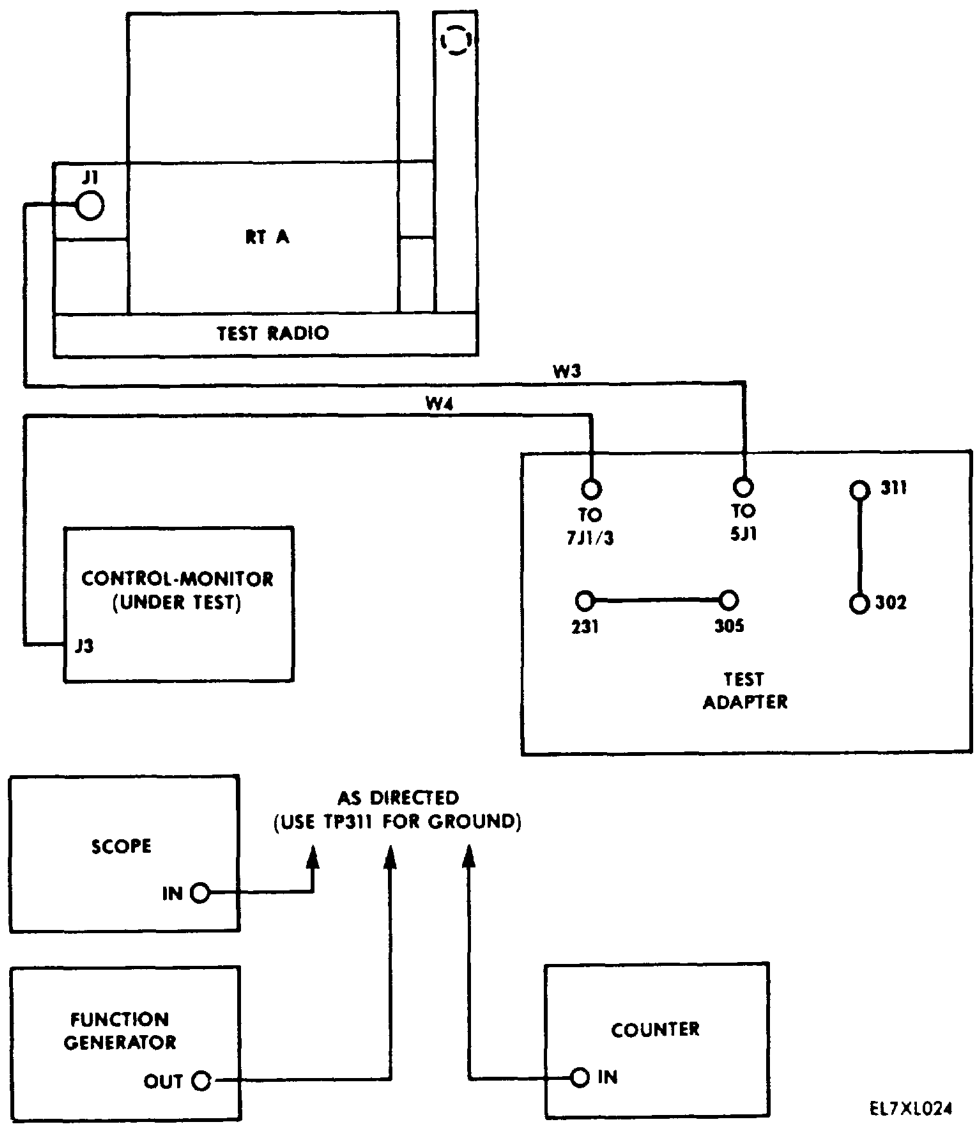
STEP 1. SELF-TEST

Action	Response
a. Connect equipment OS shown in figure 5-8.	a. No response.
b. Power supply: ON. CB1: ON	b. Control-monitor repeats self-test every 5 seconds. All display segments light for 3 seconds then 'Gd" is displayed for 2 seconds.

IF	THEN
Any display segment does not light.	Go to chart 1.
All display segments do not light.	Go to chart 1.
"F1" displayed.	Microcontroller (7A2) is bad.
"F2" displayed.	Go to chart 2.

STEP 2. CONTROL FUNCTION CHECK

Action	Response
o. FCTN: RF.	a. CONTROL S lit, all others blank. If control M is lit with the others blank, go to chart 3. If any other display is seen, go to chart 4.
b. Check DIM control operation.	b. Ccw dims display, cw brightens display. If not, control-monitor chassis (7A1) is bad.
c. FCTN: CONTROL.	C. CONTROL S lit, all others blank. If not, go to chart 4.
d. Set INIT to UP then release.	d. "Er" displayed while INIT is UP. If not, go to chart 4.
e. Set INIT to DWN then release.	e. CONTROL M lit briefly, "Fr" displayed for 2.5 seconds, then CONTROL S lit. If not, go to chart 4.
f. Use scope to check TP304 when INIT set to DWN then released.	f. Digital data pattern for about 0.9 seconds then logic 1. If not, go to chart 5.



EQUIPMENT PRESETS

POWER SUPPLY:
VOLTAGE: 27.5 V dc

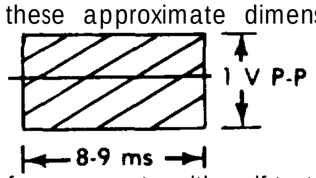
TEST RADIO:
CB1: OFF
RT A FCTN: OFF

CONTROL-MONITOR:
RADIO: 1
FCTN: TEST
DIM: FULL CW

Figure 5-8. Control-Monitor Test Setup.

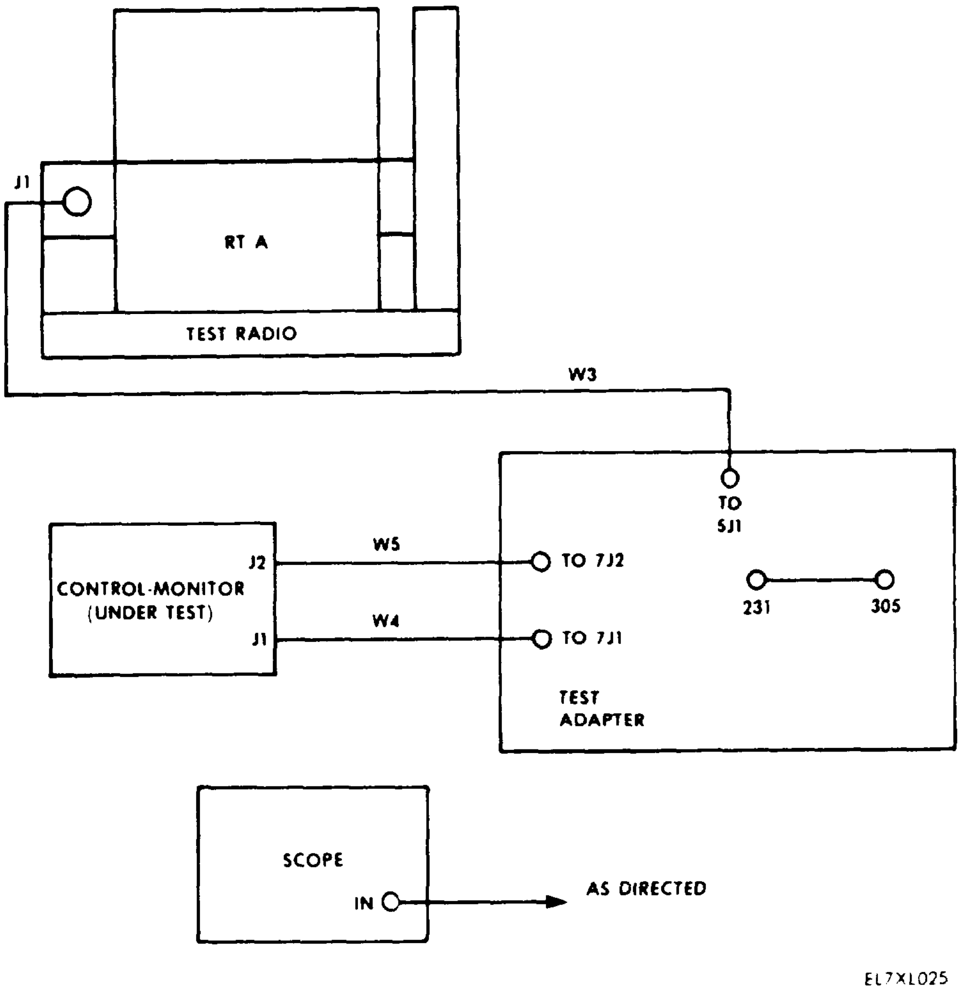
5-18. OPERATIONAL CHECK. Continued

STEP 3. OUTPUT CHECK

Action	Response
a. Connect equipment as shown in figure 5-9.	a. No response.
b. FCTN: TEST.	b. No response.
c. RADIO: 1.	c. No response.
d. Connect scope probe to TP301 and ground to TP302.	d. Scope waveform is a sine wave; burst with these approximate dimensions.  Waveform repeats with self-test cycle. IF / THEN Waveform not present. — Go to chart 6. Waveform incorrect, F2 displayed. — Analog module (7A4) is bad. Waveform incorrect, F2 not displayed. — Go to chart 1, sheet 4, at 3.
e. RADIO: 2.	e. No response.
f. Connect scope probe to TP303 and ground to TP304.	f. Some response as step d.
g. RADIO: 3.	g. No response.
h. Connect scope probe to TP306 and ground to TP307.	h. Same response as step d.
i. FCTN: RF.	i. CONTROL M lit, all others blank. If not, go to chart 4.

STEP 4. INPUT AND RADIO SELECT CHECK

Action	Response
a. Remove control-monitor front panel. Do not disconnect from control-monitor parent board.	a. No response.
b. Connect equipment as shown in figure 5-10.	b. No response.

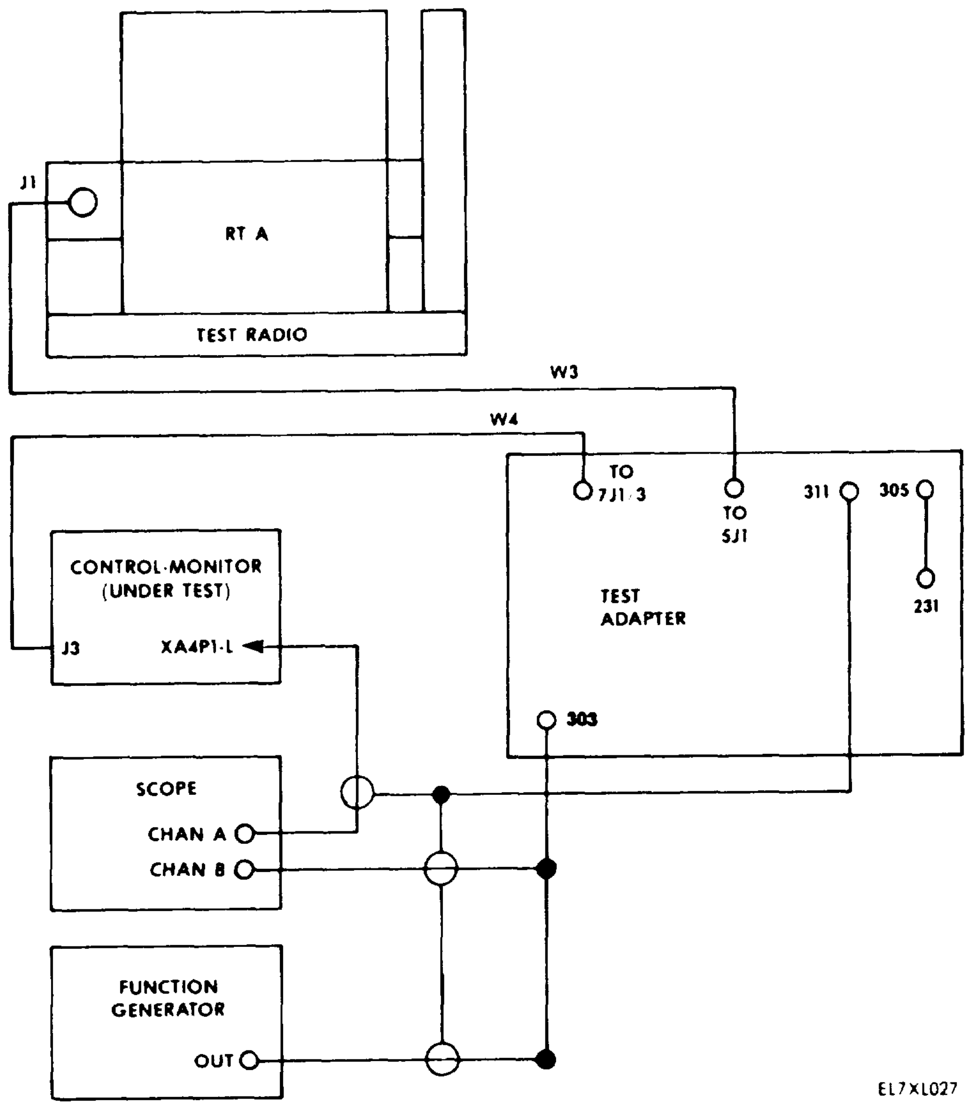


EQUIPMENT PRESETS

POWER SUPPLY:
VOLTAGE: 27.5 V DC

TEST RADIO:
CB1: ON
RT A FCTN: OFF

Figure 5-9. Output Check Test Setup.



EQUIPMENT PRESETS

CONTROL-MONITOR:
RADIO: 1
FCTN: TEST

TEST RADIO:
CB1: ON
RT A FCTN: OFF

FUNCTION GENERATOR:
FREQ: 640 Hz (600 TO 700 Hz)
LEVEL: 0 TO +5 V (USE DC OFFSET CONTROL)
FUNCTION: SQUARE

POWER SUPPLY:
VOLTAGE: 27.5 V DC

Figure 5-10. Input Check Test Setup.

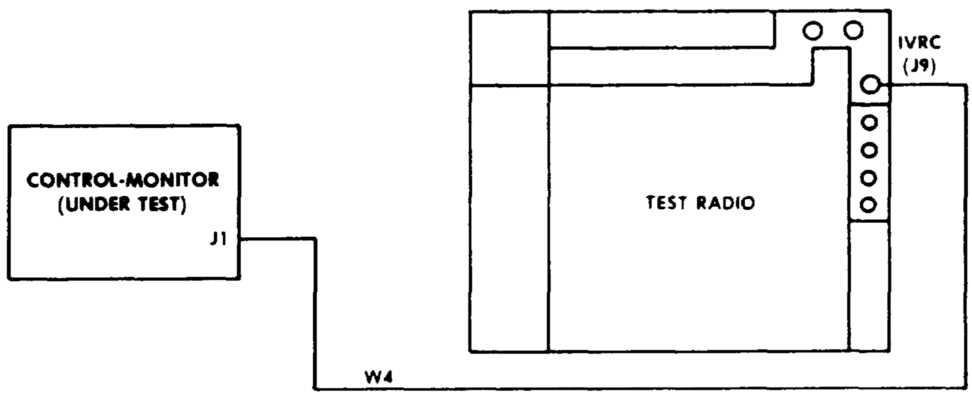
5-18. OPERATIONAL CHECK. Continued

STEP 4. INPUT AND RADIO SELECT CHECK Continued

Action	Response
c. Compare scope waveforms	c. Channel A same channel B. If not, control-monitor chassis (7A1) is bad.
d. Move scope channel A probe to XA4P1-H. Compare scope waveforms.	d. Channel A same OS channel B. Channel A may have slightly lower voltoge than channel B. If not, analog module (7A4) is bad.
e. Move scope channel A probe to XA3P1-39. Observe dc level with RADIO switch in each position.	e. DC level: RADIO 1: logic 0 RADIO 2: logic 1 RADIO 3: logic 0 If incorrect, control-monitor chassis (7A1) is bad.
f. Move scope channel A probe to XA3P1-42: Observe dc level with RADIO switch in each position.	f. Dc level: RADIO 1: logic 0 RADIO 2: logic 0 RADIO 3: logic 1 If incorrect, control-monitor chassis (7A1) is bad.
g. Install control-monitor front panel.	g. No response.

STEP 5. OPERATION WITH RADIO

Action	Response
a. Connect equipment as shown in figure 5-11.	a. No response.
b. Use INIT switch to change RF setting.	b. RF display changes. Rt changes power output. If not, go to chart 7.
c. FCTN: RT MODE.	c. No response.
d. Use INIT switch to change RT MODE.	d. RT MODE display changes. Rt function changes. If not, go to chart 7.
e. FCTN: CHAN.	e. No response.
f. Use INIT switch to change CHAN setting.	f. CHAN display changes. Rt channel changes. If not, go to chart 7.
g. Operational check complete.	



EQUIPMENT PRESETS

CONTROL-MONITOR:
RADIO: 1
FCTN: RF

TEST RADIO:
CB1: ON
RT FCTN: REM
RT IN LOWER SLOT

Figure 5-11. Operation with Radio Setup.

5-19. REPAIR PROCEDURES.

Repair of the control-monitor consists of replacing a bad module. A module is replace by removing it and installing a good module. Procedures for doing this follow.

a. General Instructions. The following instructions apply to all repair tasks.

1. Remove any cables connected to the control-monitor.
2. inspect the control-monitor for damage. Repair any obvious physical damage.
3. Use the module extractor to remove the circuit card assemblies. It is included in the maintenance tool kit. It is used as follows:

   (a) Locate the module to be removed.

   (b) Hook the module extractor through the two holes in the top corners of the module.

   (c) Hold the module extractor with one hand. Rest the other hand on the control-monitor with the fingers of the hand on top of the module to be removed.

   (d) Pull steadily with the module extractor until the module connector is free of the parent board.

   (e) Remove the module.

   (f) Unhook the module extractor from the module.

4. Handle all modules carefully.
5. Before installing a module, check the connector for bent or broken pins. Do not install if damaged.
6. Complete the operational check.

b. Repair Precautions.

CAUTION

Static electricity can damage the control-monitor modules. Ground the control-monitor and all tools before removing a module. Use a grounded wrist strop when handling a module.

5-20. DISASSEMBLY FOR TROUBLESHOOTING.

The control-monitor front panel is not replaced by I(DS) maintenance. However, to gain access to the parent board for testing, it is necessary to partially remove the front panel.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

5-20. DISASSEMBLY FOR TROUBLESHOOTING. Continued

ITEM	ACTION	REMARKS
REMOVAL		
a. Control-monitor	Set on back cover.	
b. Six captive screws	Fully loosen.	
c. Front panel	Lift free from chassis. Do not disconnect the front panel from the parent board.	The control-monitor is ready for troubleshooting.
INSTALLATION		
d. Front panel	Check location of guide pin on chassis. Set front panel in place on chassis.	
e. HCP Six captive screws	Tighten screws. Torque to 15 in-lb.	

5-21. REMOVAL AND INSTALLATION OF BACK COVER.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. Control-monitor	Set on work surface with back cover toward you.	
b. Six captive screws	Fully loosen.	
c. Back cover	Lift free from control-monitor. If damaged, replace.	
INSTALLATION		
d. Back cover	Aline with screw holes in chassis. Set cover in place on control-monitor.	
e. HCP Six captive screws	Tighten screws. Torque to 15 in-lb.	

5-22. REPLACEMENT OF CONTROL-MONITOR CHASSIS (7A1).

The control-monitor chassis (7A1) is replaced by removing each module from the faulty control-monitor then installing the modules into a good chassis.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench
Module extractor

References:

Paragraph 5-21 for removal and installation of back cover.
Paragraph 5-23 for removal and installation of modules.

ITEM	ACTION	REMARKS
REPLACEMENT		
a. Back cover	Fully loosen six captive screws and remove.	
b. Modules	Remove each module from faulty control-monitor chasss and install in good control-monitor chassis. See paragraph 5-23.	
c. HCP Back cover	Install on good control-monitor chassis. Tighten screws. Torque to 20 in-lb.	

5-23. REPLACEMENT OF CONTROL-MONITOR MODULES.

Tools:

Flat tip screwdriver
Module extractor
Torque adapter
Torque wrench

References:

Paragraph 5-21 for removal and installation of back cover.
Figure 5-12 for location of modules.

ITEM	ACTION	REMARKS
REMOVAL		
a. Back cover	Fully loosen six captive screws and remove.	
b. Module	Hook module extractor to module using two holes in top corners of circuit card.	Figure 5-12 illustrates module locations.
c. Module	Pull free of control-monitor.	

5-23. REPLACEMENT OF CONTROL-MONITOR MODULES. Continued

ITEM	ACTION	REMARKS
INSTALLATION		
d. Module	Place module in card guides.	
e. Module	Press down to fully seat circuit card.	
f. HCP Back cover	Set in place and tighten screws. Torque to 15 in-lb.	

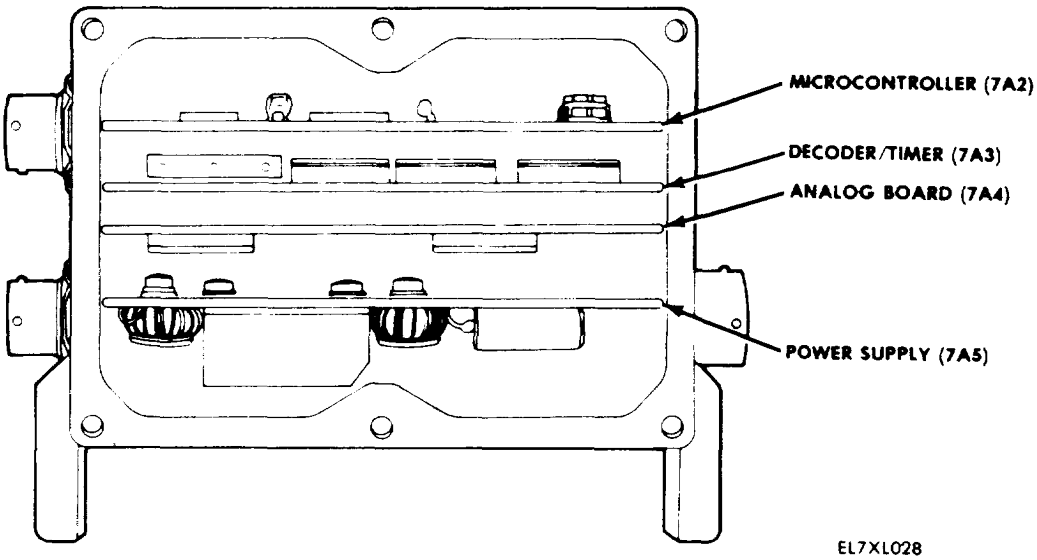


Figure 5-12. Control-Monitor Module Locations.

Section V. PREPARATION FOR STORAGE OR SHIPMENT

5-24. GENERAL INFORMATION.

a. Pack the control-monitor and modules in approved shipping containers.

b. All modules must be shipped enclosed in material that provides protection from static electricity. See the following paragraph.

5-25. PACKING STATIC SENSITIVE MODULES.

The following steps should be followed when packing a static sensitive module for storage or shipment.

CAUTION

To avoid damaging static sensitive modules, use an antistatic pad on the work surface and wear a grounded wrist strap when handling the module.

ITEM	ACTION	REMARKS
a. Module (1)	Place inside antistatic bag (2) or inside antistatic wrapping material (3). See figure 5-13.	
b. Antistatic package (4)	Seal with adhesive tape. Attach "static sensitive contents" unit pack label (5).	
c. Antistatic package (4)	Place inside approved shipping container (6). Attach "static sensitive contents" intermediate pack label (7).	

5-25. PACKING STATIC SENSITIVE MODULES. Continued

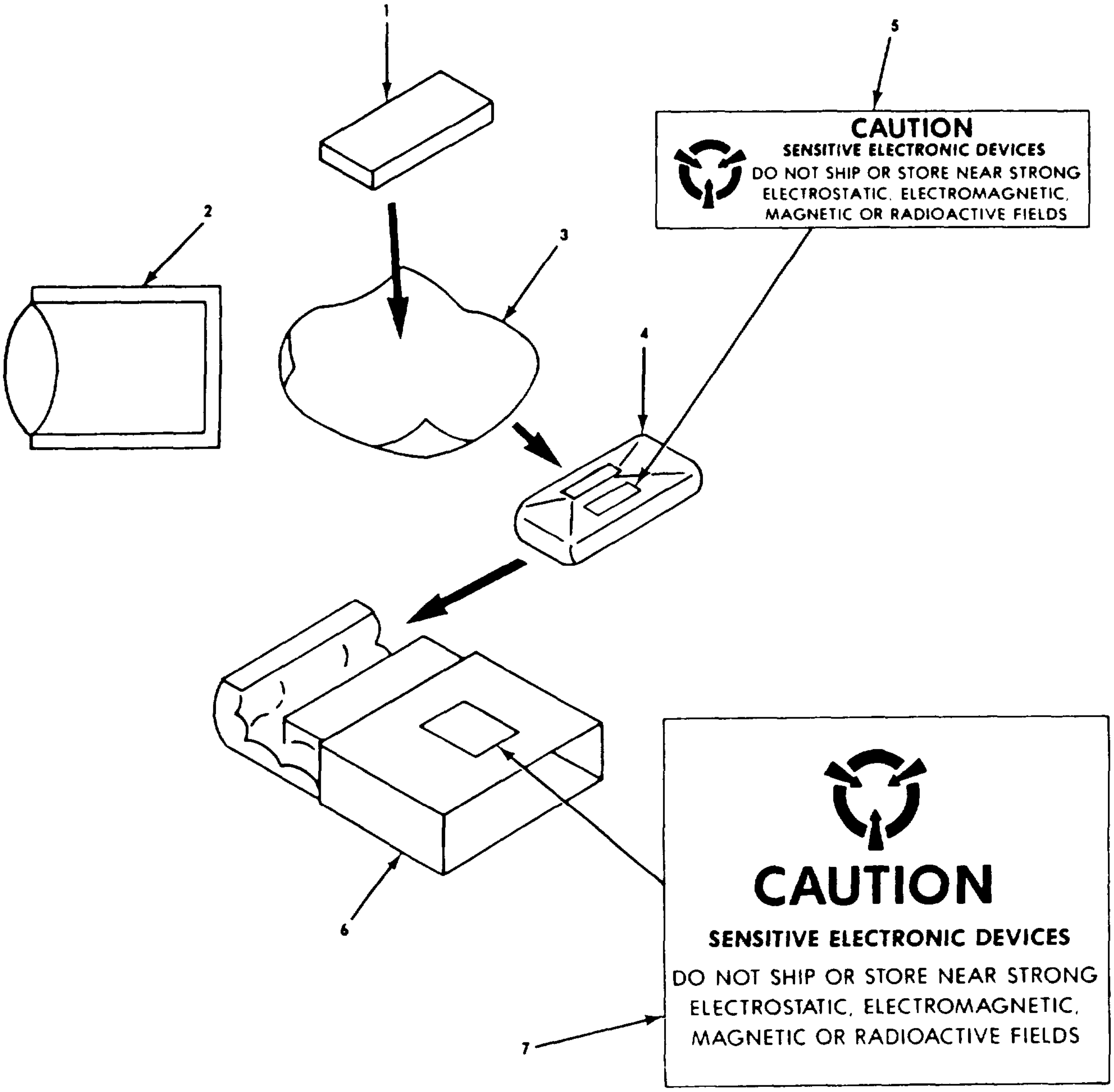


Figure 5-13. Packing Static Sensitive Modules

CHAPTER 6

MOUNTING BASE, ELECTRICAL EQUIPMENT MT-6352/VRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

6-1. INTRODUCTION.

The mounting base performs the following functions:

Physically supports the mounting adapter.

Electrically connects mounting adapter to vehicular power and intercom.

Distribution of vehicular dc power.

6-2. ELECTRICAL CONNECTOR ASSEMBLY (13A1).

The electrical connector assembly has five connectors as shown in figure 6-1. The primary power cable connects to J1. Power for a second radio or other device is available at J2. J3 and J4 are cabled to the intercom. J3 is used for rt A and J4 for rt B. J5 mates with P1 on the mounting adapter. See Chapter 3.

The electrical connector assembly has no active circuitry. Filters FL1 and FL2 help filter the dc input power. All connections are as shown in figure 6-1.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

6-3. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

6-4. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required for I (DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

6-5. REPAIR PARTS.

Repair parts are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering I (DS) maintenance for this equipment.

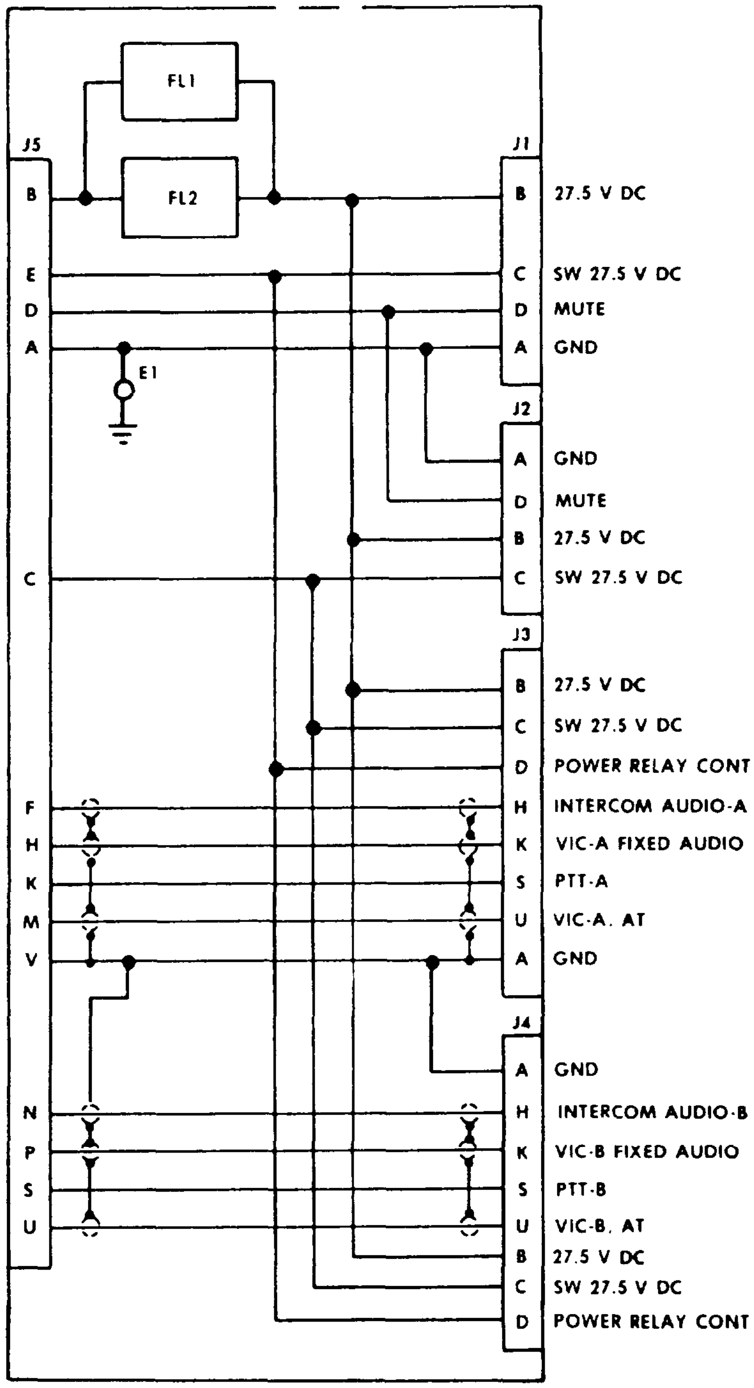


Figure 6-1. Electrical Connector Assembly Schematic Diagram.

Section III. TROUBLESHOOTING

6-6. TROUBLESHOOTING.

When a mounting base is received from unit maintenance, inspect it for damage. Repair any damage following the instructions in section IV. If the mounting base has on electrical problem, use the DMM and figure 6-1 to verify the fault. If there is o short or open circuit in the electrical connector assembly, repair it. Follow the instructions in section IV.

Section IV. MAINTENANCE PROCEDURES

6-7. INTRODUCTION.

Maintenance of the mounting base consists of replacing defective ports. The electrical connector assembly con be removed by unit maintenance. Check it OS described in section III. The repair procedure is in paragraph 6-9. Repair of the mounting base is covered in paragraph 6-8. Inspect all of the ports and replace any that ore defective.

6-8. MOUNTING BASE REPAIR PROCEDURE.

Tools:
- Tool Kit TK-100/G
- Torque wrench
- Spanner wrench
- Torque adapter

Expendable supplies:
- Sealing compound: grade A and grade H
- Silicone compound

ITEM	ACTION	REMARKS
DISASSEMBLY		
a. Electrical connector assembly (4)	Fully loosen six screws (1). See figure 6-2. Remove screws (1), lockwashers (2), and washers (3). Loosen and remove two screws, lockwashers, and flat washers securing ground strops to bock of electrical connector assembly. Lift assembly (4) from mounting base.	NOTE An adhesive has been used on some of the screws. If o screw is hard to remove, apply heat to the screw to soften the adhesive.
b. Guide pin (7)	Loosen and remove screw (6), lockwasher (5), and guide pin (7).	Apply grade H sealing compound to screw before instolling.
c. Four shock mounts (22)	Loosen and remove four screws (27) for each shock mount.	Apply grade H sealing compound to screws before instolling.
d. Mounting base	Place on work surface with bottom side up.	
e. Six ground strops (30)	Loosen and remove screw (11) lockwasher (10), and two IET washers (29 and 31) for each ground strop.	Apply silicone compound to IET washers before installing.
f. Base plate (28)	Remove from mounting troy (38).	
g. Four shock mounts (22)	Loosen and remove one screw (17) for each shock mount. Remove shock mounts from bottom troy (28).	Apply grade H sealing compound to screws before installing.

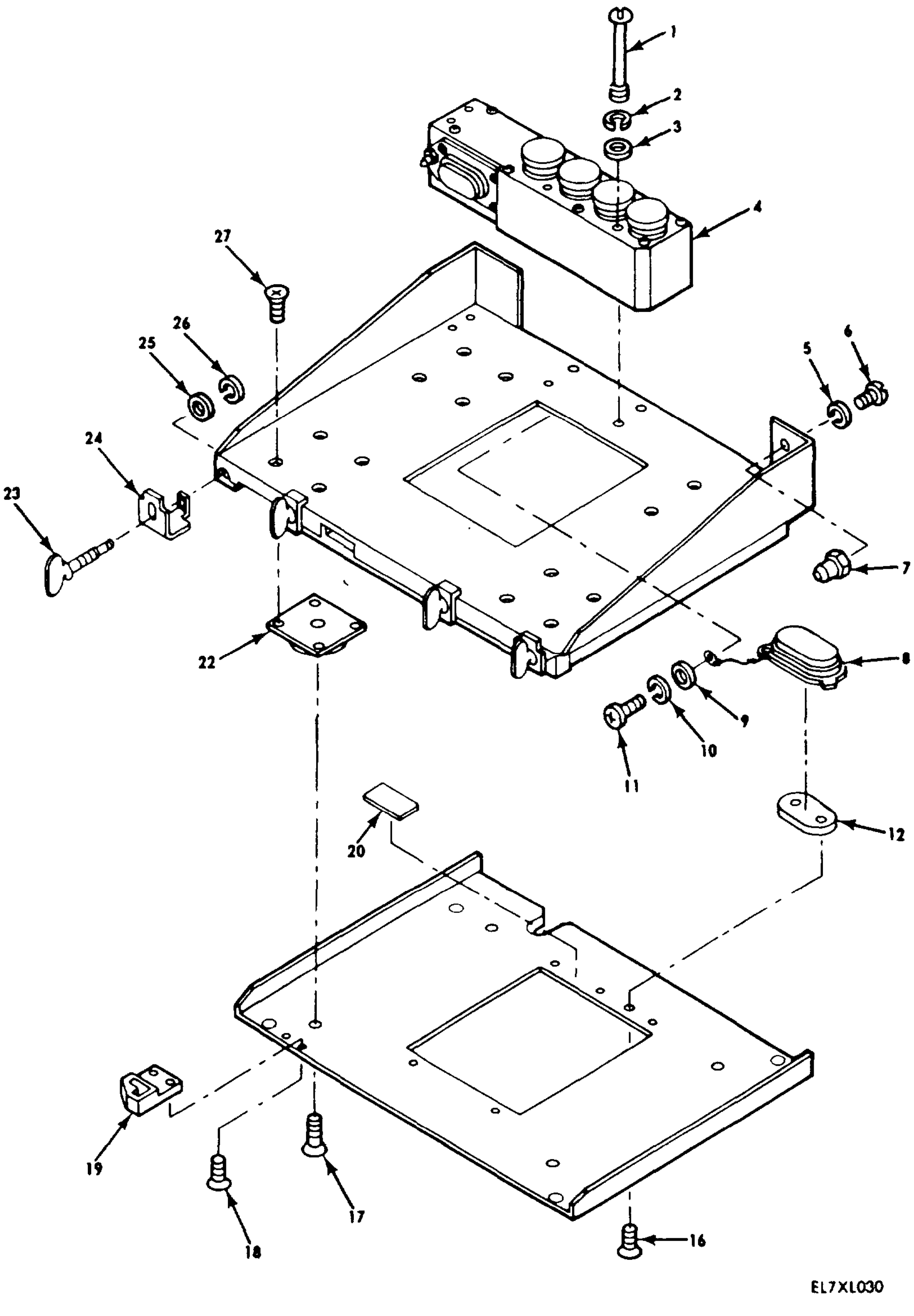


Figure 6-2. Electrical Equipment Mounting Rare MT-6352/VRC (Sheet 1 of 2)

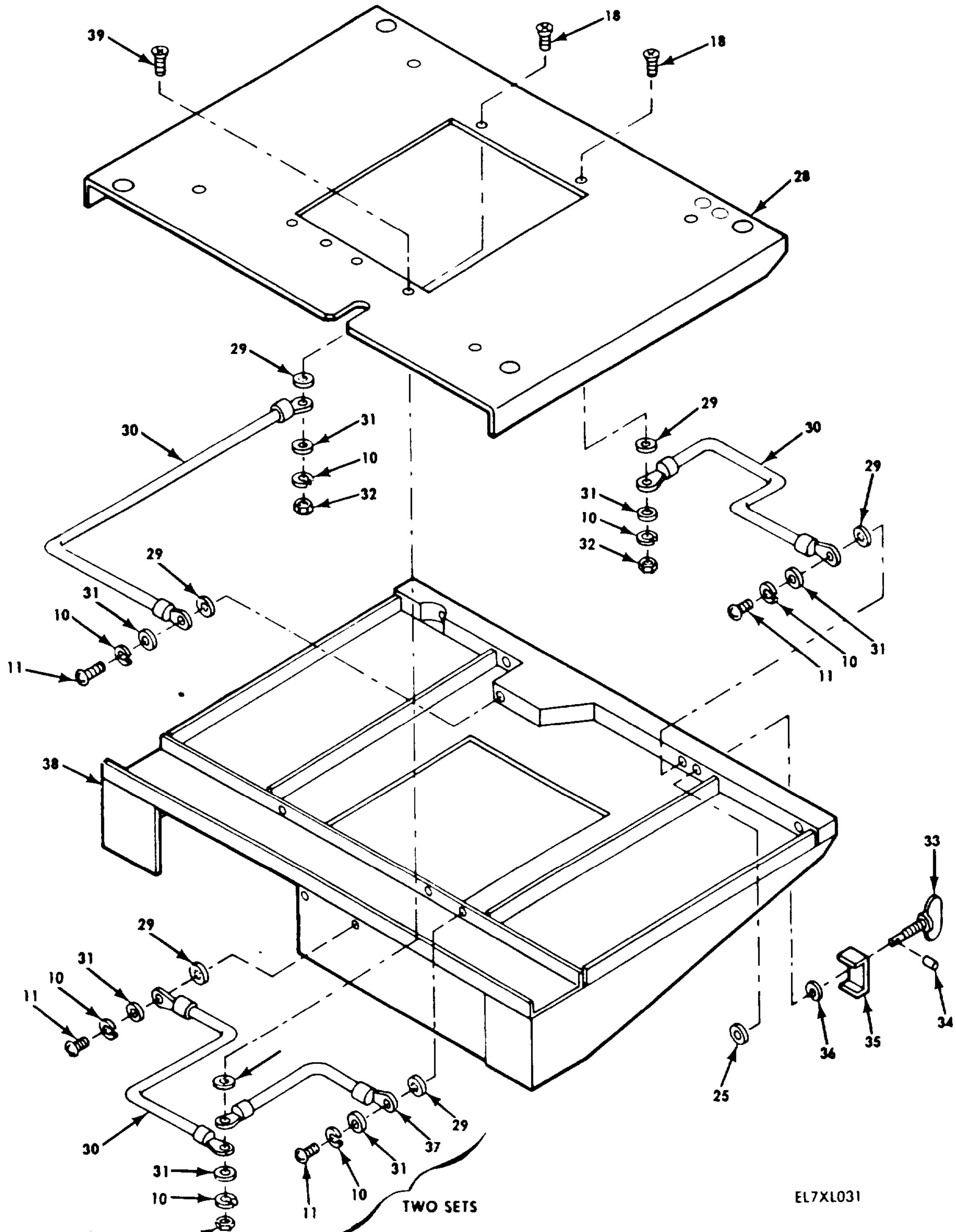


Figure 6-2. Electrical Equipment Mounting Base MT-6352/VRC (Sheet 2 of 2)

6-8. MOUNTING BASE REPAIR PROCEDURE. Continued

ITEM	ACTION	REMARKS
DISASSEMBLY Continued		
h. Two ground strops (30)	Loosen and remove screw (18), two IET washers (29 and 31), lockwasher (IO), and nut (32) for each ground strop. Remove ground straps.	Apply silicone compound to IET washers before instolling.
i. Two ground strops (30)	Loosen and remove screw (39), two IET washers (29 and 31), lockwasher (10). and nut (32). Remove ground straps.	Apply silicone compound to IET washers before instolling.
j. Connector cop (8)	Loosen and remove screw (11), lockwasher (10). and washer (9). Remove connector cap.	Apply grade H sealing compound to screws before instolling.
k. Connector cop holder (12)	Loosen and remove two screws (16). Remove cap holder.	Apply grade H sealing compound to screws before installing.
l. Locking bar bracket (19)	Loosen and remove two screws (18). Remove bracket.	Apply grade H sealing compound to screws before installing.
m. Two thumbscrews (23)	Remove lockwasher (26) and washer (25) for each thumbscrew. Fully loosen and remove thumbscrews and clomp (24).	
n. Two thumbscrews (33)	Use ballpeen hammer and pin punch to remove spring pin (34) and two washers (25 and 36) for each thumbscrew. Fully loosen and remove thumbscrews and clamp (35).	
o. Name plate (20)	Pry free from base plate (28). Use solvent to remove adhesive. Use adhesive to install.	
ASSEMBLY		
P. Mounting base	Perform steps a through o in reverse. Install items removed. Tighten screws. Torque guide pin to 48 in-lbs.	

6-9. ELECTRICAL CONNECTOR ASSEMBLY REPAIR PROCEDURE.

Tools:

Tool kit TK-105/G
Torque wrench
Torque adapter
Spanner wrench

Expendable supplies:

Sealing compound: grade H
Insulation sleeving

ITEM	ACTION	REMARKS
DISASSEMBLY		
a. Four connector caps (3)	Loosen and remove from connector. See figure 6-3.	
b. Four lock rings (21)	Loosen and remove from connectors. Remove connector cops.	Apply grade H sealing compound to lock rings, then torque to 100 in-lb. to install.
c. Plate (1)	Loosen and remove eight screws (4) and washers (5). Remove plate.	Torque screws to 9 in-lbs. when instolling.
d. Filter bracket (19)	Loosen and remove three screws (16), lockwashers (15). and washers (20). Unsolder wires at top of filters 1 (17) and 2 (18). Loosen and remove nuts l (23) securing filters to bracket.	
e. Ground wire (14)	Loosen and remove screw (16), lockwasher (15), and ground lug.	
f. Seal screw (7).	Remove and inspect, replace if necessary.	
ASSEMBLY		
g. Electrical connector assembly	Perform steps a through f in reverse. Install items removed. Tighten all screws. Use silicone compound to seal gaskets.	

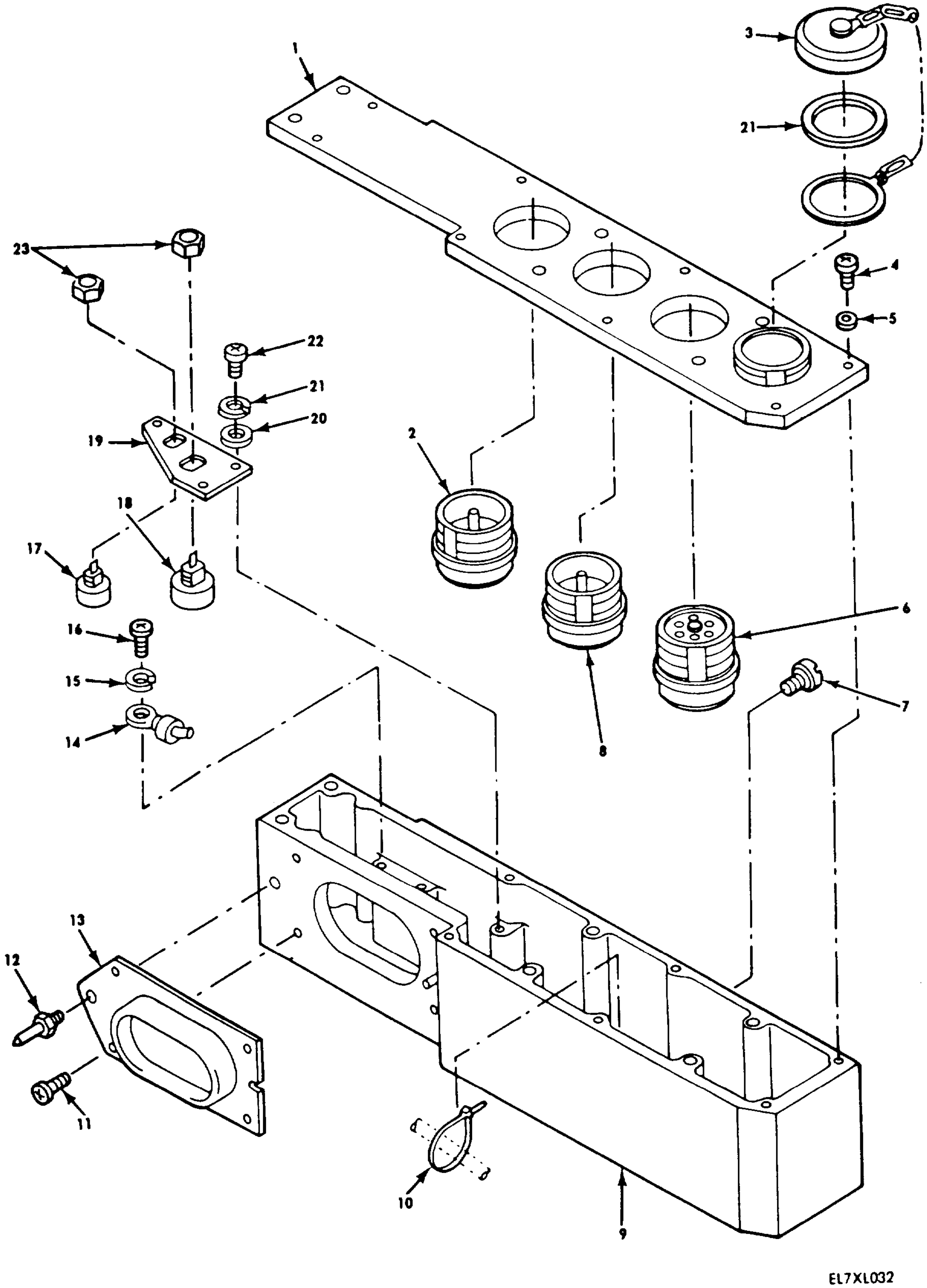


Figure 6-3. Electrical Connector Assembly

6-10. REPLACEMENT OF ELECTRICAL CONNECTORS.

Tools:

Tool kit TK-105/G
Torque wrench
Torque adapter
Spanner wrench

Expendable supplies:

Sealing compound: grade A and grade H
Insulation sleeving
Silicone compound
Solder
Q tips
Alcohol

References:

Paragraph 6-8 for disassembly and assembly of mounting base.
Paragraph 6-9 for disassembly and assembly of electrical connector assembly.

ITEM	ACTION	REMARKS
a. Plate (1).	Remove.	
CONNECTOR A4J1 (2). A412 (8), A4J3 (6), OR A4J4 (22) REPLACEMENT		
b. Connector.	Unsolder wires from connector terminals. Remove connector from plate.	**CAUTION** Before removing wires from connector, note their positions for installation. Improper installation can cause severe damage to the rt.
c. Insulation sleeving.	Cut and install new insulation sleeving on the wires, when replacing connectors J3 or J4.	
d. Wires.	Solder to proper connector leads on new connector.	Attach heat sink to wires between insulation sleeves and soldering point. Before and after soldering, clean wires and leads with Q tips and alcohol.
e. Insulation sleeves.	Slide down over new solder connections. Apply heat to sleeves until they shrink tight.	
f. Connectors (all).	Insert into plate in correct positions. Apply grade H sealing compound to threads. Thread and tighten lock ring. Torque to 100 in-lb.	
g. Plate (1).	Place on connector assembly. Thread screws (4) through washers (5). and plate into connector assembly. Torque to 9 in-lb.	

6-10. REPLACEMENT OF ELECTRICAL CONNECTORS. Continued

ITEM	ACTION	REMARKS
CONNECTOR A4J5 (13) REPLACEMENT		
h. Connector (13)	Remove four screws (11) and guide pin (12).	
i. Connector	Gently pull the top of the connector out.	
j. Wires	Unsolder from connector leads. Cut and install new insulation sleeving on wires.	CAUTION Before unsoldering wires note their position. Improper installation can severely damage the rt.
k. Connector	Apply silicone compound to gasket of new connector.	
l. Connector	Solder wires onto proper leads. Slide insulation sleeving over connections and apply heat until shrunk.	While soldering, attach heat sink as close to starting point as possible.
m. Connector	Aline with screw holes in connector assembly.	before and after soldering, clean wires and leads with Q tips and alcohol.
n. Guide pin (12)	Apply grade A sealing compound to threads. Thread and tighten.	
o. Screws (11)	Apply grade A sealing compound to threads. Thread and torque to 6 in-lb. Bock screws out one-half to three-quarters of a turn.	

Section V. PREPARATION FOR STORAGE OR SHIPMENT

6-11. GENERAL INFORMATION.

Pack the mounting base in an approved shipping container.

CHAPTER 7

BATTERY BOX CY-8346/PRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

7-1. INTRODUCTION.

The battery box has two basic functions. First, it holds the battery in place on the rt. Four latches secure the battery box to the rt. The battery is held in a water-tight enclosure. A one-way vent allows gases produced by the battery to escape. Second, it is an interface for two-wire remote control of the rt. This interface is described in paragraph 7-2.

7-2. TWO-WIRE TRANSIENT SUPPRESSOR.

The rt can be remotely controlled. Control units, such as Control, Receiver-Transmitter C-11561/U, can send control signals to the rt through a two-wire field wire. The field wire connects to binding posts El and E2 on the battery box for the AN/PRC-119. The two-wire transient suppressor filters the remote control signals. See figure 7-1. J1 mates with rt connector P1. The signals are transformer coupled to the rt. Inductors L1 and L2 are not separate components. They are part of the printed wiring board.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

7-3. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

7-4. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required in I (DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

7-5. REPAIR PARTS.

Repair parts are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering I (DS) maintenance far this equipment.

Section III. TROUBLESHOOTING

7-6. GENERAL.

This section provides the troubleshooting procedures used to fault isolate a defective battery box. The troubleshooting information is presented in the form of a flow chart. This chart will systematically check for faults in the battery box.

7-7. TROUBLESHOOTING.

Troubleshooting is done on a faulty battery box. The steps to determine if a battery box is faulty and how to troubleshoot are as follows:

a. When a battery box is received from unit maintenance, inspect it for damage. Repair any damage before proceeding with testing. See section IV if repairs are necessary.

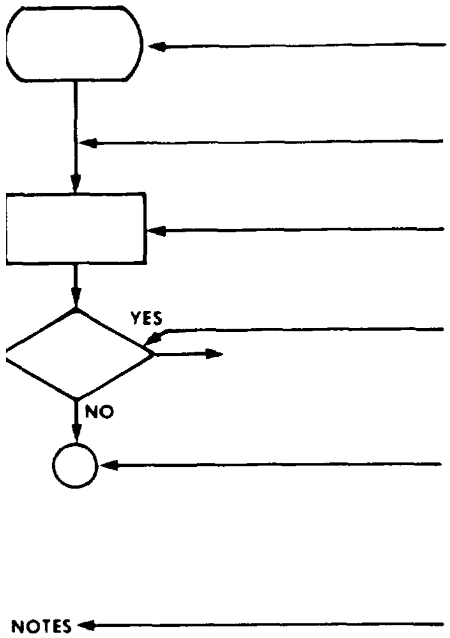
b. Troubleshoot the battery box using the flow chart. It will identify the defective electrical components.

c. Replace the defective components using the procedures in section IV.

d. Verify the repair. Perform the troubleshooting flow chart again. When the flow chart is passed. the battery box can be returned for use.

7-8. EXPLANATION OF SYMBOLS AND NOTES.

SYMBOL EXPLANATION



Test Procedure Start: (Rectangle with rounded corners) Indicates start of the test procedure and contains a brief description of the symptom of trouble.

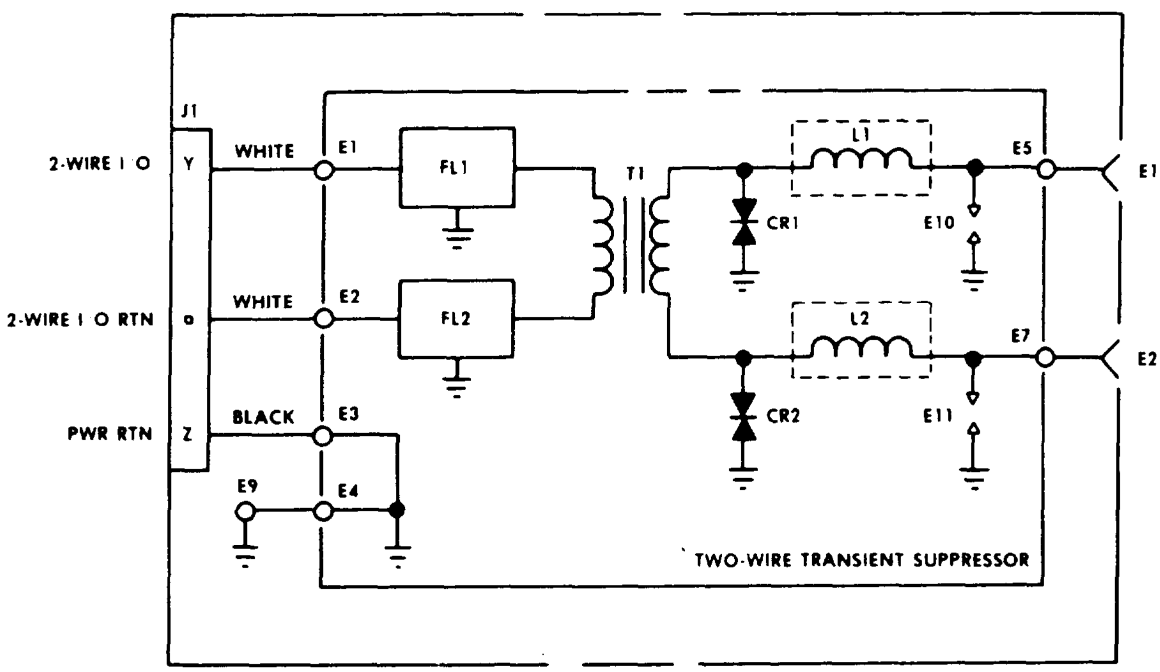
Test Procedure Flow Line: (Heavy line and arrowhead) indicates direction of the procedure flow.

Test Procedure Instruction: (Rectangle) Provides instructions for doing a specific test.

Decision: (Diamond) Indicates that a decision must be made (YES or NO) in answer to a question about the previous test. Path taken depends on the answer (YES or NO).

Connector: (Circle) Directs user to an entry point of another chart. Contains on entry number that is same OS entry number of other chart and a sheet number (Sh No.) that indicates the number of follow-on pages.

Notes Column: Presents additional information, such OS: more specific instructions about how to do a test, cautions and warnings that must be observed when doing a test, and additional information about what to do after doing a test. Also provides references to appropriate circuit diagrams.



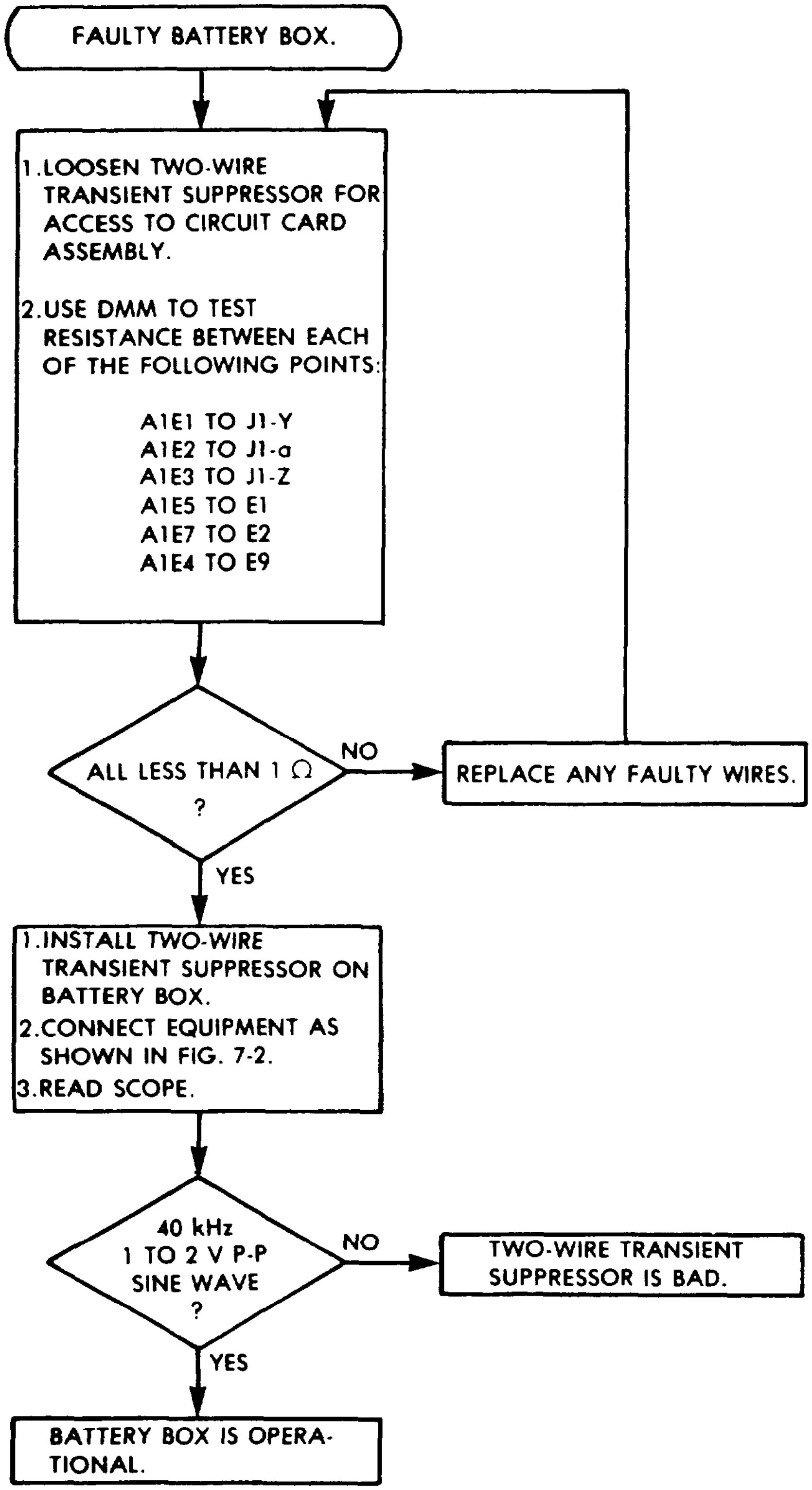
EL7XL033

Figure 7-1. Battery Box Schematic Diagram

7-9. TROUBLESHOOTING FLOW CHARTS.

Chart 1

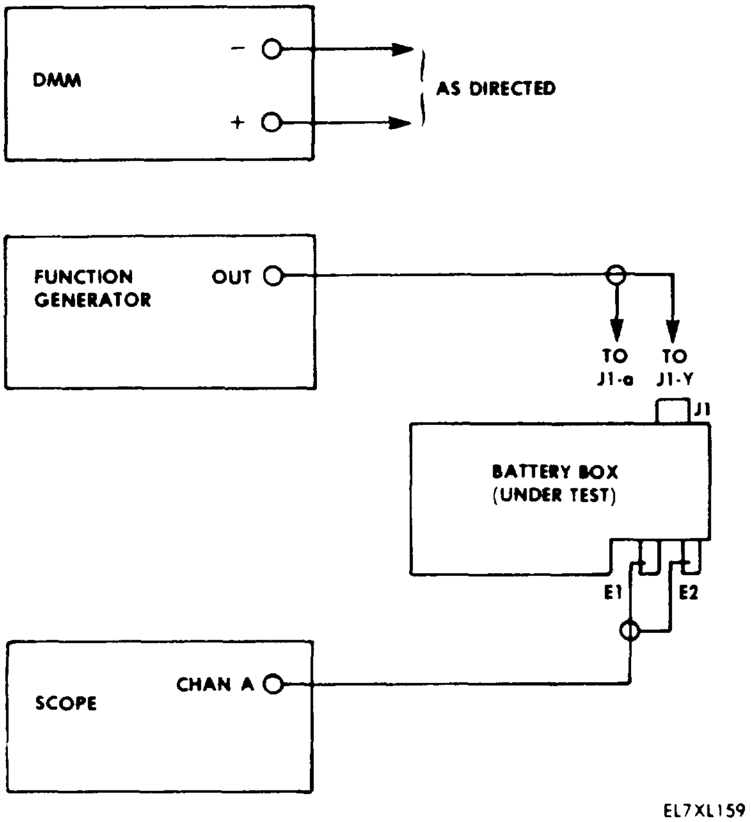
Troubleshooting Battery Box
(Sheet 1 of 1)



NOTES

1. Test points that start with "A1" indicate test points E1 through E7 on the two-wire transient suppressor CCA.

2. The principles of operation and figure 7-2 can be used to fault isolate any unusual problems not covered here.



EQUIPMENT PRESETS

BATTERY BOX:

TWO-WIRE TRANSIENT SUPPRESSOR LOOSE FOR ACCESS TO CIRCUIT CARD ASSEMBLY

FUNCTION GENERATOR:

FREQ: 40 kHz (39 TO 41 kHz)
LEVEL: 2 V P-P (1.5 TO 2.5 V P-P)
FUNCTION: SINE

DMM:
200 W SCALE

Figure 7-2. Troubleshooting Battery Box Test Setup

Section IV. MAINTENANCE PROCEDURES

7-10. INTRODUCTION.

Maintenance of the battery box consists of replacing defective components. The two-wire transient suppressor can be checked or described in section III. All other components are checked by inspection.

7-11. BATTERY BOX REPAIR PROCEDURE.

Tools:

Tool Kit TK-105/G
Alinement fixture
Torque wrench
Torque adapter

Expendable Supplies:

Sealing Compound: Grade H
Q-tips
Alcohol
Solder

ITEM	ACTION	REMARKS
DISASSEMBLY		
a. Cover (10)	Fully loosen and remove four screws (12) with flat washers (13). See figure 7-2. Pull assembly away from battery box (16). Note positions of wires connected to connector (1). Unsolder the wires connected to connector (1). Loosen and remove screw (14) with lock washer (15) securing ground wire (4) to battery box.	
b. Two-wire transient suppressor (8)	Unsolder both binding posts (11) from two-wire transient suppressor. Loosen and remove screws (5), lock washers (6), and flat washers (7) securing two-wire transient suppressor to cover. Remove from cover.	

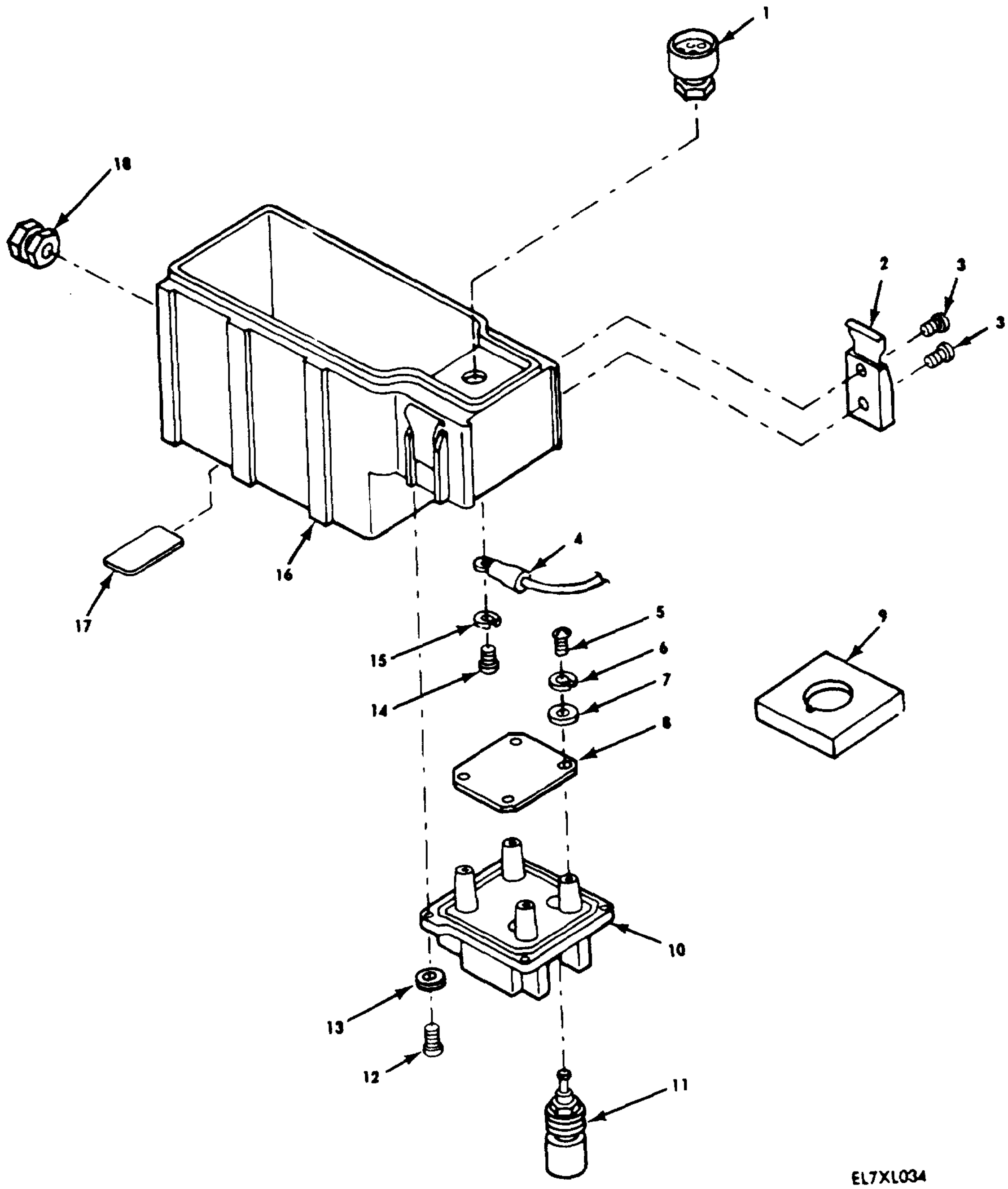


Figure 7-3. Battery Box CY-8346/PRC

7-11. BATTERY BOX PROCEDURE. Continued

ITEM	ACTION	REMARKS
c. Binding posts (11)	Fully loosen and remove nuts, flat washers, lock washers, and nylon washers securing binding posts to cover.	
d. Connector (1)	Fully loosen nut securing connector to battery box. Pull free from battery box. Repair as required using figures 7-1 and 7-3.	
e. Four latches (2)	Loosen and remove two screws (3) for each latch. Remove latches.	
f. Pressure relief valve (18)	Loosen and remove nut and valve.	
g. Name plate (17)	If bad, pry free from battery box (16). Use solvent to remove old adhesive from battery box.	
ASSEMBLY		
h. Name plate (17)	Peel backing off new name plate. Stick on battery box.	
i. Pressure relief valve (18)	Apply sealing compound to threads. insert in battery box. Thread and tighten nut. Torque to 50 in-lbs.	
j. Four latches (2)	Position latch on battery box so screw holes are alined. Thread and tighten screws (3).	
k. Connector (1)	Apply sealing compound to connector threads. Position alinement fixture (9) over connector hole with lips of alinement fixture snug against edge of battery box. Insert connector in battery box. Thread and tighten nut. Torque to 30 in-lbs.	The alinement fixture (9) is required to hold the connector (1) in place when the nut is tightened. If the connector is not properly alined, it will not be possible to install the battery box on on rt.
l. Binding posts (11)	Insert into cover (10). Thread and tighten nylon washers, flat washers, lock washers, and nuts. Torque to 6 in-lbs.	
m. Two-wire transient suppressors (8)	Position on cover (10) with screw holes alit-ted. Thread four screws (5), lock washers (8). and flat washers (7). Tighten screws. Solder binding posts (11) to two-wire transient suppressor.	NOTE Before and after soldering, clean wires and leads using Q-tips and alcohol.

7-11. BATTERY BOX PROCEDURE. Continued

ITEM	ACTION	REMARKS
n. Cover (10)	Thread screw (14) with lock washer (15) through ground wire (4) and into battery box. Tighten. Solder wires from El, E2, and E3 on two-wire transient suppressor to correct positions on connector (1). Place cover on battery box with screw holes alined. Thread screws (12) with flat washers (13) through cover into battery box. Torque to 9 in-lbs.	

Section V. PREPARATION FOR STORAGE OR SHIPMENT.

7-12. GENERAL INFORMATION.

Pack the battery box in an approved shipping container.

CHAPTER 8

MOUNTING BASE, ELECTRICAL EQUIPMENT MT-6353/VRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

8-1. INTRODUCTION

The PA mount's main sections ore:

Power Supply (power supply)

Case, Power Supply (PA mount chassis)

They ore described in the following paragraphs:

8-2. POWER SUPPLY.

The power supply is mounted on the right side of the PA mount. It provides two basic functions:

It suppresses transients on the input power line.

It converts the dc input power into the dc voltages required by the power amplifier.

The input power must be 22 to 32 V dc. The current required depends on the output loads. Normally, 2 to 12 A of input current is required. A block diagram of the power supply is included in figure 8-1.

a. Transient Suppressor. The transient suppressor protects the radio from transients that may be on the input power line. The transients, surges and ripple on the input power line must be within the requirements of MIL-STD-1275. The output of the transient suppressor is not short circuit protected. If shorted to ground, CR1 will trip. Its output is typically 0.5 V below the input voltage.

b. DC-to-DC Converter. The output of the transient suppressor is fed into the dc-to-dc converter. It provides the following output voltage.

DC output Voltage (V dc)	Maximum Current (A)	Maximum Ripple (mV pp)
6.75 (6.55 to 6.95)	1.5	75
13.0 (12.6 to 13.4)	4.3	75
200 (180 to 220)	0.008	3000

These outputs ore short-circuit protected. The power supply will not be damaged if on output is shorted to ground.

8-3. PA MOUNT CHASSIS.

The PA mount chassis provides the interconnections OS shown in figure 8-1. Several other functions are also performed. The power input is switched on and off by CB1. EMP protection is provided by CR1, VR1 , and VR2. Lamp DS1 indicates when power is applied to the power amplifier.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

8-4. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

8-5. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required for I (DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

8-6. REPAIR PARTS.

Repair ports are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering direct support maintenance for this equipment.

Section III.TROUBLESHOOTING

8-7. GENERAL.

This section provides the troubleshooting procedures used to fault isolate a defective PA mount. The troubleshooting information is presented in the form of flow charts. They systematically get from a symptom to the bad module.

8-8. TROUBLESHOOTING.

Troubleshooting is done on a faulty PA mount. The steps to determine if a mounting adapter is faulty and how to troubleshoot it are as follows:

a. When a PA mount is received from unit maintenance, inspect it for damage. Repair any damage before proceeding with testing. See section IV if repairs are necessary.

b. Verify the symptom. Perform the operational check in section IV. This will direct you to the correct troubleshooting flow chart.

c. Troubleshooting the PA mount using the flow chart. It will identify the defective module or component.

d. Replace the defective module. Follow the procedures in section IV.

e. Verify the repair. Perform the operational check in section IV. When the operational check is passed, the PA mount can be returned for use.

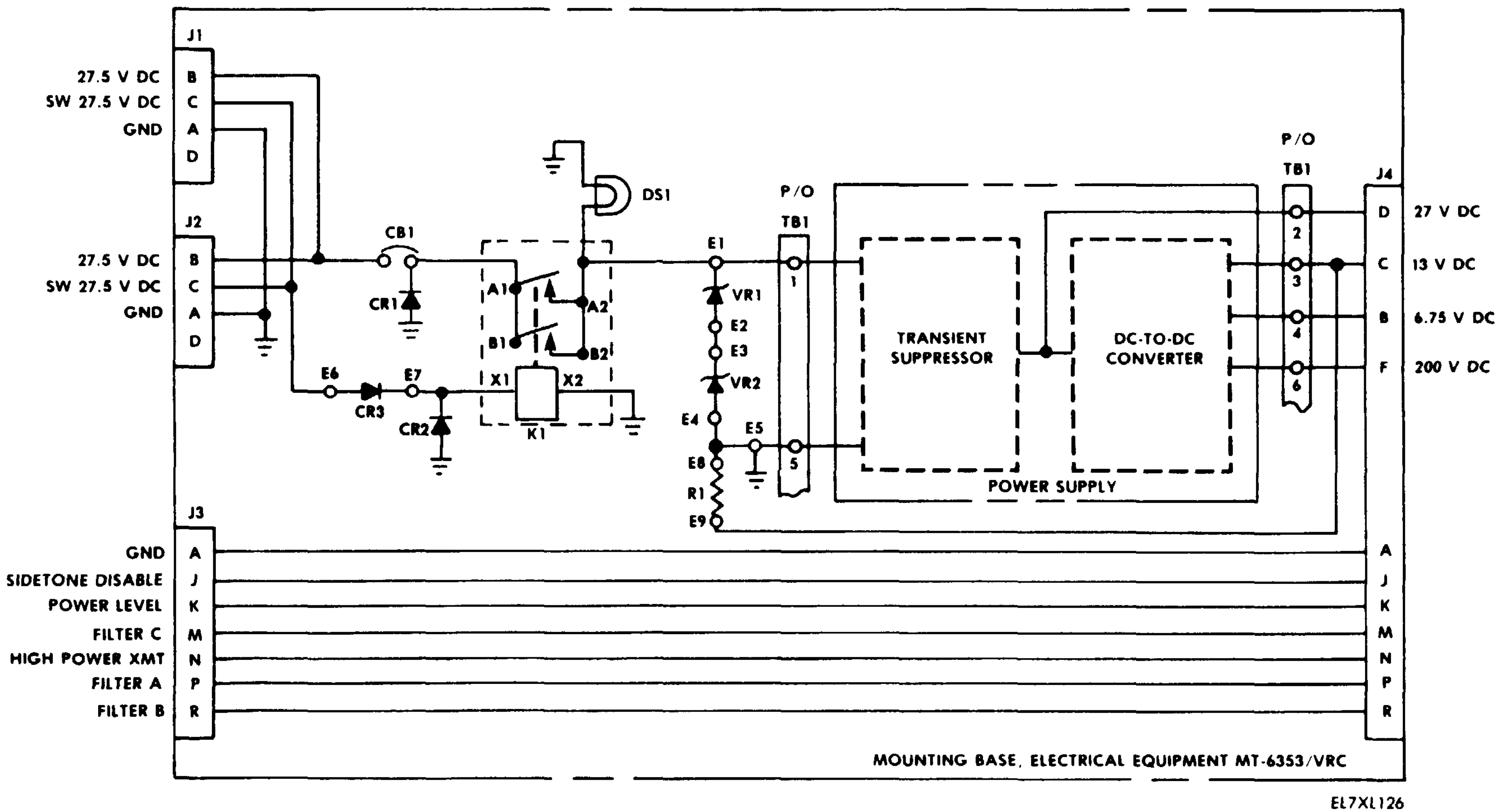


Figure 8-1. PA Mount Schematic Diagram

8-9. TEST PRECAUTIONS AND NOTES.

WARNING

High voltage (200 V dc) is present at PA mount connector J4 and TP232 on the test adopter. Use caution when connecting the test setup and taking measurements to ovoid personal injury.

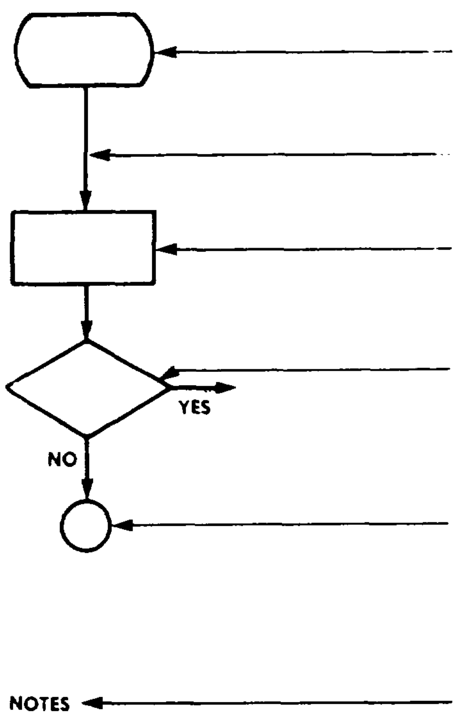
Set the test power supply to OFF before connecting or disconnecting a test setup. Current capacities are large enough to cause personal injury. Equipment can also be damaged if care is not token.

NOTE

The Principles of Operation section and schematic diagram can be used to fault isolate any unusual problems that might not be covered in the troubleshooting procedures.

8-10. EXPLANATION OF SYMBOLS AND NOTES.

SYMBOL



EXPLANATION

Test Procedures Start: (Rectangle with rounded corners) Indicates start of the test procedure and contains a brief description of the symptom of trouble.

Test Procedure Flow Line: (Heavy line and arrowhead) Indicates direction of the procedure flow.

Test Procedure instruction: (Rectangle) Provides instructions for doing a specific test.

Decision: (Diamond) Indicates that a decision must be mode (YES or NO) in answer to a question about the previous test. Path taken depends on the answer (YES or NO).

Connector: (Circle) Directs user to an entry point of another chart. Contains an entry number that is some as entry number of other chart and a sheet number (Sh No.) that indicates the number of follow-on pages.

Notes Column: Presents additional information, such as: more specific instructions about how to do a test, cautions and warnings that must be observed when doing a test, and additional information about what to do after doing a test. Also provides references to appropriate circuit diagrams.

8-11. TROUBLESHOOTING FLOW CHARTS.

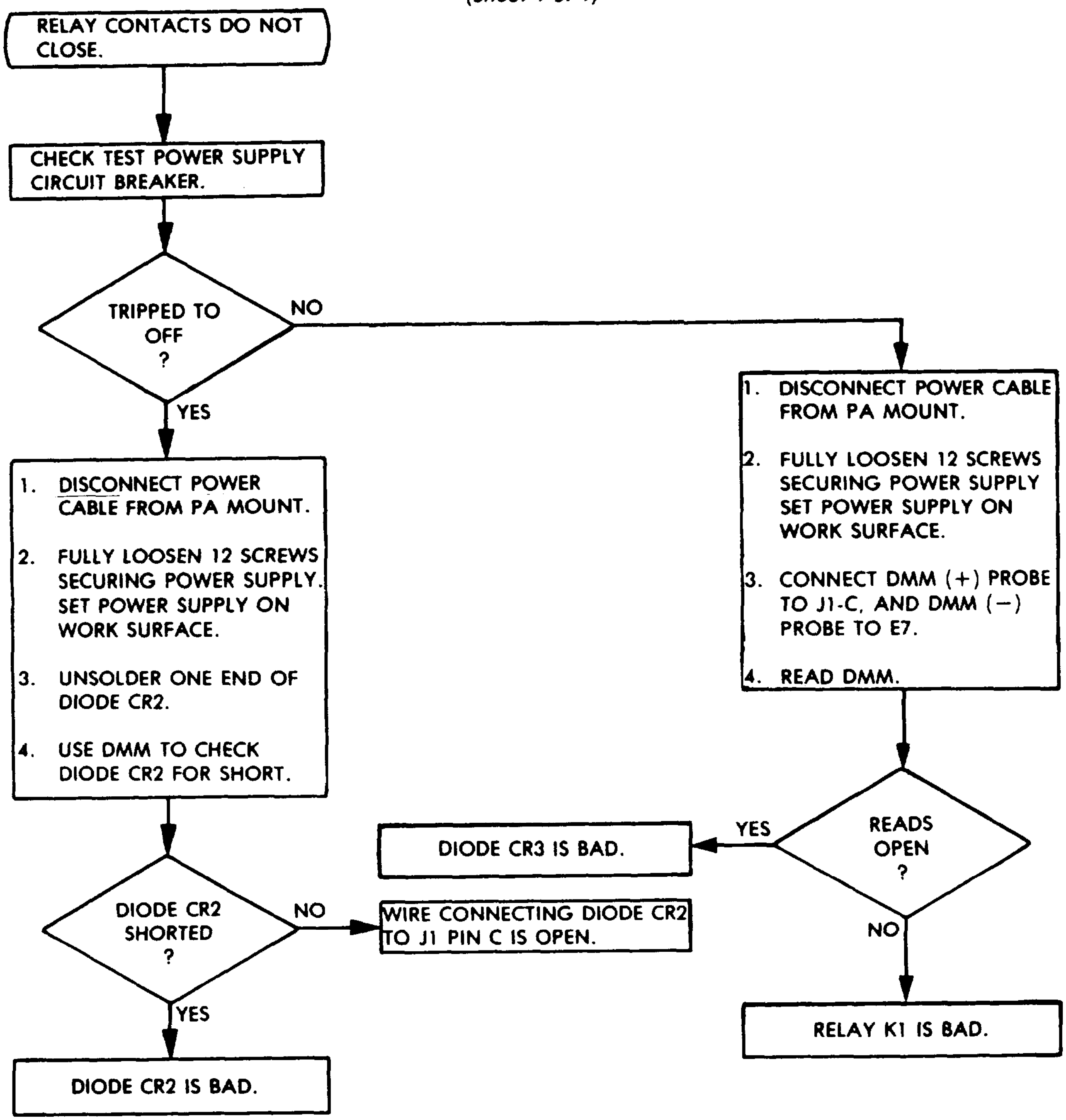
The following charts are included:

Chart	Symptom
1	Relay contacts do not close
2	CB1 trips when power applied
3	Lamp DS1 does not light
4	No 6.75 V dc output
5	No 13 V dc output
6	No 27 V dc output
7	No. 200 V dc output
8	CB1 trips when turned on

8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

Troubleshooting Relay K1 Circuit
(Sheet 1 of 1)



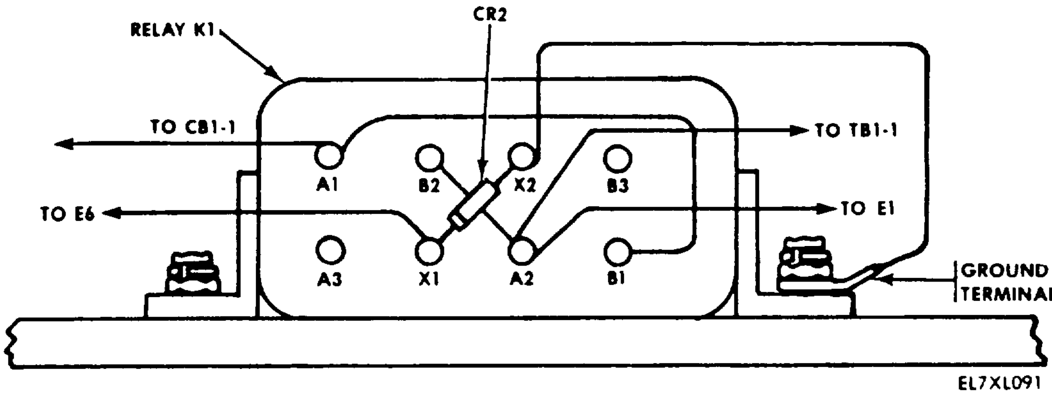


Figure 8-2. Diode CR2 Position on Relay K1.

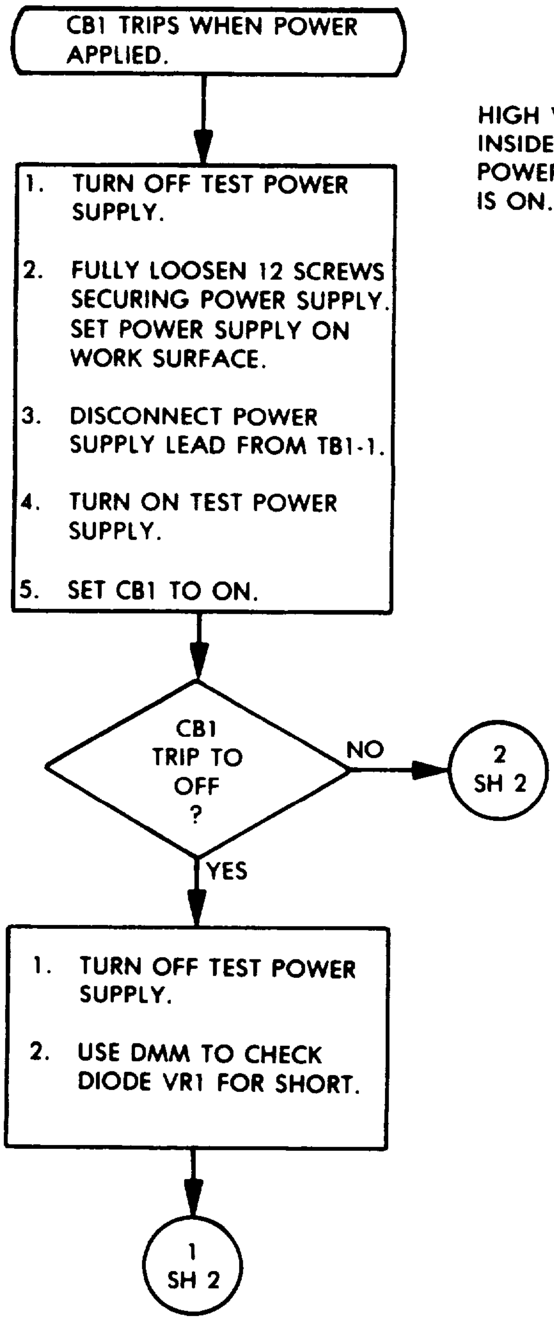
8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

Troubleshooting Short on Input to Power Supply
(Sheet 1 of 2)

WARNING

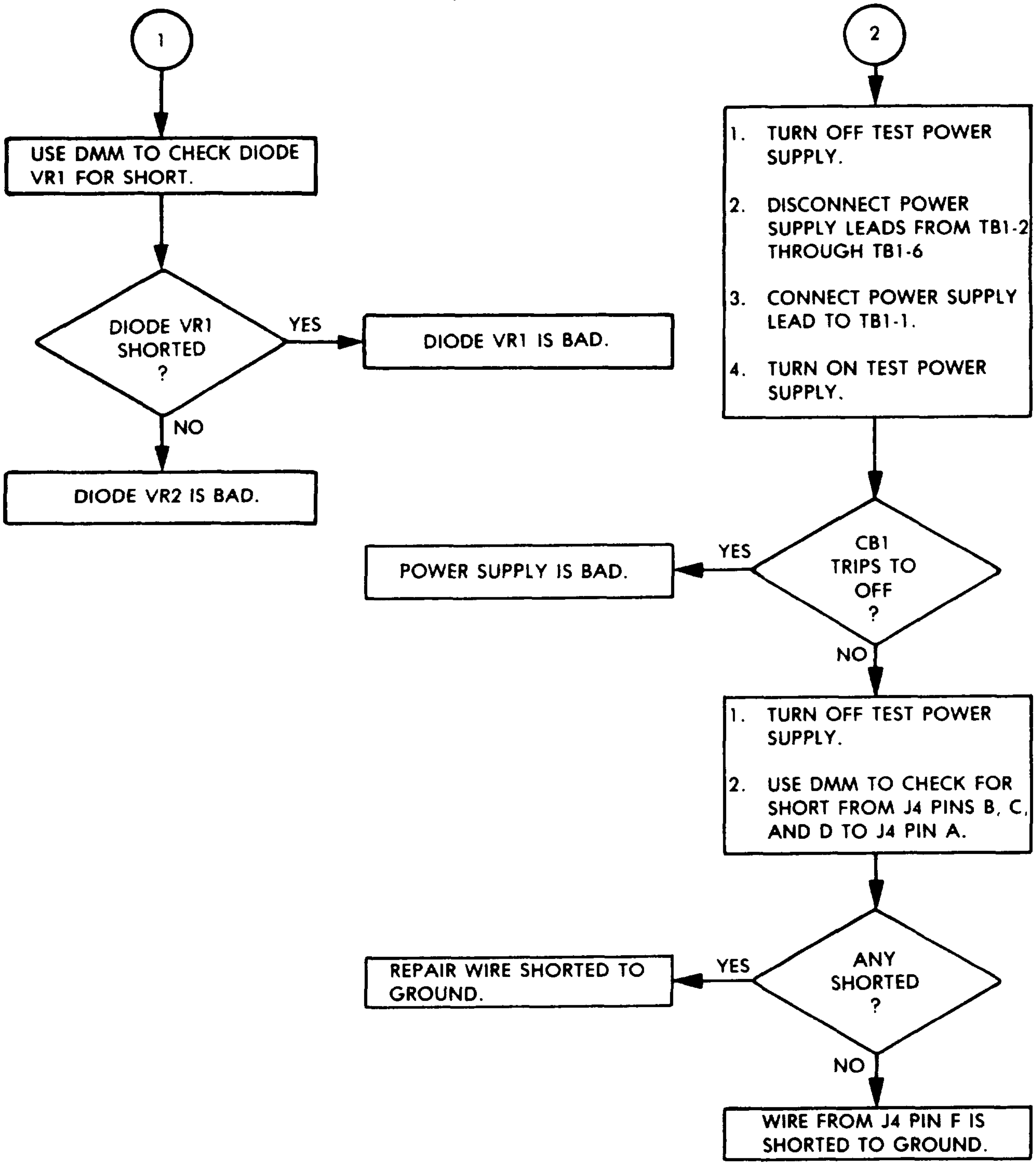
HIGH VOLTAGE IS PRESENT INSIDE PA MOUNT WHEN POWER IS APPLIED AND CB1 IS ON.



8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

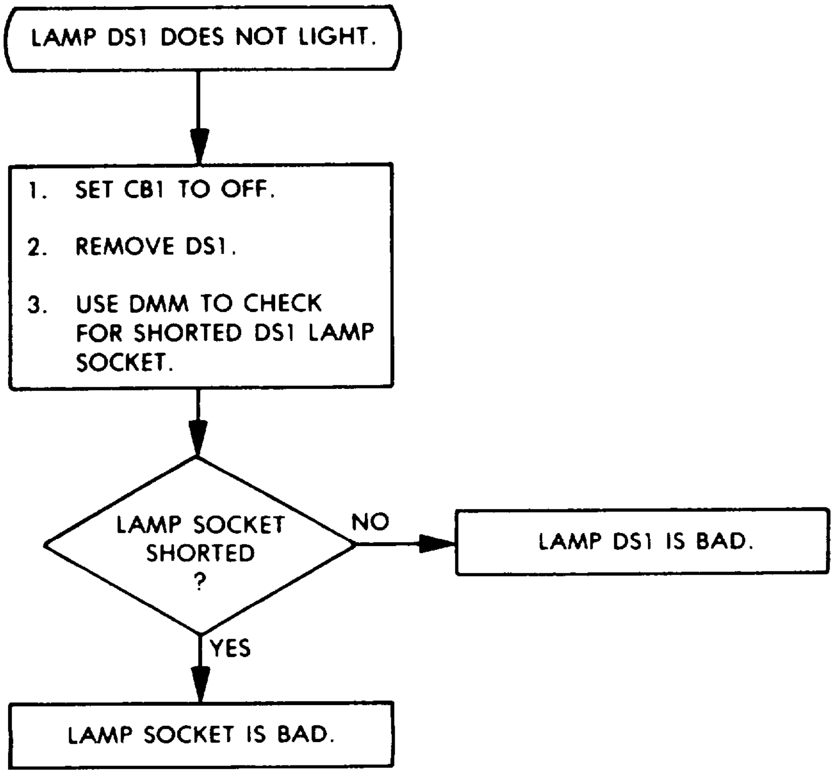
Troubleshooting Short on Input to Power Supply
(Sheet 2 of 2)



8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 3

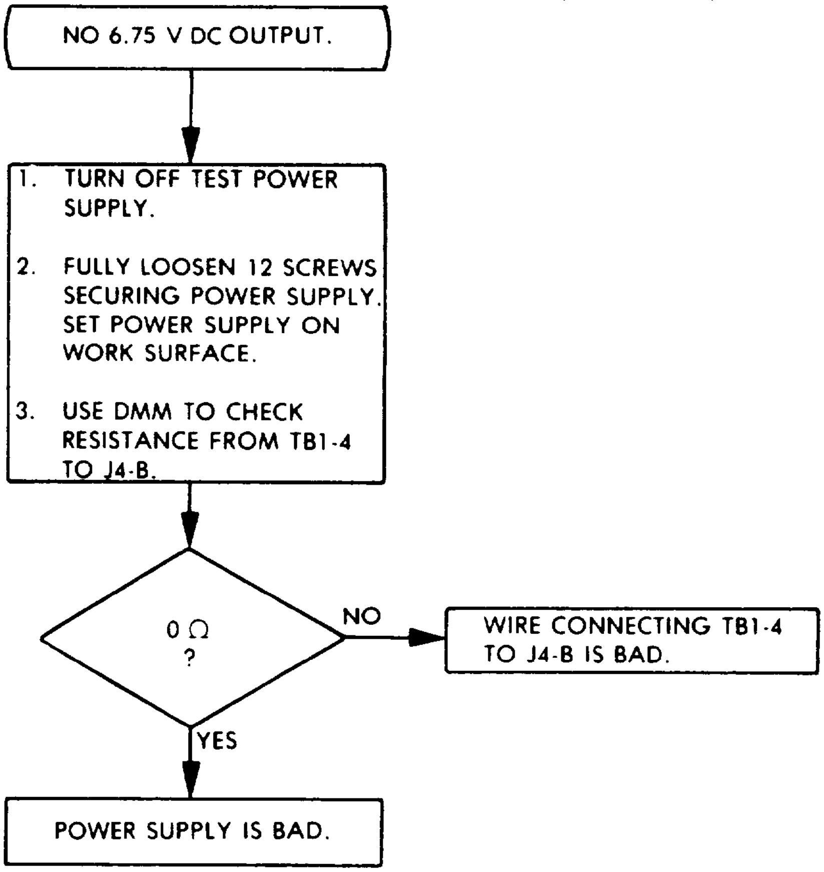
Troubleshooting Lamp DS1 Circuit
(Sheet 1 of 1)



8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 4

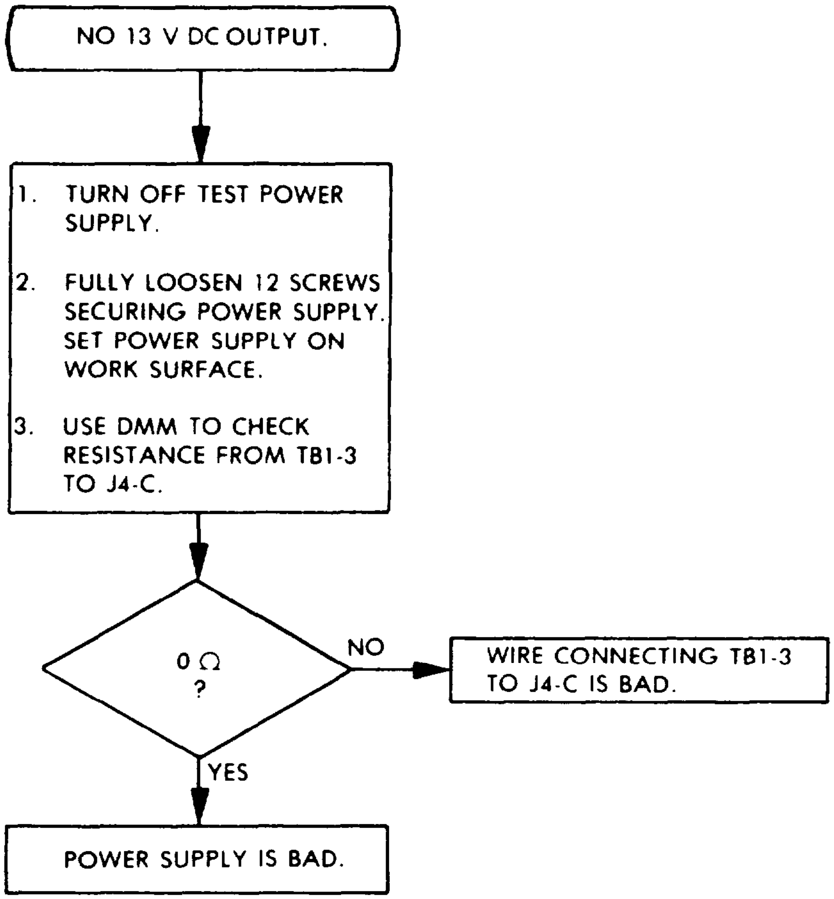
Troubleshooting Power Supply 6.75 V dc Output
(Sheet 1 of 1)



8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

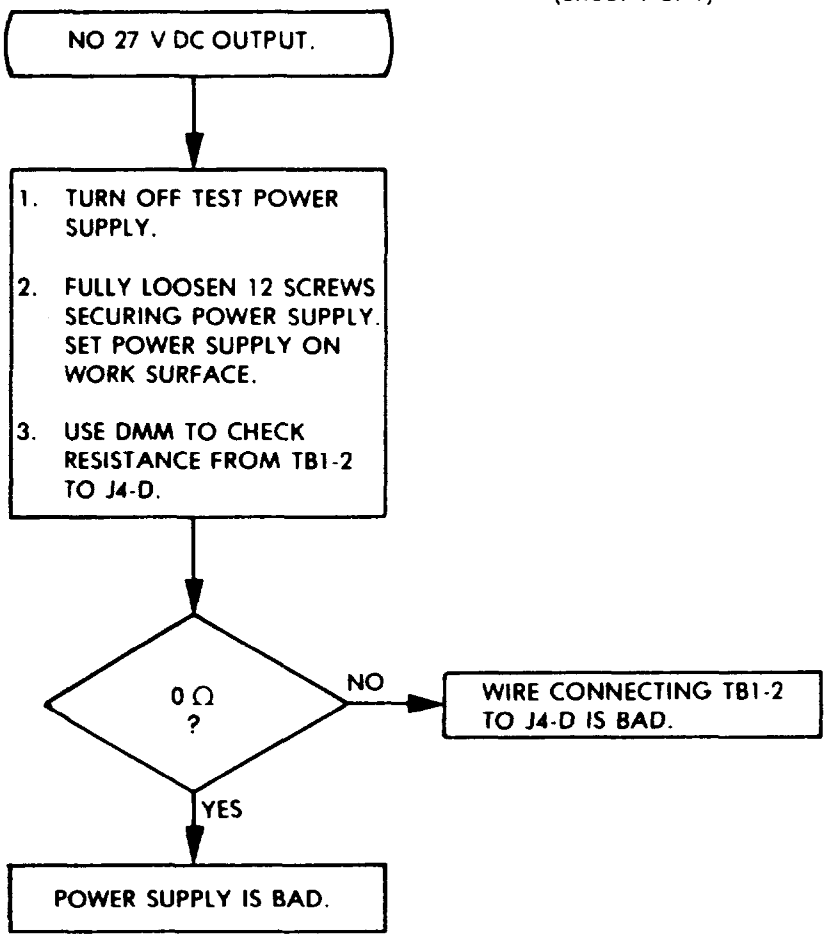
Troubleshooting Power Supply 13 V dc Output
(Sheet 1 of 1)



8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 6

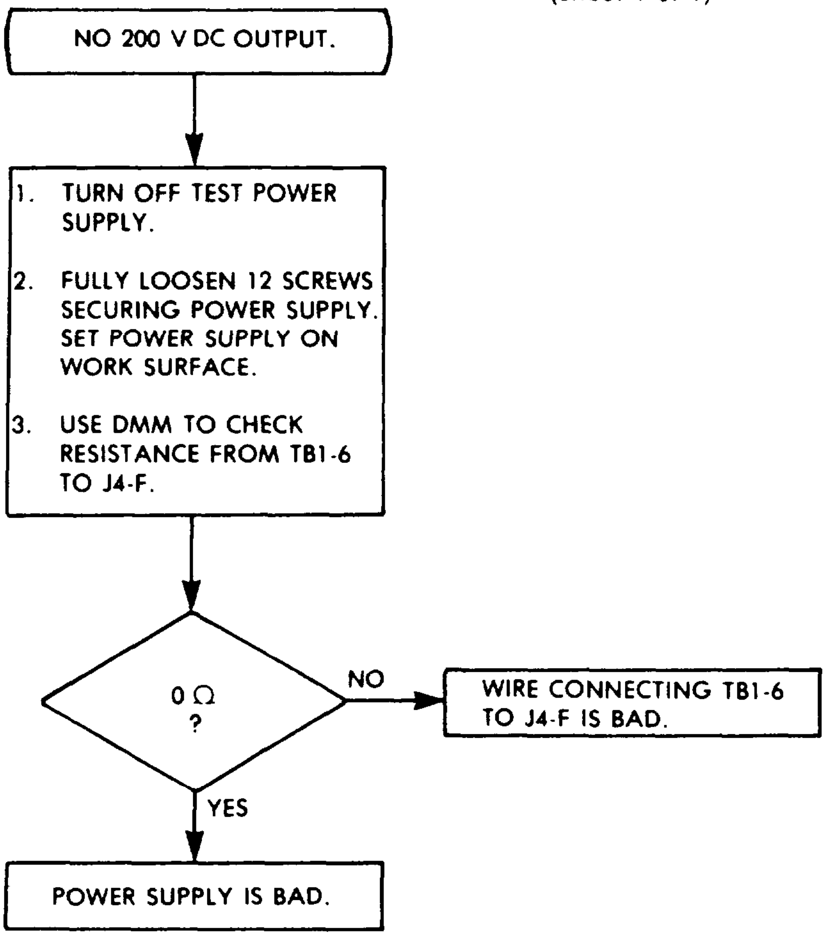
Troubleshooting Power Supply 27 V dc Output
(Sheet 1 of 1)



8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 7

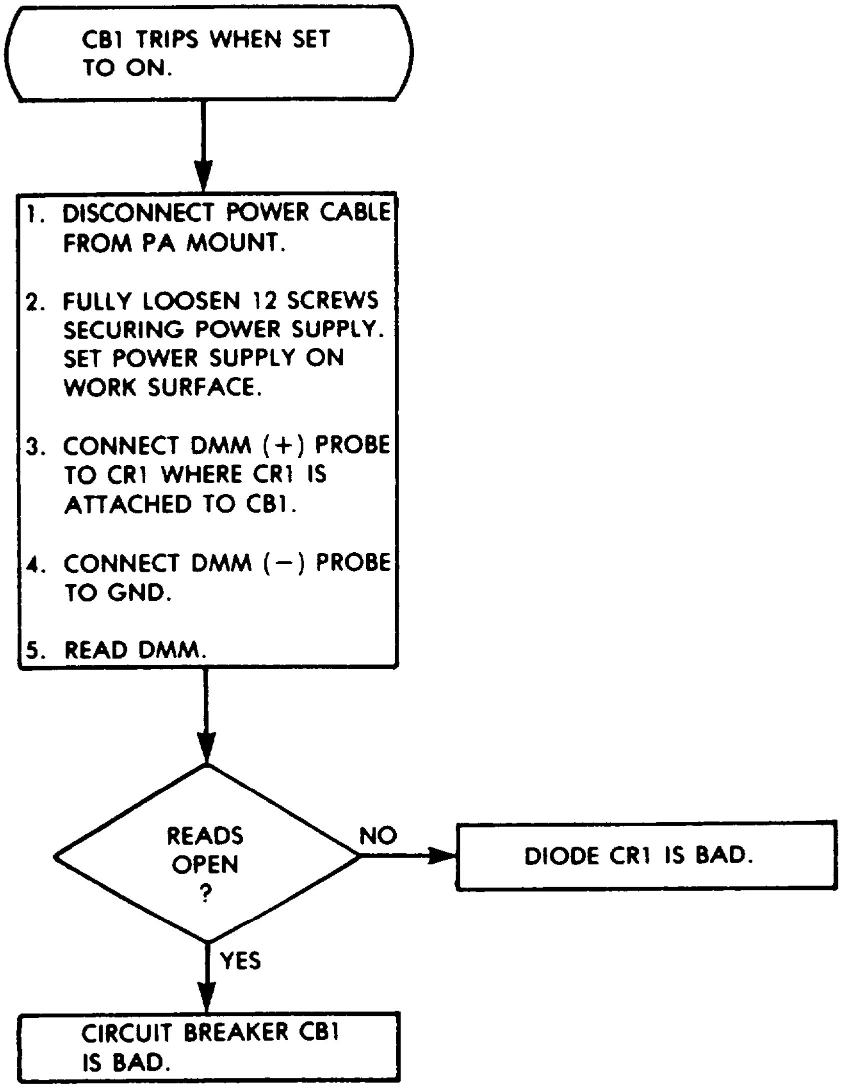
Troubleshooting Power Supply 200 V dc Output
(Sheet 1 of 1)



8-11. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 8

Troubleshooting Circuit Breaker CB1
(Sheet 1 of 1)



Section IV. MAINTENANCE PROCEDURES

8-12. GENERAL.

This section includes the operational check and the repair procedures. The operational check is used to verify the operation of a repaired PA mount. It is also used to verify the symptom of a faulty PA mount. It will identify the troubleshooting chart to be used. When a bad module is identified, replace it using the procedure in this section.

8-13. OPERATIONAL CHECK.

The operational check provides a step-by-step procedure for evaluating a PA mount. If the operotional check is passed, the PA mount can be returned to service. If it does not, the bad module, component, or troubleshooting chart to be used will be identified. The troubleshooting procedures are in section III.

The operational check is broken into steps. Each step verifies a particular function. Follow the instructions in the "Action" column. Check the response. If the response is correct, proceed with the next lettered step. When a STEP has been completed, proceed with the next STEP.

WARNING

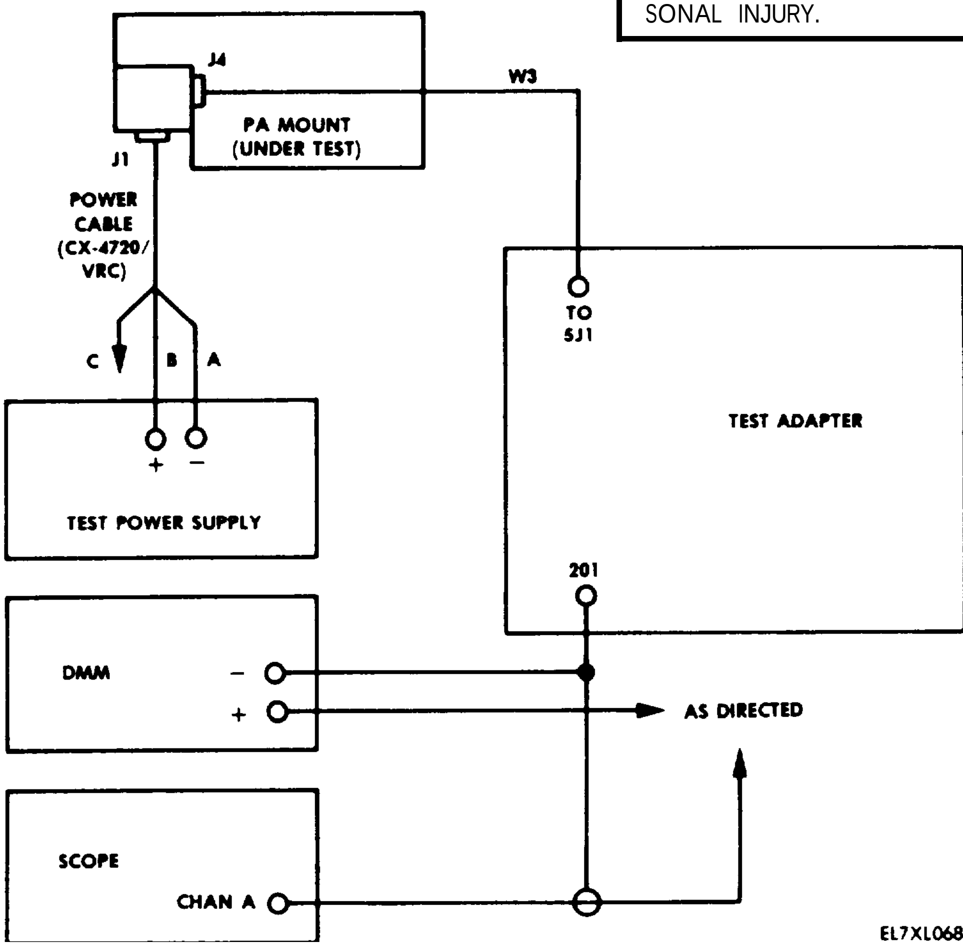
High voltage (200 V dc) is present at PA mount connector J4 and TP232 on the test adapter. Use caution when connecting the test setup and taking measurements to avoid personal injury.

Connect the test setups only when directed and with the power supply set to OFF. The large current capacity of the test power supply can cause personal injury. Verify the test setup before turning the power supply on.

Step 1. TURN-ON CHECK

Action	Response
a. Remove connector caps from connectors J1, J3, and J4.	a. No response.
b. Adjust test power supply for 27 V dc.	b. No response.
c. Connect test setup as shown in figure 8-3	c. No response.

WARNING
HIGH VOLTAGE IS PRESENT AT TP232 ON THE TEST ADAPTER AND INSIDE THE PA MOUNT. USE CAUTION TO AVOID PERSONAL INJURY.



EQUIPMENT PRESETS

TEST POWER SUPPLY:
  POWER: OFF
  CURRENT LIMIT: 3A

PA MOUNT:
  CB1: OFF

Figure 8-3. PA Mount Test setup.

8-13. OPERATIONAL CHECK. Continued

Step 1. TURN-ON CHECK. Continued

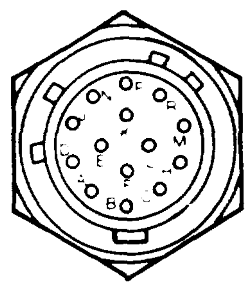
Action	Response
d. Turn-on test power supply.	d. Test power supply circuit breaker does not trip. If the circuit breaker trips, repair short between connector J1 pin B and ground.
e. PA mount C81: ON.	e. DS1 does not light. If it does, relay K1 is bad. CB1 does not trip. If it does, go to chart 8.
f. Connect pin C of connector J2 to pin B. listen for relay contacts to close.	f. Responses: 1. Relay contacts close. If they do not, go to chart 1. 2. CB1 remains at ON. If it trips to OFF, go to chart 2. 3. DS1 lights. If it does not, go to chart 3.

Step 2. POWER SUPPLY OUTPUT CHECK.

Action	Response
a. Use DMM to check TP229. J2-C must be connected to J2-8.	a. DMM reading is 6.55 to 6.95 V dc. If it is not, go to chart 4.
b. Use DMM to check TP230.	b. DMM reading is 12.6 to 13.6 V dc. If it is not, go to chart 5.
c. Use DMM to check TP231.	c. DMM reading is 26.5 to 27.5 V dc. If it is not, go to chart 6.
WARNING High voltage is present at TP232. Use caution when making the following measurement.	
d. Use DMM to check TP232.	d. DMM reading is 180 to 220 V dc. If it is not, go to chart 7.
e. Use scope to check ac ripple at TP229, TP230, and TP231.	e. Ripple is less than 100 mV p-p at each TP. If any is greater than 100 mV p-p, power is bad.

8-13. OPERATIONAL CHECK. Continued

Step 3. INTERCONNECTION CHECK.

Action	Response
a. Turn off test power supply.	a. No response.
b. Disconnect all cables from PA mount.	b. No response. J3, J4  EL7XL102
c. Use DMM to check resistance from pins A, J, K, M, N, P, and R of PA mount connector J3 to the same pins on J4.	c. DMM reading is 0 ohms (continuity). If any indicate an open circuit, the wire connecting J3 to J4 is bad.
d. Use a jumper wire to connect J4 pin A to PA mount chassis.	d. No response.
e. Use DMM to check resistance from J3 pin A to pins J, K, M, N, P, and R of J4.	e. DMM reading is infinite ohms (open circuit). If any indicate continuity, that pin is shorted to ground. Check wiring harness and replace bad wire.
f. Use DMM to check resistance between J4 pin C and ground.	f. DMM reads less than 160Ω. If not, R1 is bad.
g. Operational check complete.	

8-14. REPAIR PROCEDURES.

The following instructions apply to all repair tasks unless otherwise noted in the procedure. See figure 8-4 for parts location.

a. Begin the procedure with PA mount switch CB1 set to OFF.

b. Disconnect any external cables connected to the PA mount.

c. Inspect the PA mount. Replace the PA mount chassis if it is physically damaged, such as with a broken connector.

d. The PA mount must be tested after the replacement of a module. See section IV for the test procedure.

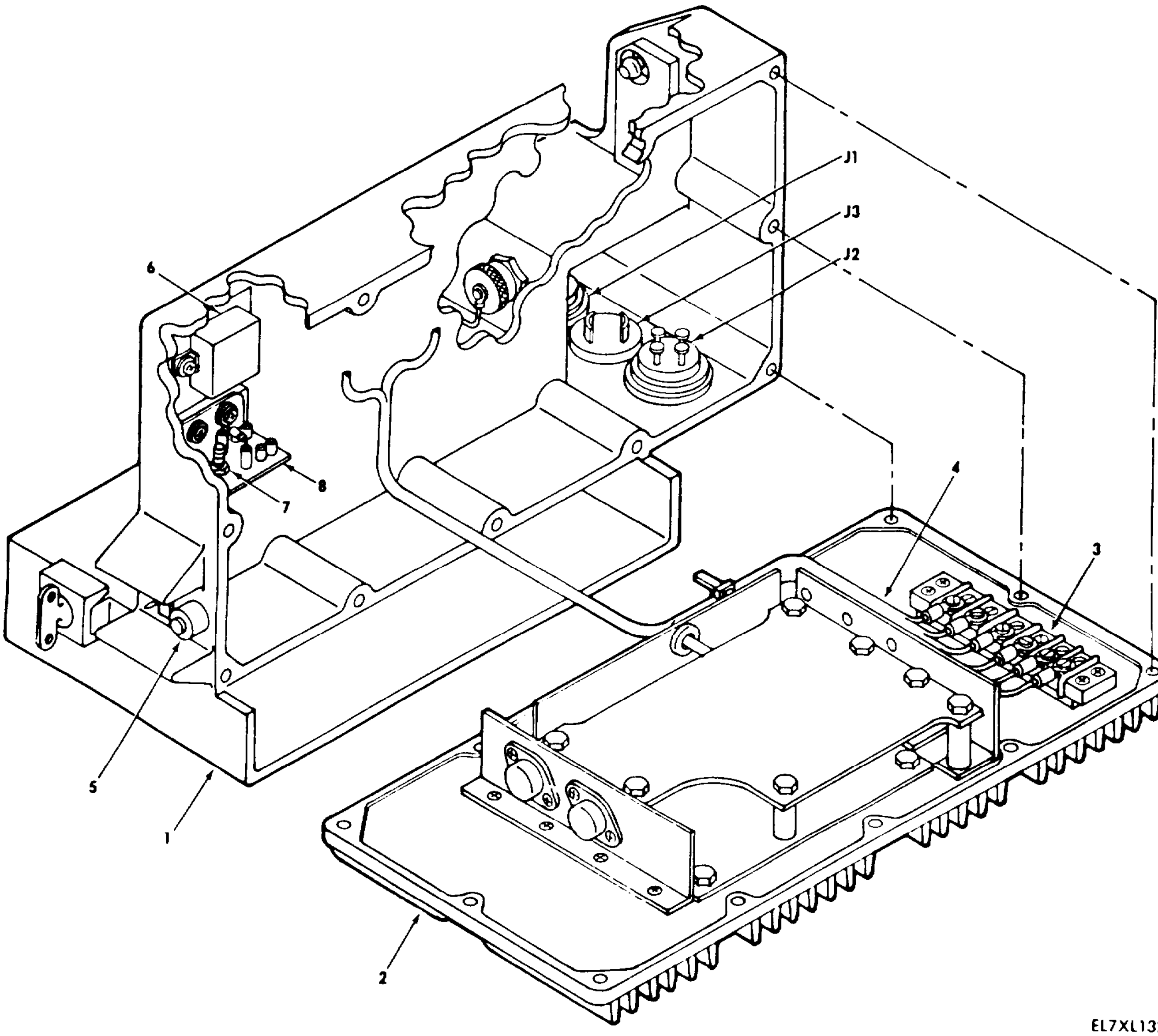


Figure 8-4. PA Mount

8-15. REPLACEMENT OF POWER SUPPLY.

Tools:

Flat tip screwdriver
Torque adapter
Torque wrench

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount (1)	Set on work surface with right side toward you.	
b. 12 captive screws	Fully loosen.	
c. Power supply (2)	Set power supply on work surface.	
d. Six screws on TB1 (3)	loosen and remove.	
e. Power supply	Remove.	
INSTALLATION		
f. Power supply	Set on work surface so that wires can be connected to TB1.	
g. PA mount chassis wires (4)	Connect to TB1. Wire labeled "1" connected to TB1 position 1. Repeal for all six wires.	
h. Six screws on TB1	Tighten.	
i. HCP Power supply and 12 captive screws	Hold power supply in place on PA mount and tighten screws. Torque to 9 in-lb.	

8-16. REPLACEMENT OF PA MOUNT CHASSIS.

Tools:

Flat tip screwdriver
Cross tip screwdriver
Torque adapter
Torque wrench

References:

Paragraph 8-15 for removal and installation of power supply

ITEM	ACTION	REMARKS
a. HCP Power supply	Remove from faulty PA mount chassis. Install in good PA mount chassis.	

8-17. LAMP DS1 REPLACEMENT.

ITEM	ACTION	REMARKS
REMOVAL		
a. Lens assembly (5)	Loosen and remove.	
b. Lamp DS1	Pull free from lens assembly.	
INSTALLATION		
c. Lamp DS1	Install in lens assembly.	
d. Lens assembly	Install and tighten.	

8-18. LAMP SOCKET FOR DS1 REPLACEMENT.

Tools:

- Tool kit TK-105/G
- Torque adapter
- Torque wrench

Expendable Supplies:

- Solder
- Q tips
- Alcohol

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount	Set on work surface with right side toward you.	
b. Power supply	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	
c. Lamp socket	Unsolder wires connected to lamp socket.	
d. Nut	Loosen and remove.	
e. Lamp socket	Remove.	
INSTALLATION		
f. lamp socket	Hold in place and install nut. Torque nut to 30 in-lb. Solder wires to lamp socket.	Before and after soldering, clean wires and leads using Q tips and alcohol.
g. HCP Power supply	Hold in place and tighten 12 captive screws. Torque to 9 in-lb.	

8-19. RELAY K1 REPLACEMENT.

Tools:

Tool kit TK-105/G
Soldering iron
Torque adapter
Torque wrench

Expendable supplies:
Insulation sleeving
Solder
Q tips
Alcohol

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount	Set on work surface with right side toward you.	
b. Power supply	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	
c. Relay K1 (6)	Loosen screws securing relay to PA mount chassis. Unsolder wires from relay. Unsolder diode CR2 from relay.	
INSTALLATION		
d. Relay K1	Replace any damaged insulation sleeving on wires or CR2. Solder diode CR2 to relay. Observe proper orientation. Solder wires to relay. Hold in place ond install screws.	Before and after soldering, clean wires and leads with Q tips and alcohol.
e. HCP Power supply	Hold in place and tighten 12 captive screws. Torque to 9 in-lb.	

8-20. DIODE CR1 REPLACEMENT.

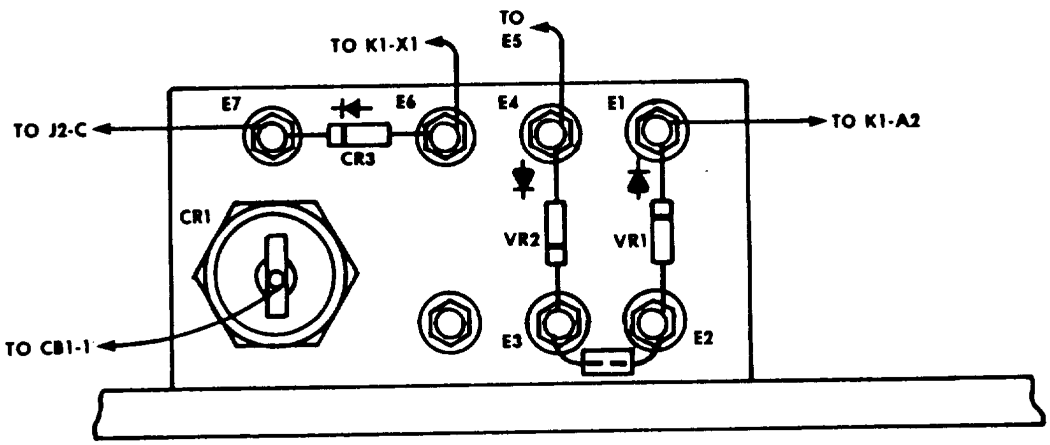
Tools:

Tool kit TK-105/G
Torque adopter
Torque wrench

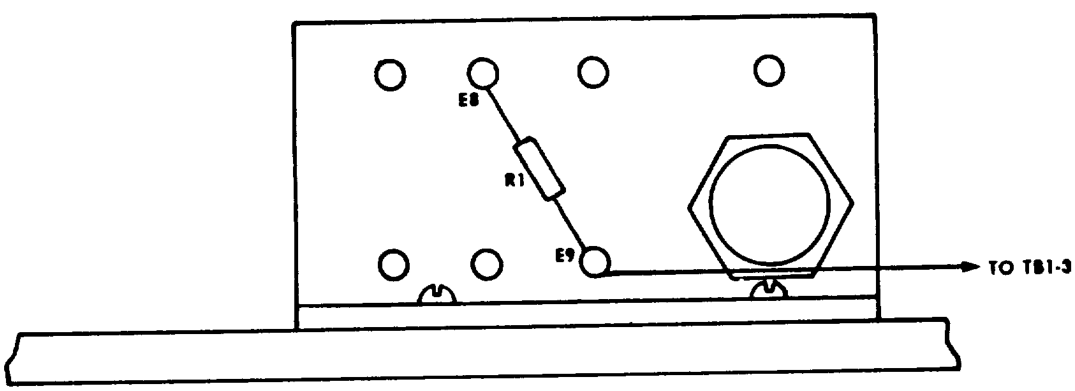
Expendable supplies:

Solder
Q tips
Alcohol

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount	Set on work surface with right side toward you.	
b. Power supply	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	
c. Diode CR1 (7)	Unsolder wire from bottom of diode. Loosen and remove nut securing diode to mounting bracket (8). Remove diode. See figure 8-5 for location of wire on diode.	
INSTALLATION		
d. Diode CR1	Hold in place and thread nut onto diode. Tighten nut. Solder wires to diode terminal.	Before and after soldering, clean wires and leads using Q tips and alcohol.
e. HCP Power supply	Hold in place and tighten 12 captive screws. Torque to 9 in-lb.	



BOTTOM VIEW



TOP VIEW

EL7XL090

Figure 8-5. Mounting Bracket with CR1, VR1, VR2, CR3 and R1

8-21. DIODE CR2 REPLACEMENT.

Tools:	Expendable supplies:
Tool kit TK-105/G	Insulation sleeving
Torque adapter	Solder
Torque wrench	Q tips
	Alcohol

References:
See paragraph E-19 for removal of Relay K1

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount	Set on work surface with right side toward you.	
b. Power supply	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	
c. Relay K1	Remove from chassis. Turn for best access to CR2.	
d. Diode CR2	Unsolder and remove. See figure 8-2 for component location.	
INSTALLATION		
e. Diode CR2	Place new insulation sleeving on leads of new diode. Install in place. Observe proper orientation. Solder.	Before and after soldering, clean wires and leads using Q tips and alcohol.
e. HCP Power supply	Hold in place and tighten 12 captive screws. Torque to 12 in-lb.	

8-22. DIODE VR1, VR2, CR3, OR RESISTOR R1 REPLACEMENT.

Tools:	Expendable supplies:
Tool kit TK-105/G	Insulation sleeving
Torque adapter	Solder
Torque wrench	Q tips
	Alcohol

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount	Set on work surface with right side toward you.	
b. Power supply	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	

8-22. DIODE VR1, VR2, CR3, OR RESISTOR R1 REPLACEMENT. Continued

ITEM	ACTION	REMARKS
c. Mounting bracket (8)	Remove two screws securing mounting bracket to chassis.	
d. Diode VR1, VR2, CR3, or Resistor R1	Unsolder. See figure 8-5 for location of diodes on mounting bracket.	Note orientation of components before unsoldering.
INSTALLATION		
e. Wire connecting E2 to E3	Inspect wire and insulation sleeving. If damaged replace.	
f. Diode VR1, VR2, CR3 or Resistor R1	Attach to terminal lugs and solder. Observe proper orientation	Before and after soldering, clean wires and leads using Q tips and alcohol.
g. Mounting bracket	Aline with holes in chassis. Thread two screws with lock washers and flat washers. Tighten.	
h. $\boxed{\text{HCP}}$ Power supply	Hold in place and tighten 12 captive screws. Torque to 9 in-lb.	

8-23. CIRCUIT BREAKER CB1 REPLACEMENT.

Tools: Tool kit TK-105/G
Torque wrench
Torque adapter

Expendable supplies:
Solder
Q tips
Alcohol

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount (1)	Set on work surface with right side toward you.	
b. Power supply (2)	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	
c. CB1	Loosen and remove nut securing CB1 to chassis. Pull CB1 out of chassis far enough to gain access to wires. Unsolder 3 wires from CB1.	Note the location of the wires before unsoldering.

8-23. CIRCUIT BREAKER CB1 REPLACEMENT. Continued

ITEM	ACTION	REMARKS
INSTALLATION		
d. CB1	Solder 3 wires to CB1. Push CB1 through front of chassis. Install ON/OFF plate and thread nut. Tighten to 30 in.-lbs.	Before and after soldering, clean wires and leads using Q tips and alcohol.
e. HCP Power supply	Hold in place and tighten 12 captive screws. Torque to 9 in-lb.	

8-24. CONNECTOR J2 REPLACEMENT.

Tools:
- Tool kit TK-105/G
- Torque wrench
- Torque adapter
- Spanner wrench

Expendable supplies:
- Solder
- Q tips
- Alcohol

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount (1)	Set on work surface with right side toward you. See figure 8-4.	
b. Power supply (2)	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	
c. Connector J2	Remove connector cover. Remove spanner nut with spanner wrench. Gently pull connector out through side for maximum access.	
d. Wires	Unsolder from connector J2.	Note the location of the wires before unsoldering.

8-24. CONNECTOR J2 REPLACEMENT. Continued

ITEM	ACTION	REMARKS
INSTALLATION		
e. Connector J2	Inspect O-ring on new connector. If damaged, replace connector.	O-ring must be in good condition in order to use connector.
f. Wires	Solder onto correct leads of good connector J2.	Before and after soldering, clean wires and leads using Q tips and alcohol.
g. Connector J2	Slide into mounting hole. Thread spanner nut. Torque to 100 in-lb. Put connector cover bock on.	
h. HCP Power supply	Hold in place and tighten 12 captive screws. Torque to 9 in-lb.	

8-25. CONNECTOR J3 REPLACEMENT.

Tools:
- Tool kit TK-105/G
- Torque wrench
- Torque adapter
- Spanner wrench
- Socket wrench
- Deep well socket, 1 1/16 inch

Expendable supplies:
- Insulation sleeving
- Solder
- Q tips
- Alcohol

References:
- See paragraph 8-24 far removal of connector J2
- See paragraph 8-26 for removal of connector J1

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount (1)	Set on work surface with right side toward you. See figure 8-4.	
b. Power supply (2)	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	

8-25. CONNECTOR J3 REPLACEMENT. Continued

ITEM	ACTION	REMARKS
REMOVAL		
c. Connector J2	Remove connector cover. Remove spanner nut with spanner wrench. Push into chassis.	
d. Connector J1	Remove connector cover and spanner nut.	
e. Connector J3	Remove connector cover. Use socket wrench to remove lock nut securing J3 to chassis. Push connector into chassis and pull out through side.	
f. Insulation sleeving	Slide back from solder connections on J3.	
g. Wires	Unsolder from J3. Replace any damaged insulation sleeving.	Note the location of the wires before unsoldering.
INSTALLATION		
h. Connector JC3	Inspect O-ring on new connector. If damaged, replace connector.	O-ring must be in good condition in order to use connector.
i. Wires	Solder to correct leads. Slide insulation sleeving over solder connections.	Before and after soldering, clean wires and leads using Q tips and alcohol.
j. Connector J3	Slide into correct mounting hole. Thread lock nut and torque to 100 in-lb..	
k. Connector J2	Thread spanner nut and torque to 100 in-lb.	
l. Connector J2	Slide into correct mounting hole. Thread spanner nut and torque to 100 in-lb. Put all connector covers back on.	
m. HCP Power supply	Hold in place and tighten 12 captive screws. Torque to 9 in-lb.	

8-26. CONNECTOR J1 REPLACEMENT.

Tools:
- Tool kit TK-105/G
- Torque wrench
- Torque adapter
- Spanner wrench
- Socket wrench
- Deep well socket, 1 1/16 inch

Expendable Supplies:
- Insulation sleeving
- Q tips
- Alcohol
- Solder

References:
- See paragraph 8-24 for removal of connector J2
- See paragraph 8-25 for removal of connector J3

ITEM	ACTION	REMARKS
REMOVAL		
a. PA mount (1)	Set on work surface with right side toward you. See figure 8-4.	
b. Power supply (2)	Fully loosen 12 captive screws securing power supply. Set power supply on work surface.	
c. Connector J2	Remove from chassis. Do not unsolder wires.	
d. Connector J1	Remove connector cover. Remove spanner nut with spanner wrench.	
e. Connector J3	Remove from chassis. Do not unsolder wires.	
f. Connector J1	Push into chassis and pull out through side for maximum access.	
g. Wires	Unsolder from connector J1.	Note the location of the wires before unsoldering.

8-26. CONNECTOR J1 REPLACEMENT. Continued

ITEM	ACTION	REMARKS
INSTALLATION		
h. Connector J1	Inspect O-ring on new connector. If damaged, replace connector.	O-ring must be in good condition in order to use connector.
i. Wires	Solder to correct leads of connector J1.	Before and after soldering, clean wires and leads using Q tips and alcohol.
j. Connectors J1, J2, J3	Slide each into proper mounting hole.	
k. Connector J3	Thread and tighten lock nut and torque to 100 in-lb.	
l. Connector J1, J2	Thread and tighten spanner nuts, on each. Torque to 100 in-lb. Put all connector covers back on.	
m. HCP Power supply	Hold in place and tighten 12 captive screw. Torque to 9 in-lb.	

Section V. PREPARATION FOR STORAGE OF SHIPMENT

8-27. GENERAL INFORMATION.

Pack the PA mount, chassis, or power supply in approved shipping containers.

CHAPTER 9

MAINTENANCE GROUP OA-9263/GRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

9-1. INTRODUCTION

Maintenance Group OA-9263/GRC is used to test and troubleshoot the radio set components. It is made up of the following:

Radio Set AN/VRC-87

Mounting Base, Electrical Equipment MT-6352/VRC

Fill Device, Electronic Counter-Countermeasure MX-10579/VRC

Interconnecting Device J-4404/GRC

9-2. RADIO SET AN/VRC-87

Radio Set AN/VRC-87 is a short-range radio. One is part of the maintenance group. As a test radio, it performs several useful functions. When testing on rt, it functions as a receiver or transmitter. It is used to check the FH and data capabilities of the rt. It provides the rf, power, and control signals needed to check a power amplifier. It is also used to check the control-monitor.

Operating instructions are in TM 11-5820-890-10-1. Unit maintenance instructions are in TM 11-5820-890-20-1. If an rt or mounting adapter is determined to be faulty, see chapter 2 or 3 as needed.

9-3. MOUNTING BASE, ELECTRICAL EQUIPMENT MT-6352/VRC.

The mounting base is used with the radio. A power cable connects the mounting base to a 24 V dc supply. The power is routed to the radio. The mounting base can be secured to the work surface. This may be desirable in some maintenance shops. The mounting base is covered in TM 11-5820-890-20-1 and Chapter 6 of this TM.

9-4. FILL DEVICE, ELECTRONIC COUNTER-COUNTERMEASURES MX-10579/VRC.

The fill device is used to hold and transfer ECCM fill data. It con hold hopsets, lockout sets, and TRANSEC variables. Operating instructions are in TM 11-5820-890-10-1. Unit maintenance instructions are in TM 11-5820-890-20-1.

9-5. INTERCONNECTING DEVICE J-4404/GRC.

The interconnecting device is used to interconnect a unit under test and the test equipment. It includes a test adapter, cables, and tools used for unit repair. The COEI list in Appendix C lists the items found in the interconnecting device.

a. Test Adapter. The test adapter is the lid of the chest. It provides an easy way to access the connector pins on the rt, mounting adapter, and control-monitor. It is shown in figure 9-1. FO-18 is a schematic diagram of it.

The connectors along the top are cabled to the unit under test or the test radio. The tip jocks (test points) are used for inputs and outputs. Test equipment are cabled to the test points. The test points are in three groups. Test paints 101 through 122 are used with the rt. Test points 201 through 236 are used with the mounting adapter. Test paints 301 through 311 are used with the control-monitor. Some test points have more than one function.

There is no active circuitry in the test adapter. Some of the test points ore connected to ground through resistors. These are typically loads for audio outputs. The loads ore necessary for evaluation of circuit operation. No adjustments, alinements, or calibration is required.

b. Tool Kit. The tool kit includes the following tools:

Module extractor
Threaded insert replacement tools
Torque wrench and adapters
Open end wrenches
Deep well socket set
Spanner adapters

The module extractor is used to remove modules from the rt and the control-monitor. Instructions for using it are included in Chapters 2 and 5. The torque wrench, adapters, and sockets are used to torque the cover screws and other items. All of the items that come with the interconnecting device are stored in the chest. It functions as a shipping and storage container.

c. Electronic Equipment Parts Kit. The items included in the parts kit ore used to connect the test setups. It contains 14 adapters, 11 cables, and a jumper.

d. Cables. There are 17 cables included in the interconnecting device. A drawing and schematic of each is included in figure 9-2. They are used as follows:

REF DES or PIN	PURPOSE
W1	Connects test adapter to mounting adapter J10 (SNAP).
W2	Connects test adapter to mounting adopter P1.
W3	Connects test adapter to mounting adapter J1.
W4	Connects test adapter to mounting adapter J9 or control-monitor J1, J2, or J3.
W5	Same function as W4.
W6	Connects test adapter to rt P1.
W7	Connects test adapter to mounting adapter J7 or J8.
W8	Standard 6-pin audio/data cable.
W9	Standard 6-pin audio/data cable.
W10	Standard 6-pin audio/data cable.
W11	Connects test adapter to rt J5 (COMSEC).
CX-4720/VRC-12 FT	Power cable. Connects mounting base to 24 V dc power supply.
CG-1773B/U-10 FT	Rf cable.
	Rf cables (4)

e. Handset H-250/U. Two standard handsets are included in the interconnecting device.

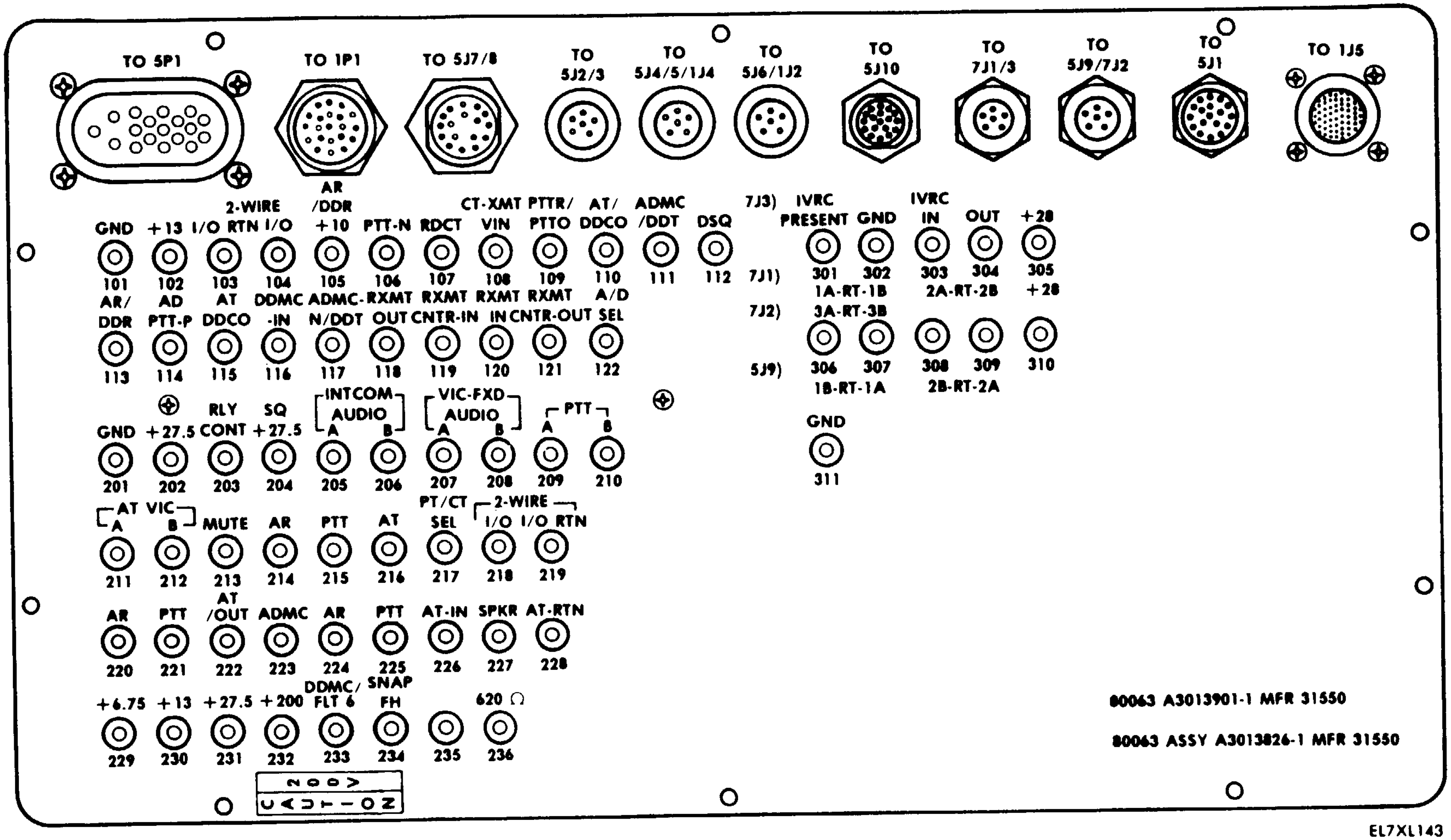
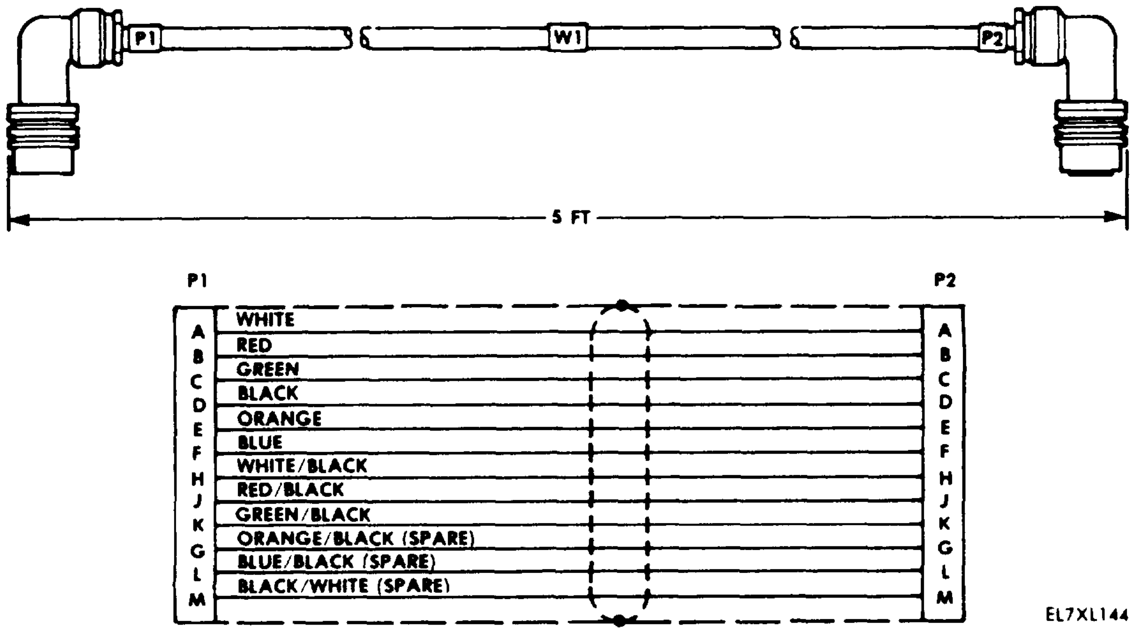


Figure 9-1. Test Adapter Front Panel.



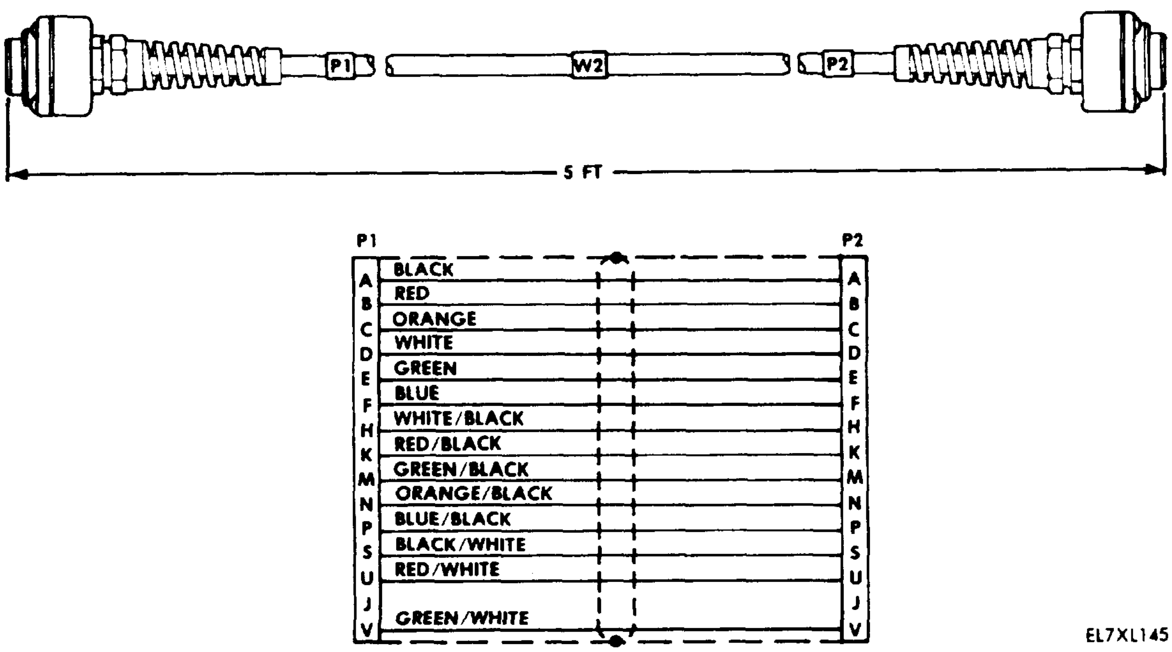
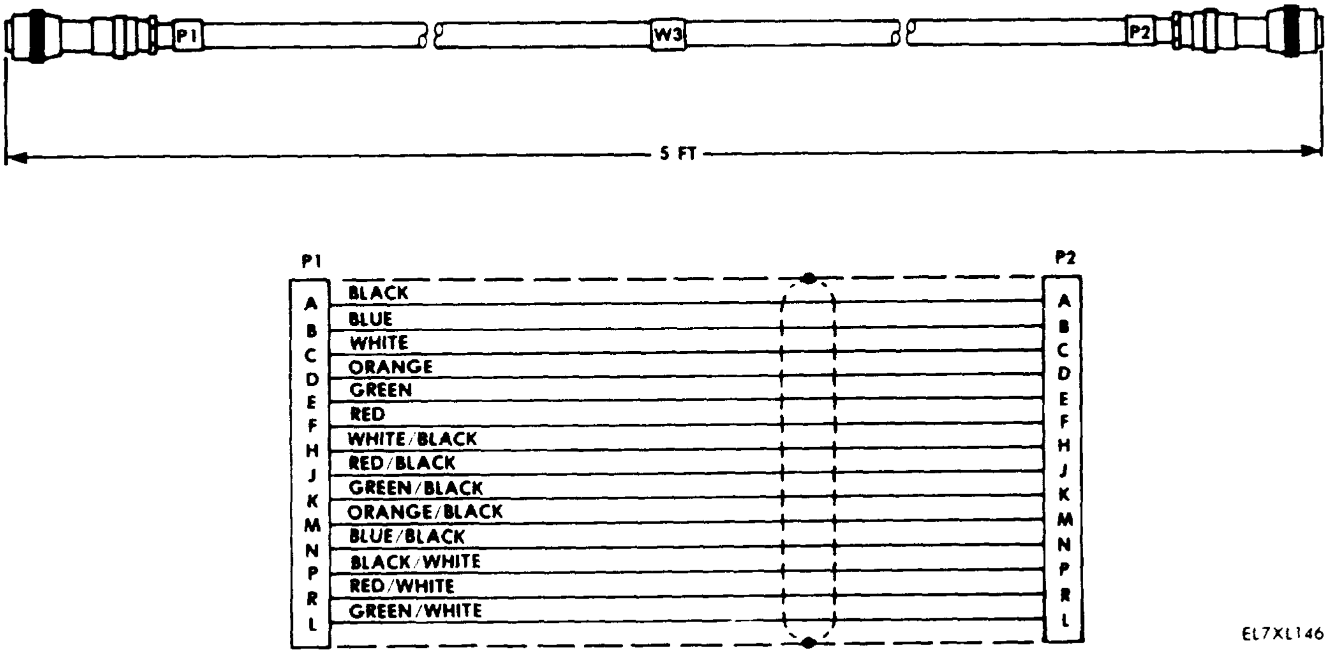


Figure 9-2. Test Cables (Sheet 1 of 6)



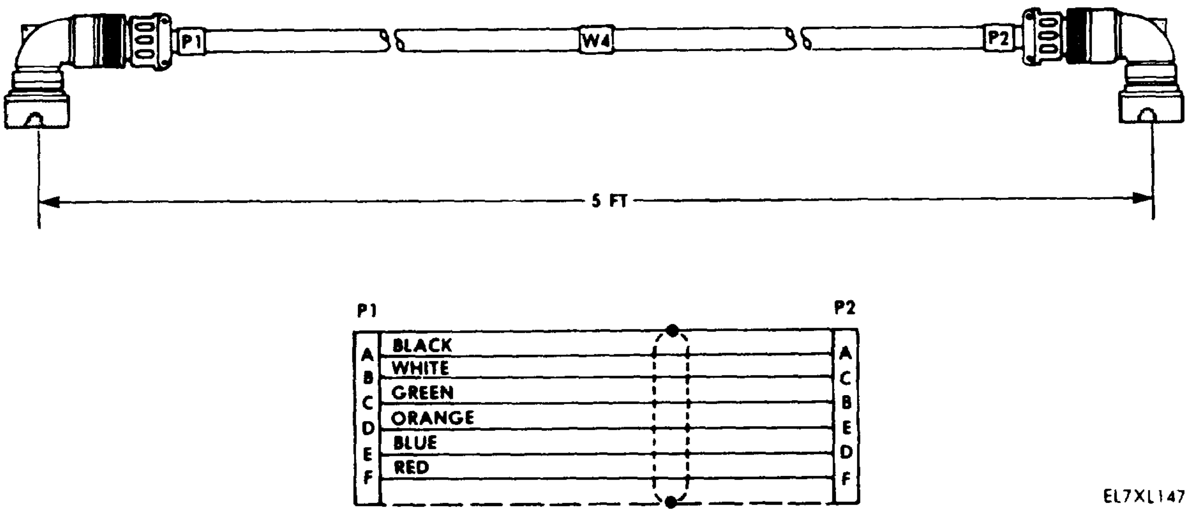
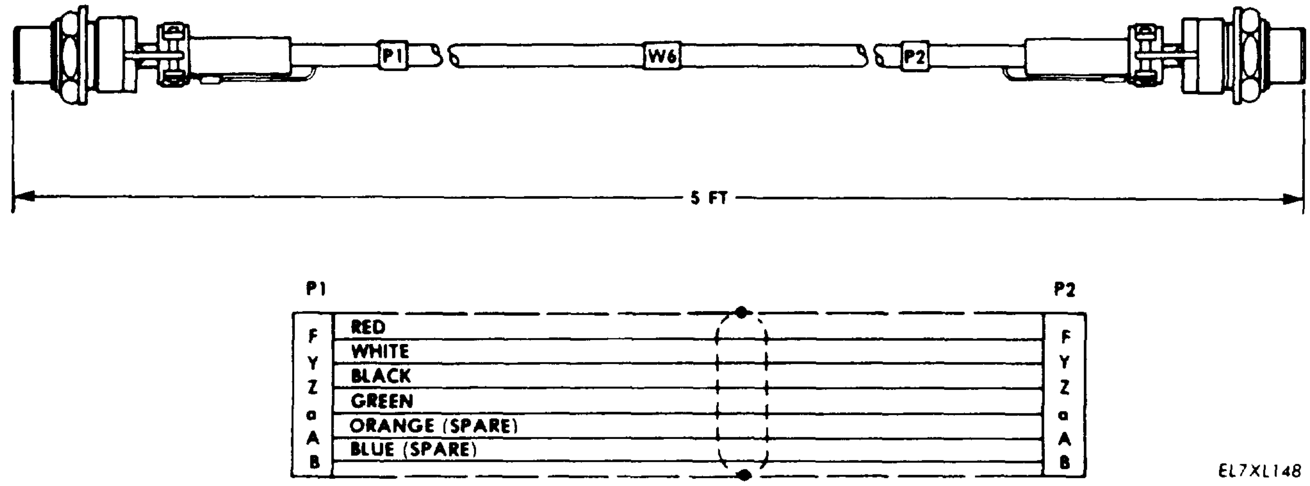


Figure 9-2. Test Cables (Sheet 2 of 6)



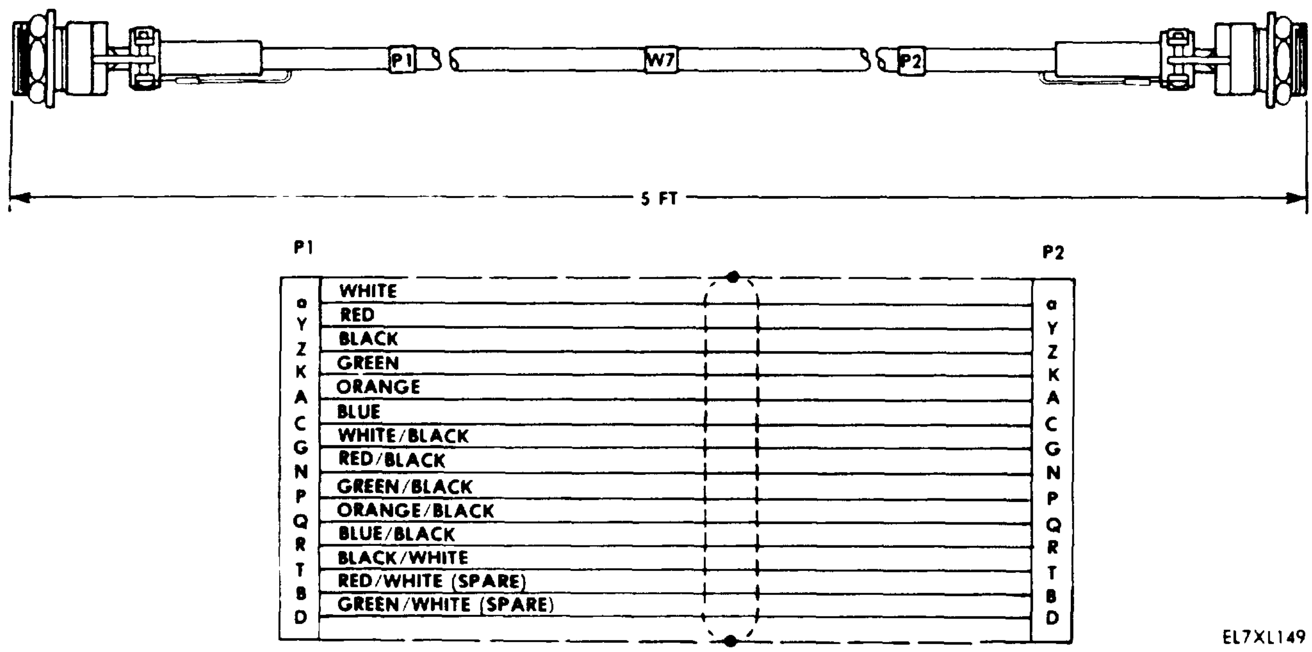
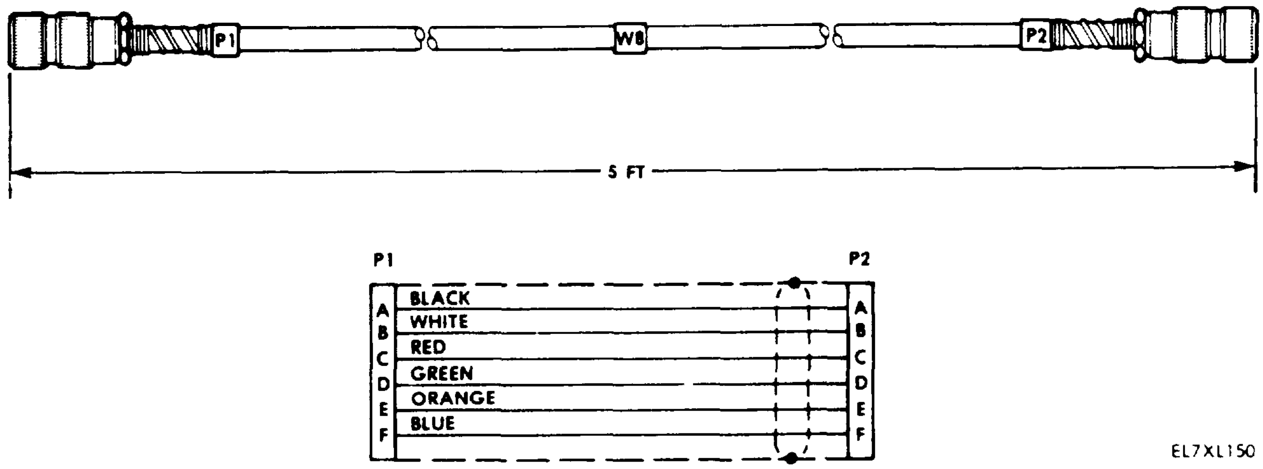


Figure 9-2. Test Cables (Sheet 3 of 6)



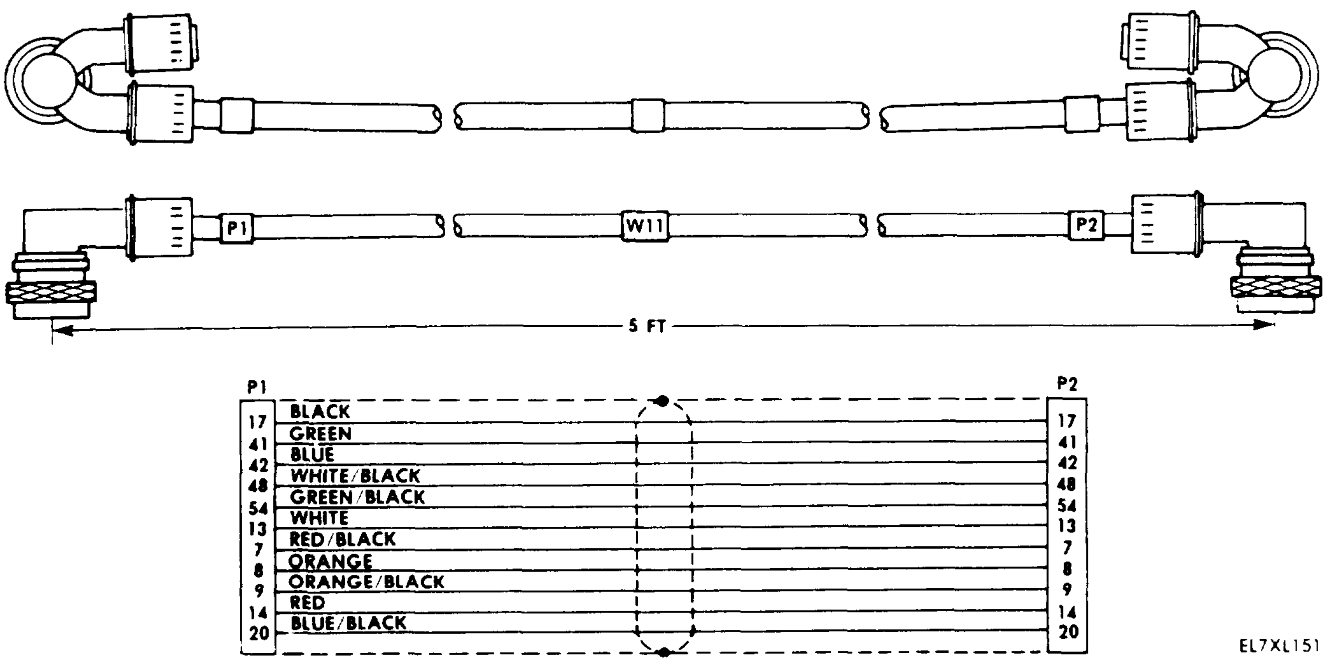
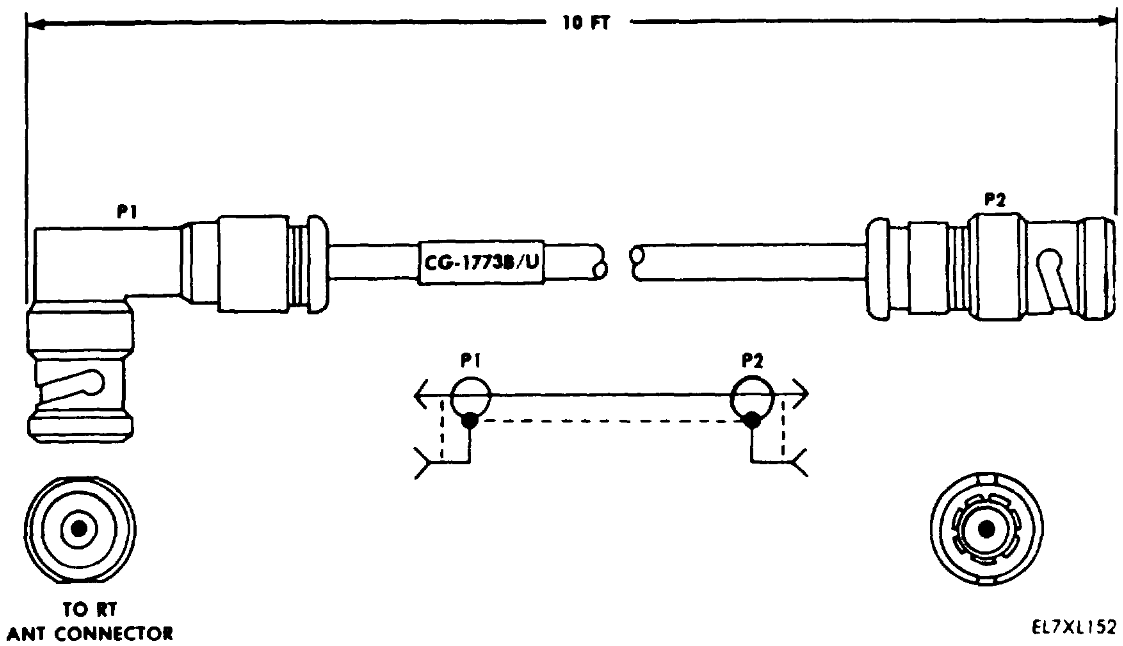


Figure 9-2. Test Cables (Sheet 4 of 6)

CG-1773B/U



CX-4720/VRC

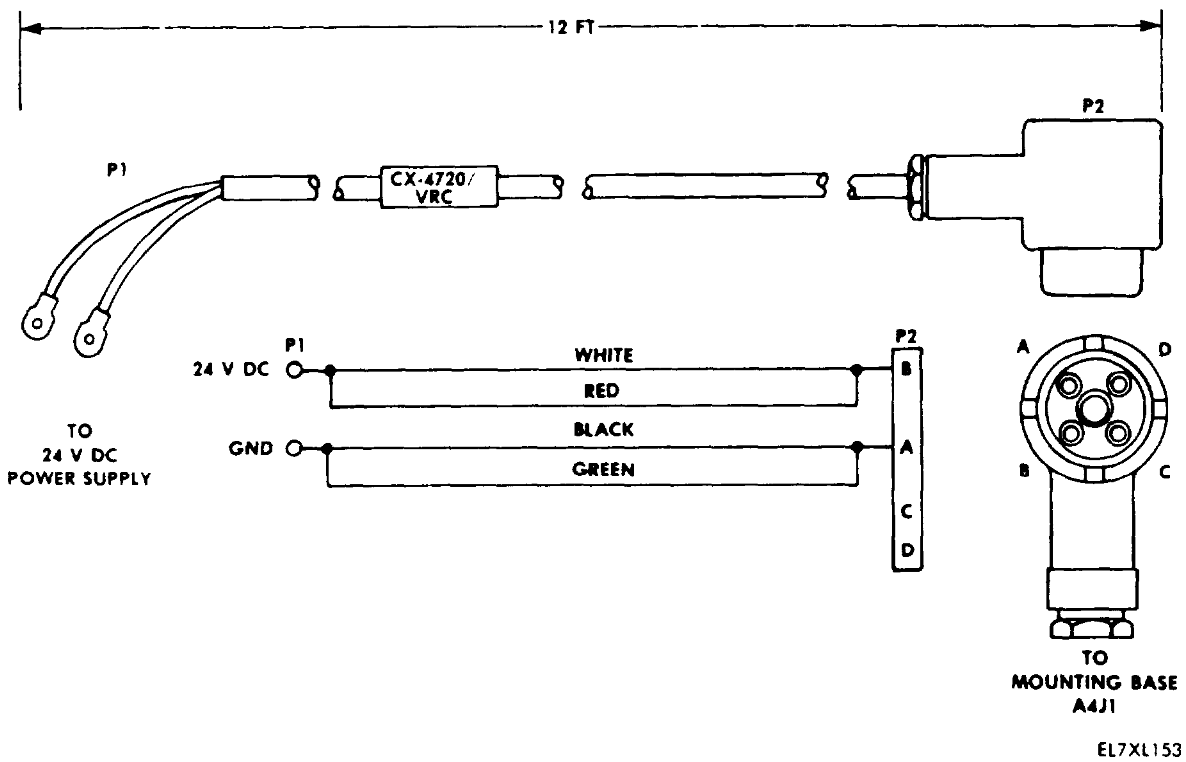


Figure 9-2. Test Cables (Sheet 5 of 6)

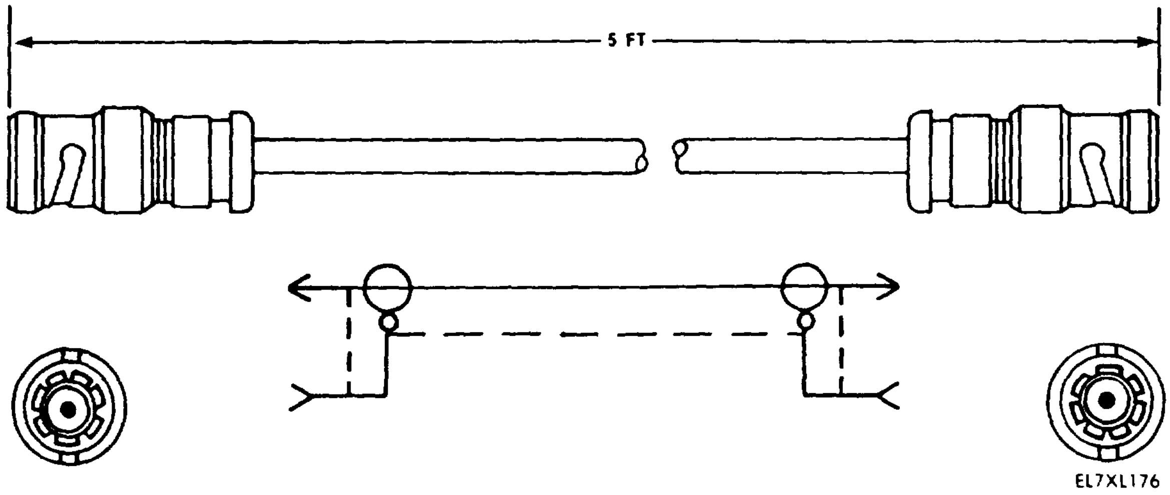


Figure 9-5. Test Cables (Sheet 6 of 6)

9-5. INTERCONNECTING DEVICE J-4404/GRC. Continued

f. Static Control. Included with the interconnecting device are a static control mat for the workbench and two grounding wrist straps. These are used whenever handling the radio equipment. They must be used when handling or testing electrostatic sensitive parts.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

9-6. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

9-7. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required for I(DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

9-8. REPAIR PARTS.

Repair parts are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering direct support maintenance for this equipment.

Section III. SERVICE UPON RECEIPT

9-9. CHECKING UNPACKED EQUIPMENT.

a. Inspect the equipment for damaged incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Report.

b. Check the equipment against the pocking slip to use if the shipment is complete. Report all discrepancies in accordance with the instructions of TM 38-750.

c. Check to see whether the equipment has been modified.

9-10. ASSEMBLY AND INSTALLATION OF STANDARD TEST SETUP.

The test radio and mounting base can be secured to a work bench. This may be desirable for some installations. A 12-ft power cable is provided. A 24-V dc power source must be provided by the user. The following procedure describes a typical installation.

ITEM	ACTION	REMARKS
a. Mounting base	Set on work surface. Secure to work surface if desired. See figure 9-3. Remove connector caps from J1 and J5.	Attaching hardware is provided with the mount. Position must be within 12 feet of power source (22 to 32 V dc).
b. Cable CX-4720/VRC	Connect to mounting base J1 and power source.	
c. HCP Mounting adapter	Remove cover and check position of shorting bar. It should connect TB2-1 to TB2-2. Torque cover screws to 12 in-lbs. Remove cop from P1. Set CB1 to OFF. Install mounting adapter in mounting base. Tighten outer thumbscrews.	
d. HCP Rt	Install holding battery. Remove caps from J6 and P1. Install in lower slot in the mounting adapter. Tighten thumbscrews.	
e. Audio cable	Connect to rt AUD/DATA connector and mounting adopter DATA J5 connector.	
f. Handset	Connect to mounting adopter AUD/DATA J3 connector.	
g. Rf cable CG-17738/VRC	Connect from rt ANT connector to 50Ω load.	
h. Test radio	Insure all thumbscrews are tight. Perform operational check in paragraph 9-20.	
i. Test radio	Normal presets are: CHAN — FREQUENCY MAN — 30.000 1 — 37.875 2 — 42.975 3 — 43.375 4 — 49.075 5 — 56.200 6 — 68.775 CUE — 87.975 Also load time-of-day, TRANSEC, and hopset.	

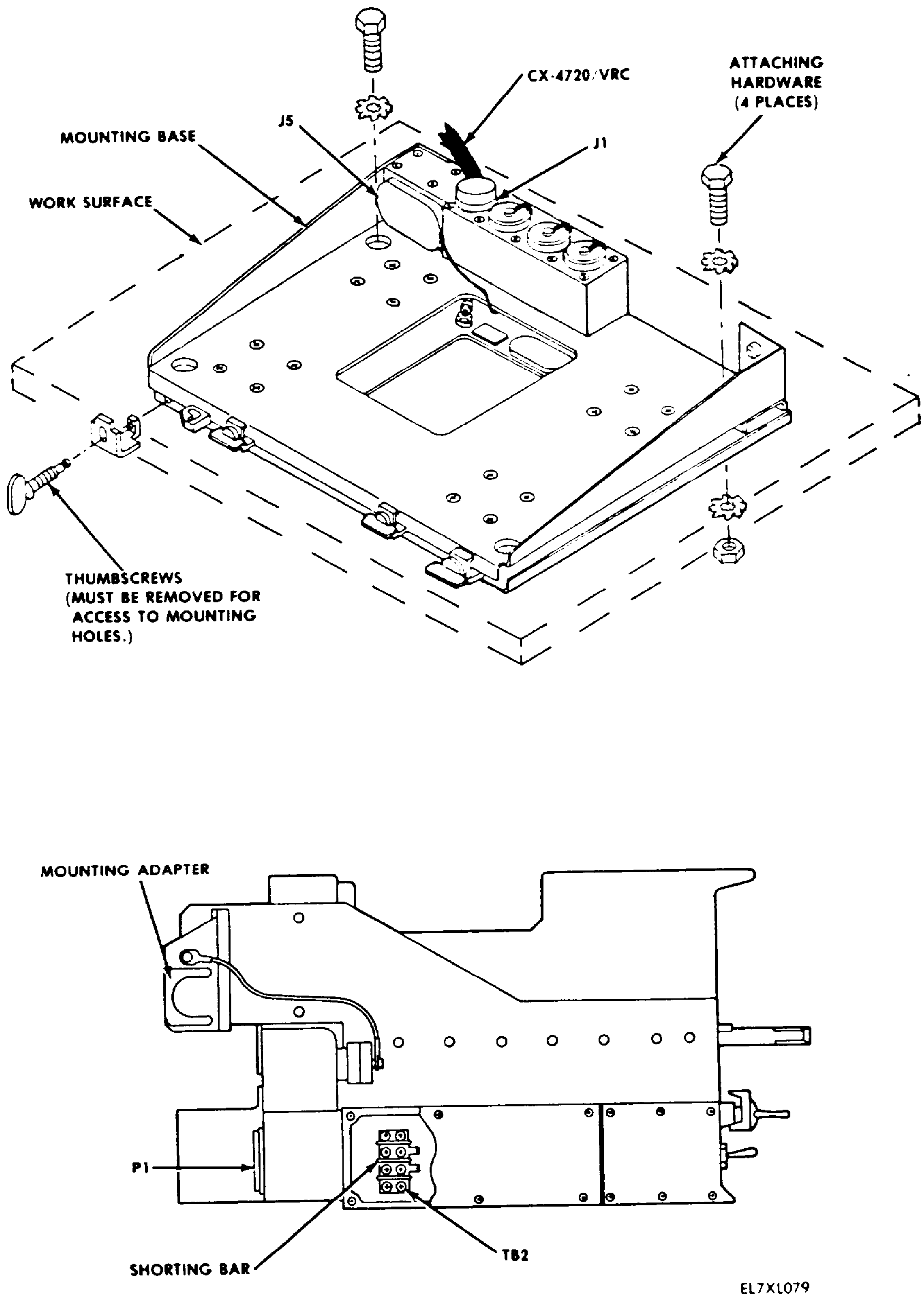


Figure 9-3. Assembly and installation of Test Radio (Sheet 1 of 2)

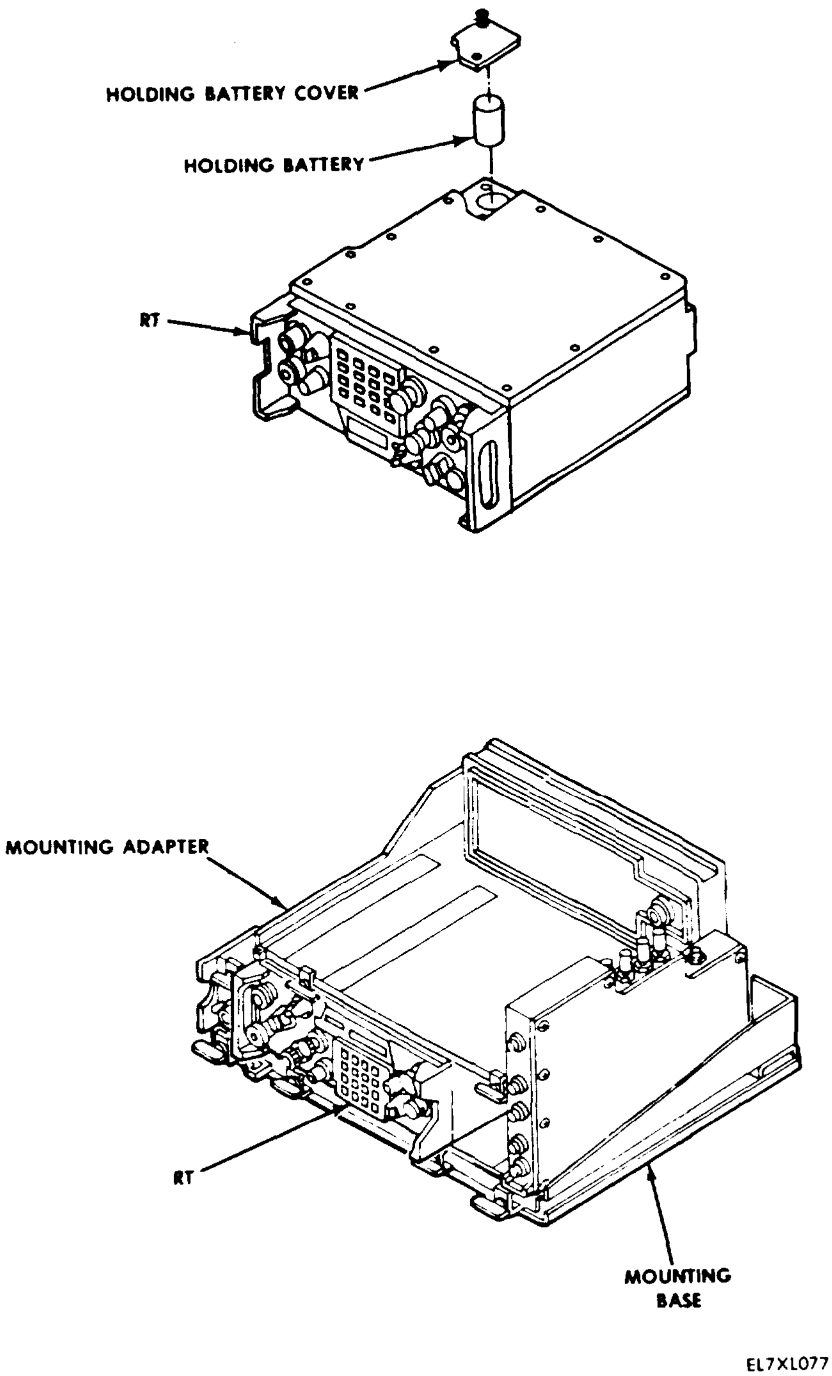


Figure 9-3. Assembly and Installation of Test Radio (Sheet 2 of 2)

9-10. ASSEMBLY AND INSTALLATION OF STANDARD TEST SETUP. Continued

ITEM	ACTION	REMARKS
	Preset switch settings. CB1: ON MODE: SC RF: LO CHAN: MAN FCTN: OFF DATA: OFF VOL: As required DIM: As required	**NOTE** When the test radio is not going to be used for long periods (over-night), set FCTN: STW to extend holding battery life. Presets will have to be re-loaded afterward.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

9-11. GENERAL.

PMCS are required for the test radio. They are needed to keep it in good working order. Do the checks in the PMCS table at the intervals listed. Some checks and services must be done whenever you see they need to be. These routine tasks are not listed in the table. They include cleaning, checking cables for damage, stowing items not used, and checking for loose nuts, bolts, and screws.

9-12. PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

ITEM	ACTION	REMARKS
a. Holding battery in rt.	Set FCTN: OFF Set CB1: OFF If rt loses fill information replace holding battery.	Perform this check every six months.
b. Holding battery in ECCM fill device.	Replace every six months.	
c. ECCM fill device.	Test daily for presence of fill information.	Refer to para. 9-18 for loss of fill information.

Section V. TROUBLESHOOTING PROCEDURES

9-13. GENERAL.

Troubleshooting is performed on a unit that is not operating properly. Use the operational checks in Section VI to determine if a unit is operating properly. If it is not, follow the troubleshooting instructions in this section.

9-14. TEST RADIO AND MOUNTING BASE.

Troubleshoot the test radio using the troubleshooting flow charts as follows:

a. When a test radio is faulty, inspect it for damage. Repair any damage before proceeding with testing. See the proper chapter for the damaged equipment if repairs are necessary.

b. Verify the symptom. Perform the operational check in section VI. This will direct you to the correct troubleshooting flow chart or chapter.

c. Troubleshoot the test radio using the flow chart. It will identify the defective unit.

d. Repair the defective unit Follow the procedures in section VI or indicated chapters.

e. Verify the repair. Repeat the operational check in section VI that failed. If it posses, then continue with the rest of the operational check. When the operational check is passed, the test radio can be returned for use.

9-15. TEST PRECAUTIONS AND NOTES.

WARNING

High voltage (200 V dc) is present at mounting adapter connector J1 and TP232 on the test adapter. Use caution when connecting the test setup and taking measurements to avoid personal injury.

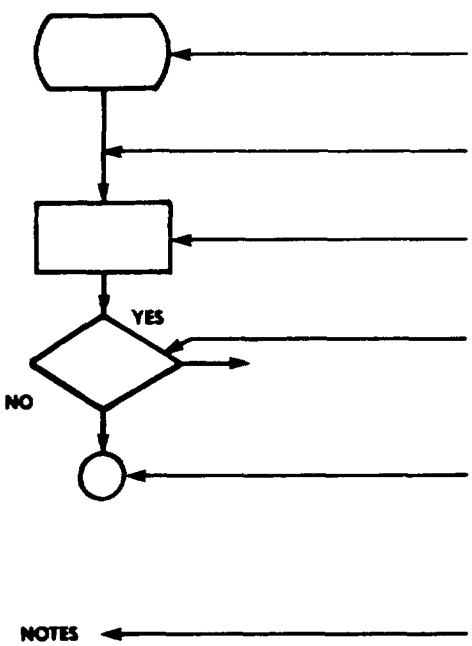
Set the test power supply to OFF before connecting or disconnecting a test setup. Current capacities are large enough to cause personal injury. Equipment con also be damaged if core is not taken.

NOTE

Chapter 2 can be used to fault isolate any unusual problems that might not be covered in the troubleshooting procedures.

9-16. EXPLANATION OF SYMBOLS AND NOTES.

SYMBOL | EXPLANATION



Test Procedure Start: (Rectangle with rounded corners) Indicates start of the test procedure and contains a brief description of the symptom of trouble.

Test Procedure Flow Line: (Heavy line and arrowhead) Indicates direction of the procedure flow.

Test Procedure Instruction: (Rectangle) Provides instructions for doing a specific test.

Decision: (Diamond) Indicates that a decision must be made (YES or NO) in answer to a question about the previous test. Path taken depends on the answer (YES or NO).

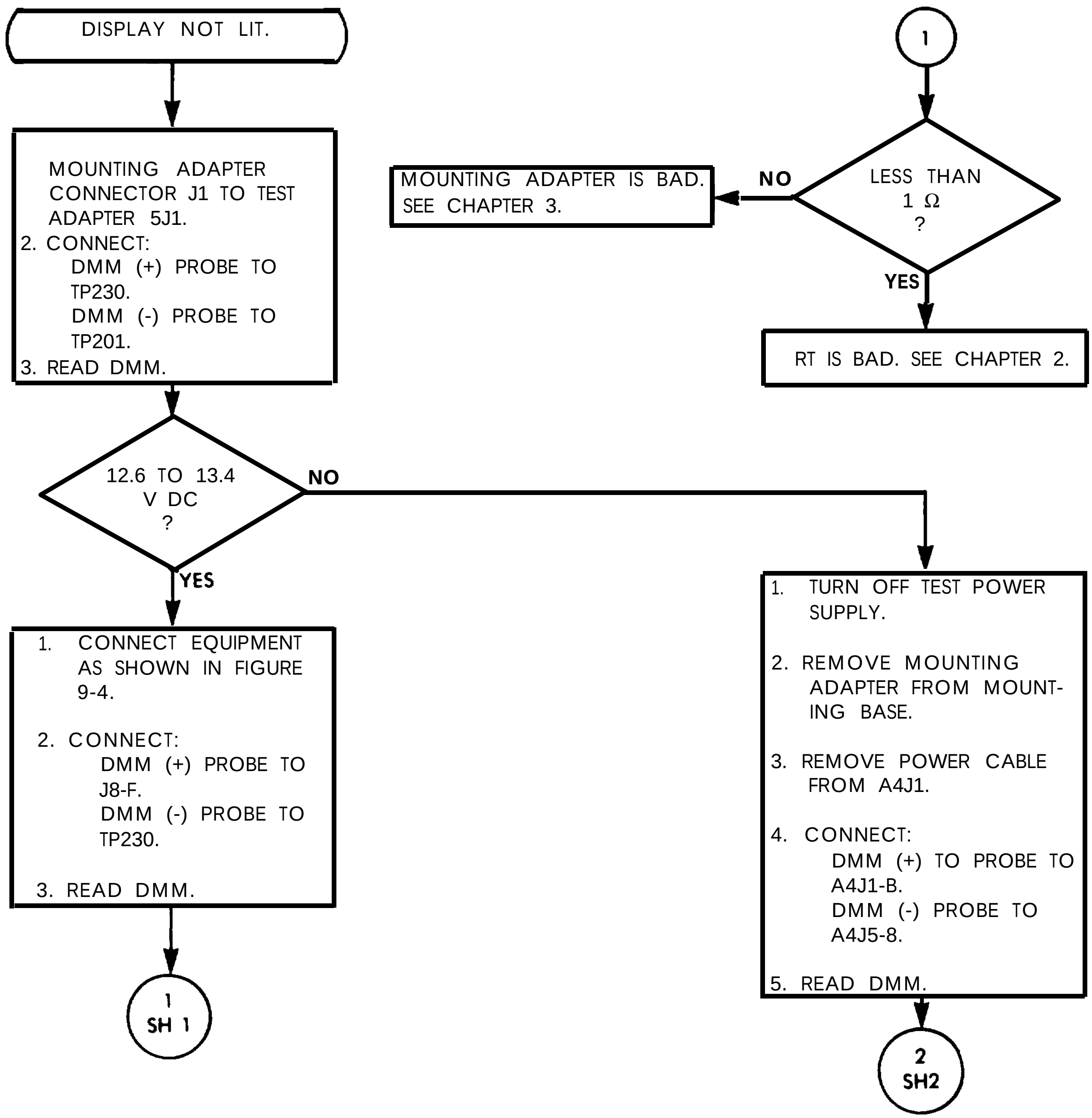
Connector: (Circle) Directs user to an entry point of another chart. Contains an entry number that is same as entry number of other chart and o sheet number (Sh No.) that indicates the number of follow-on pages.

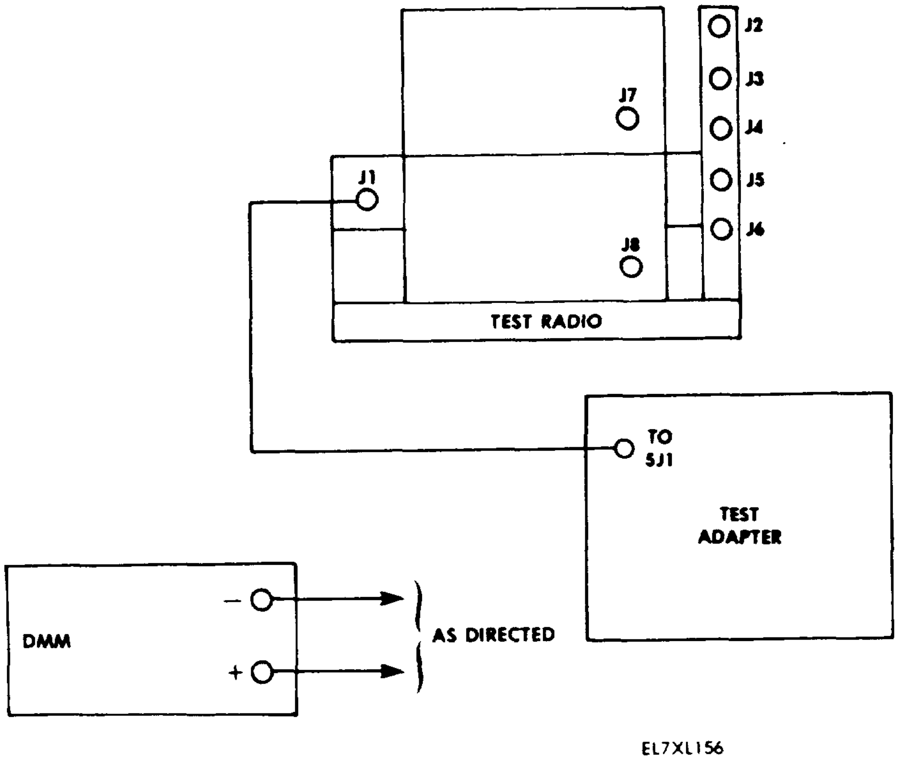
Notes Column: Presents additional information, such as: more specific instructions about how to do a test, cautions and warnings that must be observed when doing a test, and additional information about what to do after doing a test. Also provides references to appropriate circuit diagrams.

9-17. TROUBLESHOOTING FLOW CHARTS.

CHART 1

Troubleshooting Faulty Display
(Sheet 1 of 2)





EQUIPMENT PRESETS

POWER SUPPLY: DISCONNECTED

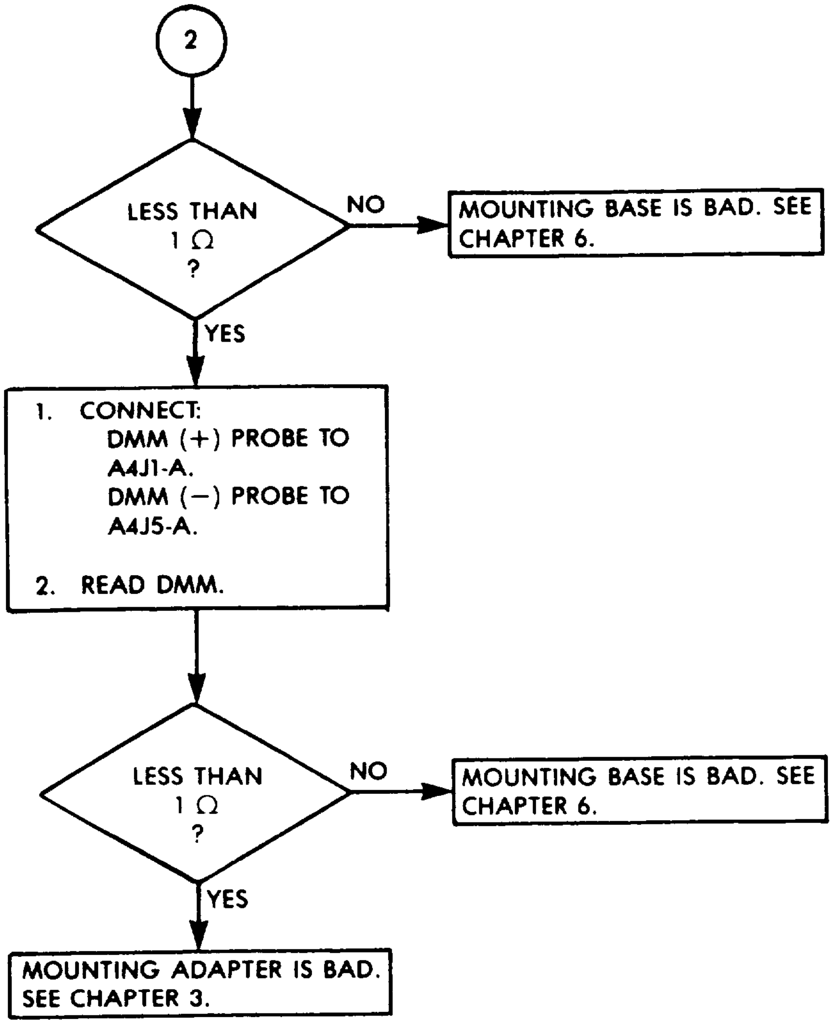
REMOVE RT FROM MOUNTING ADAPTER

Figure 9-4. Troubleshooting Test Setup Diagram

9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 1

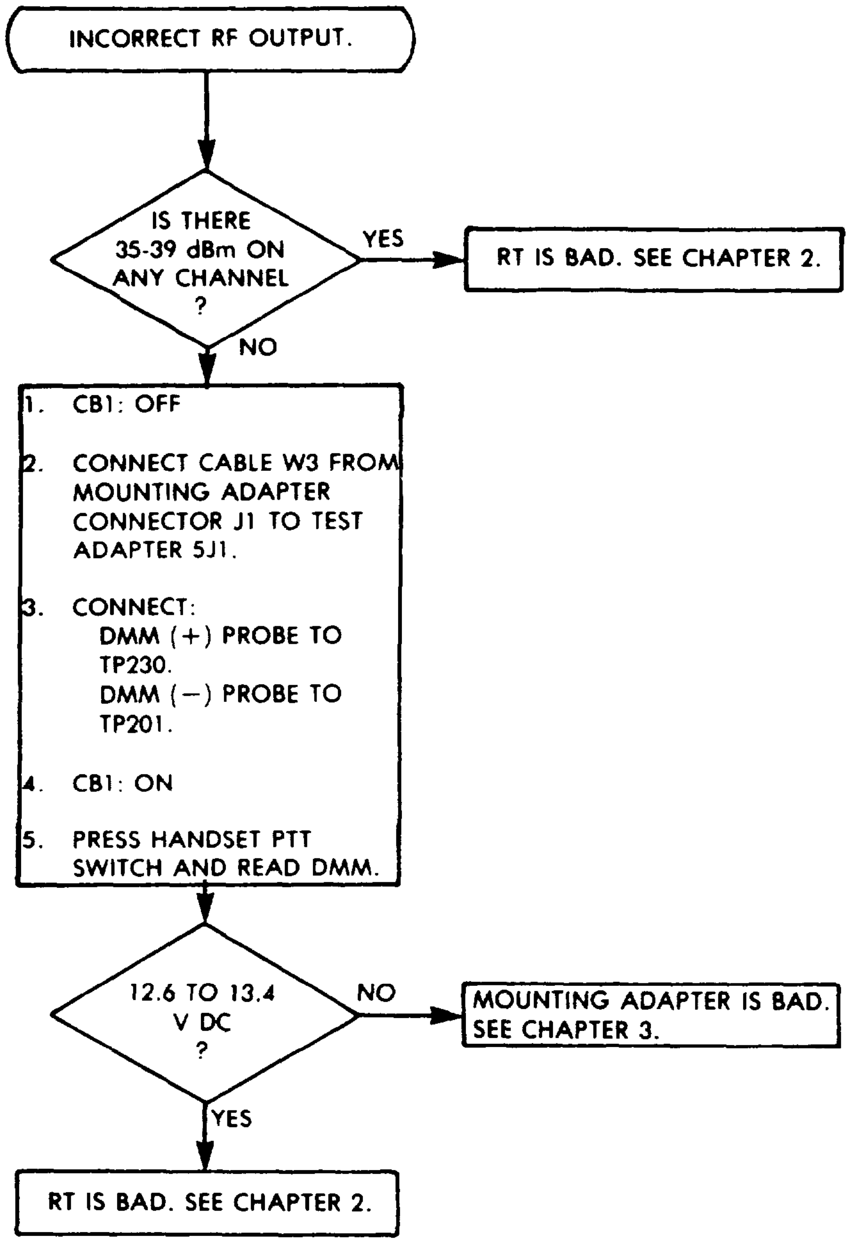
Troubleshooting Faulty Display
(Sheet 2 of 2)



9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 2

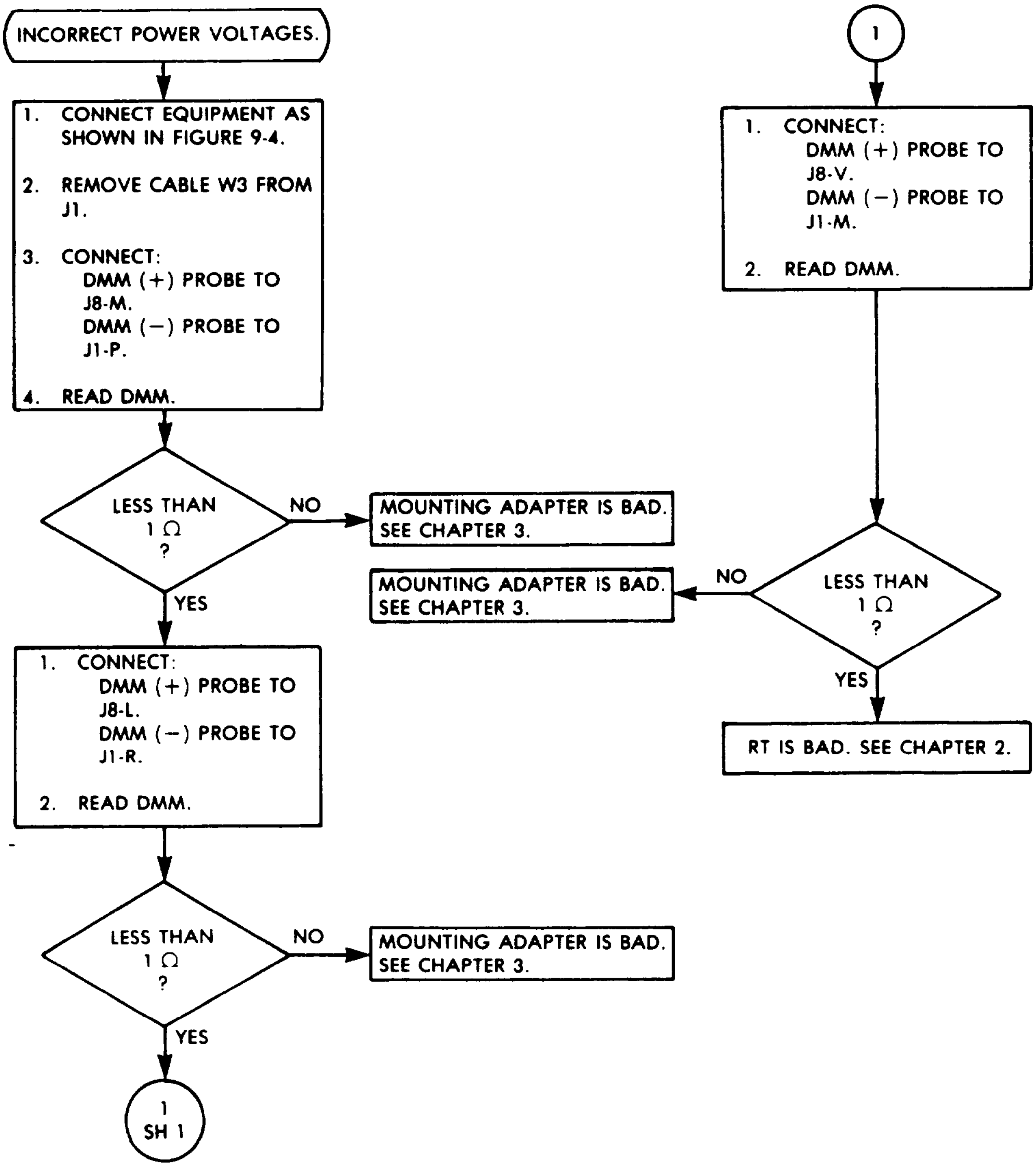
Troubleshooting RF Output
(Sheet 1 of 1)



9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 3

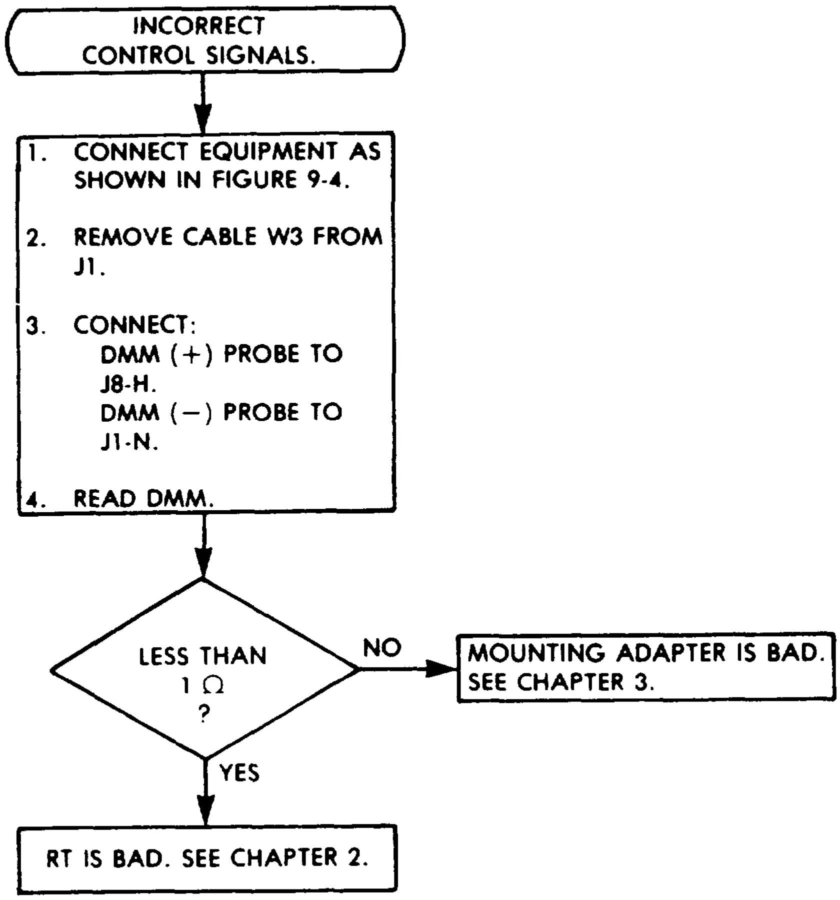
Troubleshooting Power Output
(Sheet 1 of 1)



9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 4

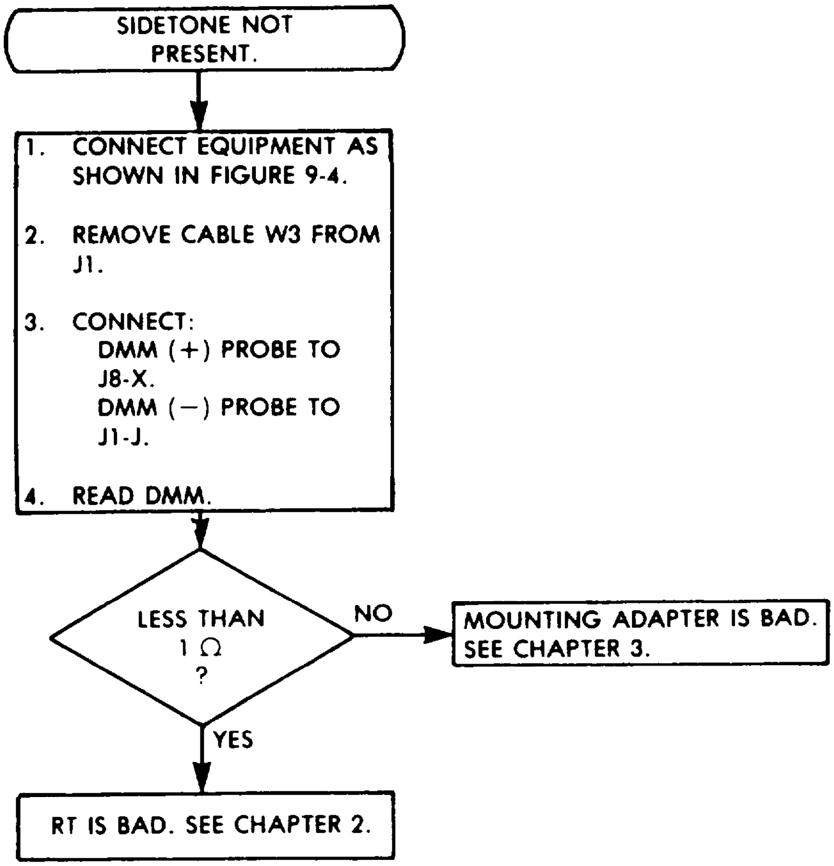
Troubleshooting Control Signals
(Sheet 1 of 1)



9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 5

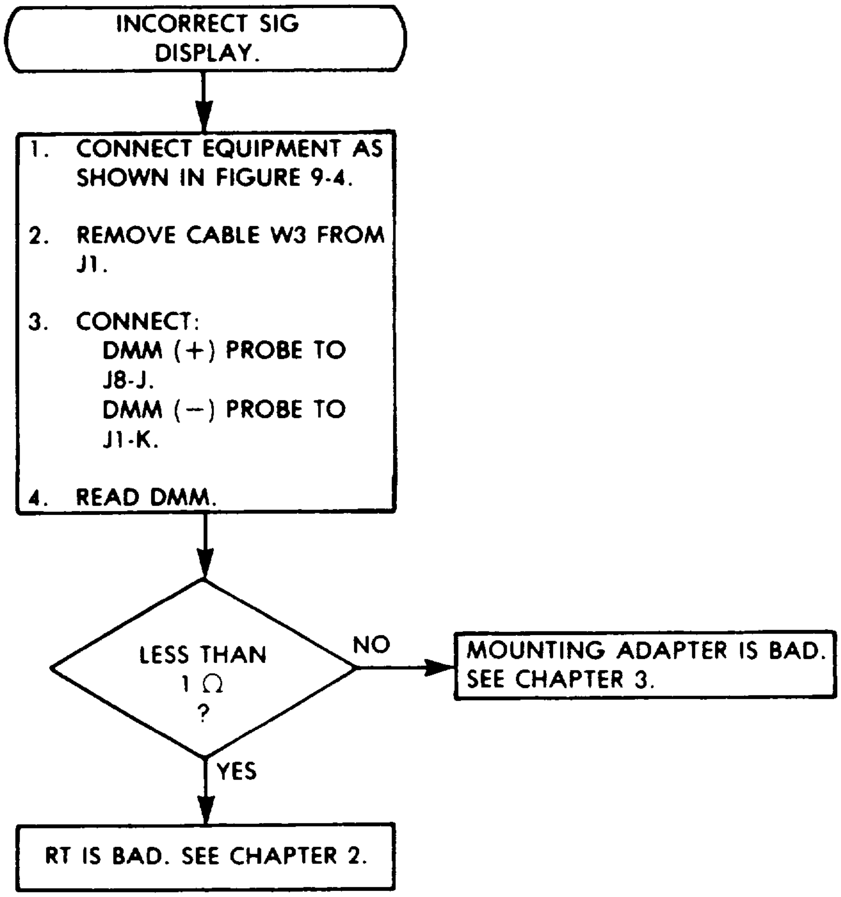
Troubleshooting Loss of Sidetone
(Sheet 1 of 1)



9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 6

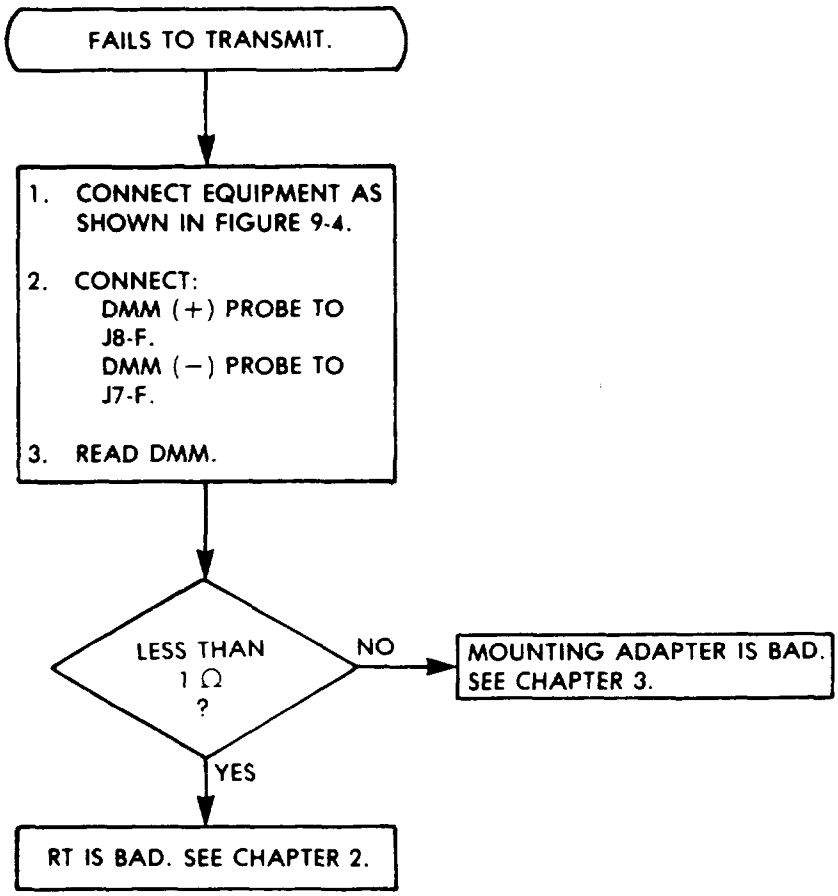
Troubleshooting Faulty Sig Display
(Sheet 1 of 1)



9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 7

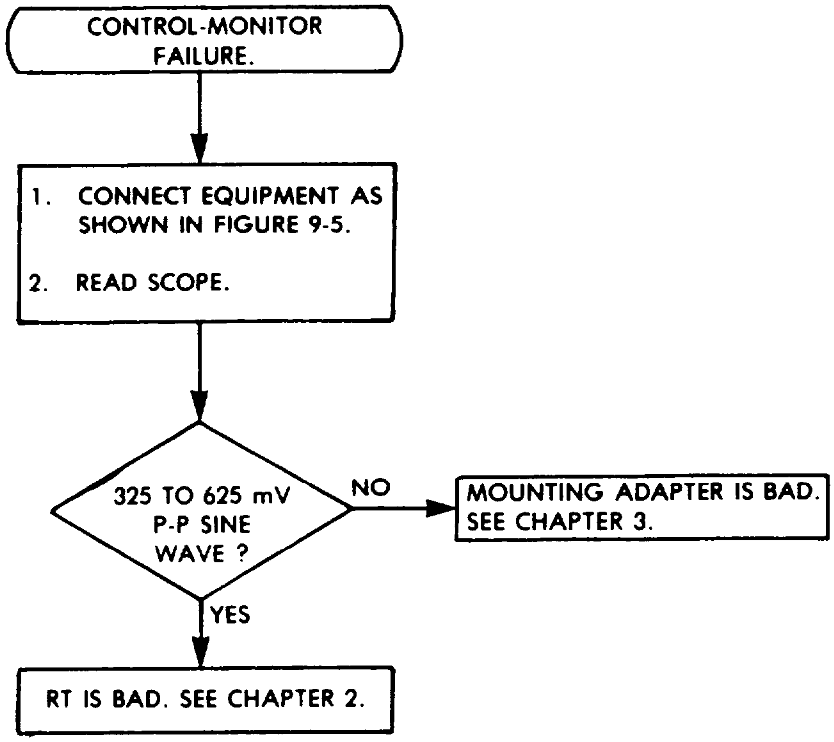
Troubleshooting Transmit Failure
(Sheet 1 of 1)

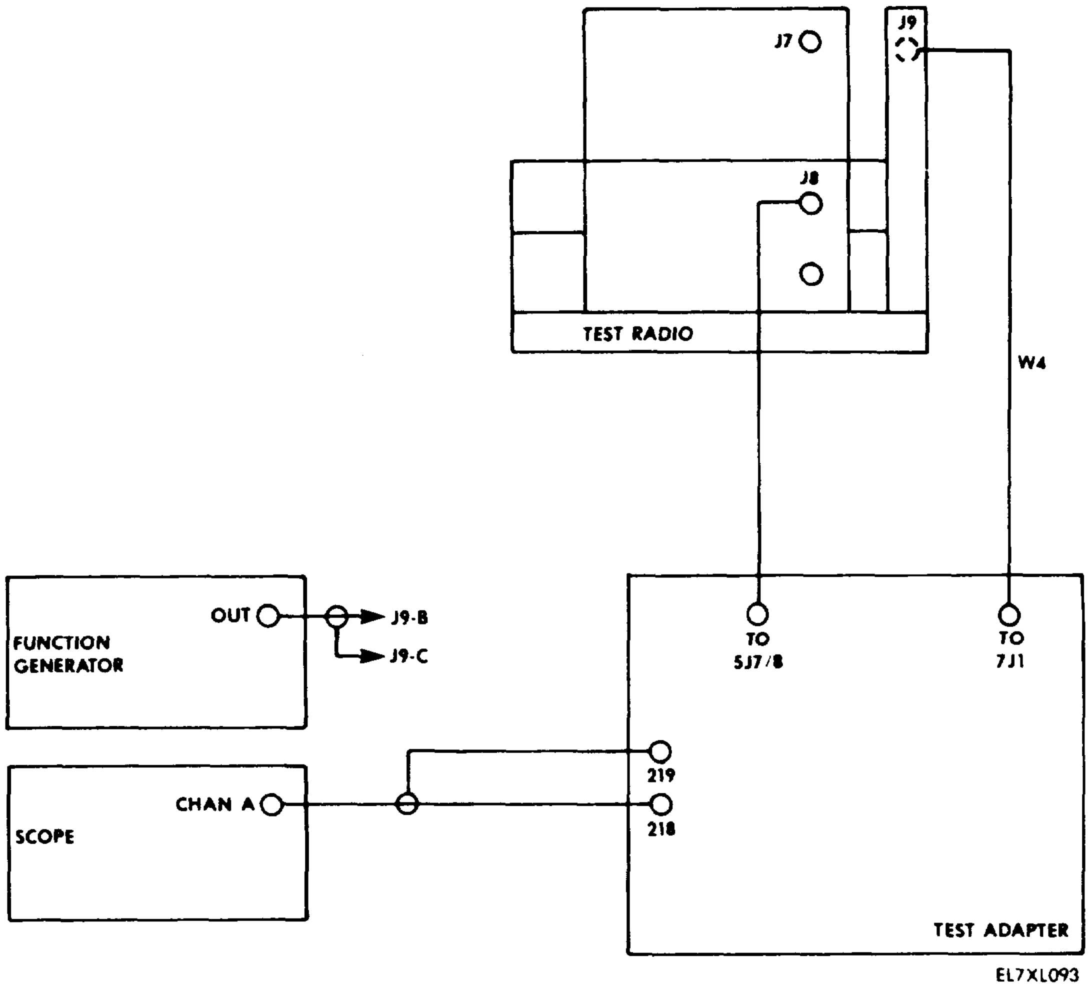


9-17. TROUBLESHOOTING FLOW CHARTS. Continued

CHART 8

Troubleshooting Remote Operation Failiure
(Sheet 1 of 1)





EQUIPMENT PRESETS

FUNCTION GENERATOR:
- FREQ: 40000 Hz (39900 TO 40100 Hz)
- LEVEL: 500 mV P-P (490 TO 510 mV P-P)
- FUNCTION: SINE

REMOVE RT A AND B FROM MOUNTING ADAPTER.

Figure 9-5. Remote RT Operation Transformers Test Setup Diagram

9-18. ECCM FILL DEVICE.

If the ECCM fill device will not hold or transfer a fill with a good battery, send it to depot for repair.

9-19. INTERCONNECTING DEVICE.

Troubleshoot the components of the interconnecting device using the schematics. See FO-18. Check for open circuits and shorts to ground. Replace connectors and wires as required to correct the fault. Follow the instructions in Section VI.

Section VI. MAINTENANCE PROCEDURES

9-20. OPERATIONAL CHECKS.

The operational check provides a step-by-step procedures for evaluating the test radio. If the operational check is passed, the test radio may be returned to service. If it does not, the bad unit or the troubleshooting chart to be used will be identified. The troubleshooting procedures are in Section V.

No operational checks are required for the interconnecting device. Continuity checks can be performed using the schematic FO-18 and an ohmmeter if necessary. Use the operational check in TM 11-5820-890-20-1 for the ECCM fill device.

The operational check requires the use of a second rt that is known to be good. Obtain this rt from another maintenance group.

The operational check is divided into steps. Each step verifies a particular function. Follow the instruction in the "Action" column. Check the response. If the response is correct, proceed with the next lettered step. When a STEP has been completed, proceed with the next STEP. A "no response" in the "Response" column means that any response is not of interest.

When instructed, set up the test equipment as indicated in the figures. Each figure shows the proper settings for the test equipment.

WARNING

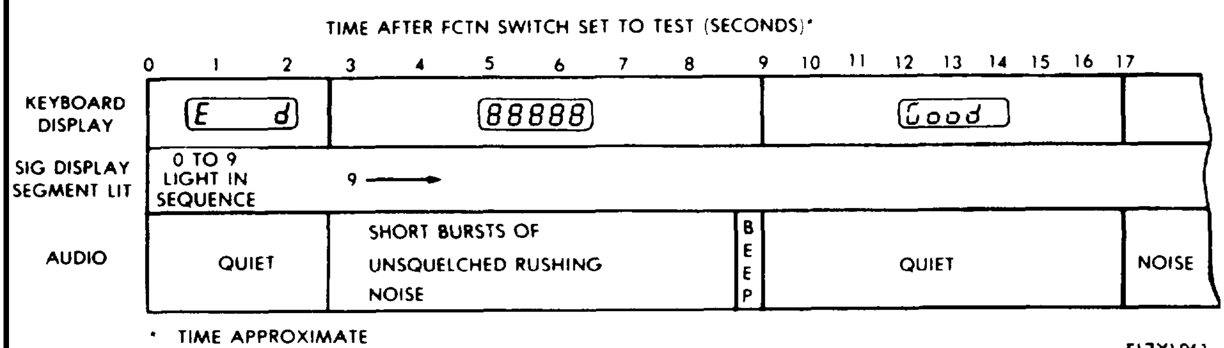
Connect the test setups only when directed, and with the power supply set to OFF. The large current capacity of the test power supply can cause personal injury. Verify the test setup before turning the power supply on.

High voltage (200 V dc) is present at mounting adopter connector J1 and TP232 on the test adapter. Use caution when connecting the test setup and taking measurements to avoid personal injury.

9-20. OPERATIONAL CHECKS. Continued

Step 1. SELF-TEST, RECEIVE, AND TRANSMIT CHECK

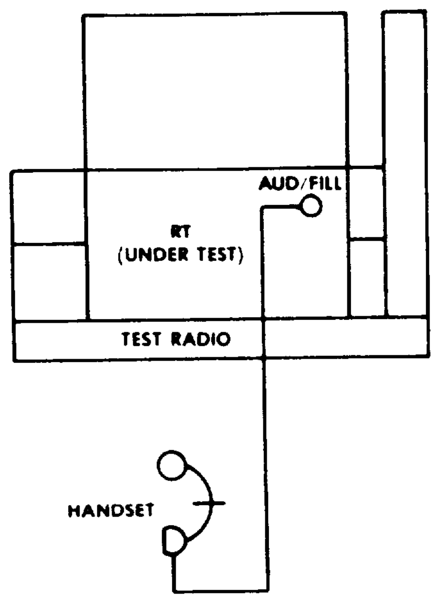
Action	Response
a. Connect equipment as shown in figure 9-6.	a. No response.
b. Rt FCTN: Z-A.	b. Display lights. If not, go to chart 1. If the display does not read "Good", rt is bad. See chapter 2.
c. Vary DIM control while display reads "Good".	c. Display brightness varies in intensity. If not, the rt is bad. See chapter 2.
d. Rt FCTN: TST.	d. Responses:



EL7XL061

Action	Response
	If any of these do not occur, the rt is bad. See chapter 2.
e. Rt FCTN: REM.	e. SIG display segments light 9 through 0 in sequence then go blank. Keyboard display reads 30000. If not, rt is bad. See chapter 2.
f. Press and hold rt BATT 'CALL button and handset PTT switch.	f. "CALL" displayed on rt. If not, rt is bad. See chapter 2.
g. Rt FCTN: LD. Load the following frequencies:	g. Frequencies load correctly. If not, rt is bad. See chapter 2.

CHAN	FREQ
MAN	49.000 MHz
1	87.975 MHz
2	55.000 MHz
3	33.000 MHz
4	40.000 MHz
5	61.000 MHz
6	72.000 MHz
CUE	80.000 MHz



EQUIPMENT PRESETS

RT:

RF:	LO	DATA:	OFF
FCTN:	OFF	CHAN:	MAN
MODE:	SC	DIM & VOL:	FULL CW

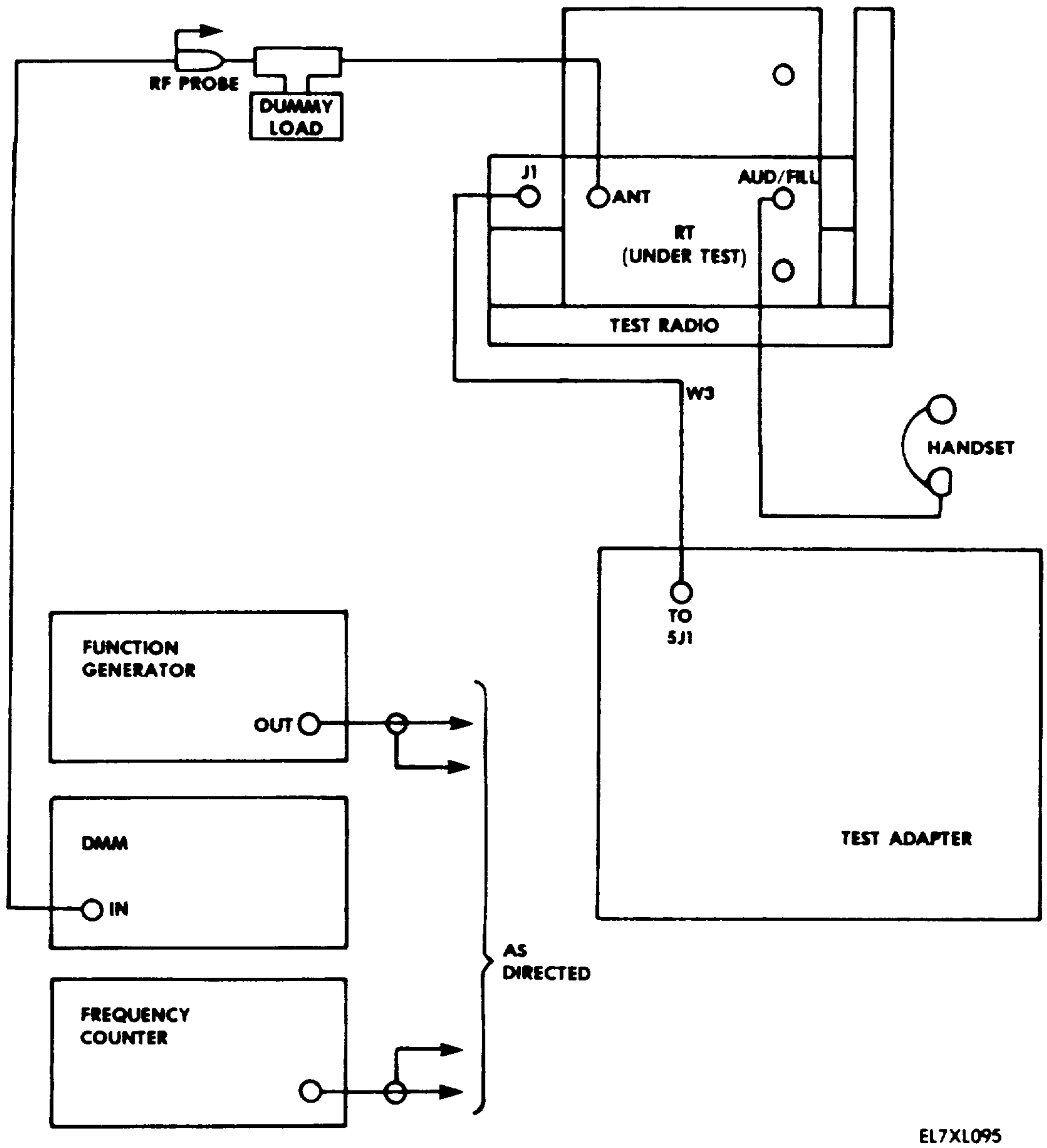
CB1: ON

Figure 9-6. Self-Test Setup Diagram

9-20. OPERATIONAL CHECKS. Continued

Step 1. SELF-TEST, RECEIVE, AND TRANSMIT CHECK Continued

Action	Response
h. Connect equipment os shown in figure 9-7.	h. No response.
i. Press rt handset PTT switch, read DMM. Repeat for each channel.	i. DMM reads 35 to 39 dBm for all channels. If not, go to chart 2.
j. Set power supply to 22 V dc.	j. No response.
k. Press handset PTT switch and read DMM.	k. DMM reading to 35 to 39 dBm. If not, go to chart 2.
l. Set power supply to 31 V dc. Press handset PTT switch and read DMM.	l. DMM reading is 35 to 39 dBm. If not, go to chart 2.
m. Set power supply to 27.5 V dc.	m. No response.
n. Disconnect DMM and connect frequency counter to dummy load. Set RF: LO	n. No response.
o. Press handset PTT switch and read frequency counter. **NOTE** If CHAN 1 fails, set RF: M. 87.975 MHz is at the extreme high end of the rt transmit band and may be hard for the frequency counter to detect.	o. Frequencies should read: CHAN — FREQ MAN — 48.999750 to 49.000250 MHz 1 — 87.974550 to 87.975450 MHz 2 — 54.999770 to 55.000230 MHz 3 — 32.999825 to 33.000175 MHz 4 — 39.999800 to 40.000200 MHz 5 — 60.999700 to 61.000300 MHz 6 — 71.999650 to 72.000350 MHz CUE — 79.999600 to 80.000400 MHz If not, rt is bad. See chapter 2.
p. Disconnect frequency counter Set RF: HI. Read SIG display while handset PTT switch is pressed.	p. SIG display reading is 5, 6, or 7. If not, rt is bad. See chapter 2.
q. Press handset PTT switch and talk into handset.	q. Sidetone is present. If not, rt is bad. See chapter 2.



EQUIPMENT PRESETS

RT:

RF:	HI
FCTN:	SQ ON
MODE:	SC
DATA:	OFF
CHAN:	MAN
DIM & VOL:	FULL CW
CB1:	ON

DMM:
dBm, 50Ω REF

FUNCTION GENERATOR:
FREQ: DC
DC OFFSET: +3.5 V dc (3.25 to 3.75 V dc)

Figure 9-7. RF Output Test Set-Up Diagram

9-20. OPERATIONAL CHECKS. Continued

Step 1. SELF-TEST, RECEIVE, AND TRANSMIT CHECK Continued

Action	Response
WARNING 200 V dc is present at test point 232, and cable W3 pin F. Use caution to avoid personal injury.	
r. Connect DMM (-) probe to TP201. Connect DMM (+) probe to each of the following test points: Test Adapter TP229 TP230 TP231 TP232	r. DMM readings are: Test Adopter — Reading TP229 — 6.55 to 6.95 V dc TP230 — 12.6 to 13.4 V dc TP231 — 25.0 to 29.0 V dc TP232 — 180 to 220 V dc If any voltage is incorrect, go to chart 3.
s. Disconnect cable W3 from the test adopter.	s. No response.
t. Rt: CHAN 1. Connect DMM (-) probe to cable W3 pin A. Connect DMM (+) probe to cable W3 pins P, R, and M, one at a time, and press handset PTT switch. Read DMM for each	t. DMM readings are: Cable W3 Pin — Reading P — -0.5 to 0.5 V dc R — -0.5 to 0.5 V dc M — 6.25 to 7.25 V dc If any voltage is incorrect, go to chart 3.
u. Rt CHAN: 2. Connect DMM (+) probe to cable W3 pins P, R, and M, one at a time, and press handset PTT switch for each. Read DMM.	u. DMM readings are: Cable W3 Pin — Reading P — -0.5 to 0.5 V dc R — 6.25 to 7.25 V dc M — -0.5 to 0.5 V dc If any voltage is incorrect, go to chart 3.
v. Rt CHAN: 3. Connect DMM (+) probe to cable W3 pins P, R, and M, one at a time, and press handset PTT switch for each. Read DMM.	v. DMM readings ore: Cable W3 Pin — Reading P — 6.25 to 7.25 V dc R — -0.5 to 0.5 V dc M — - 0.5 to 0.5 v dc If any voltage is incorrect, go to chart 3.

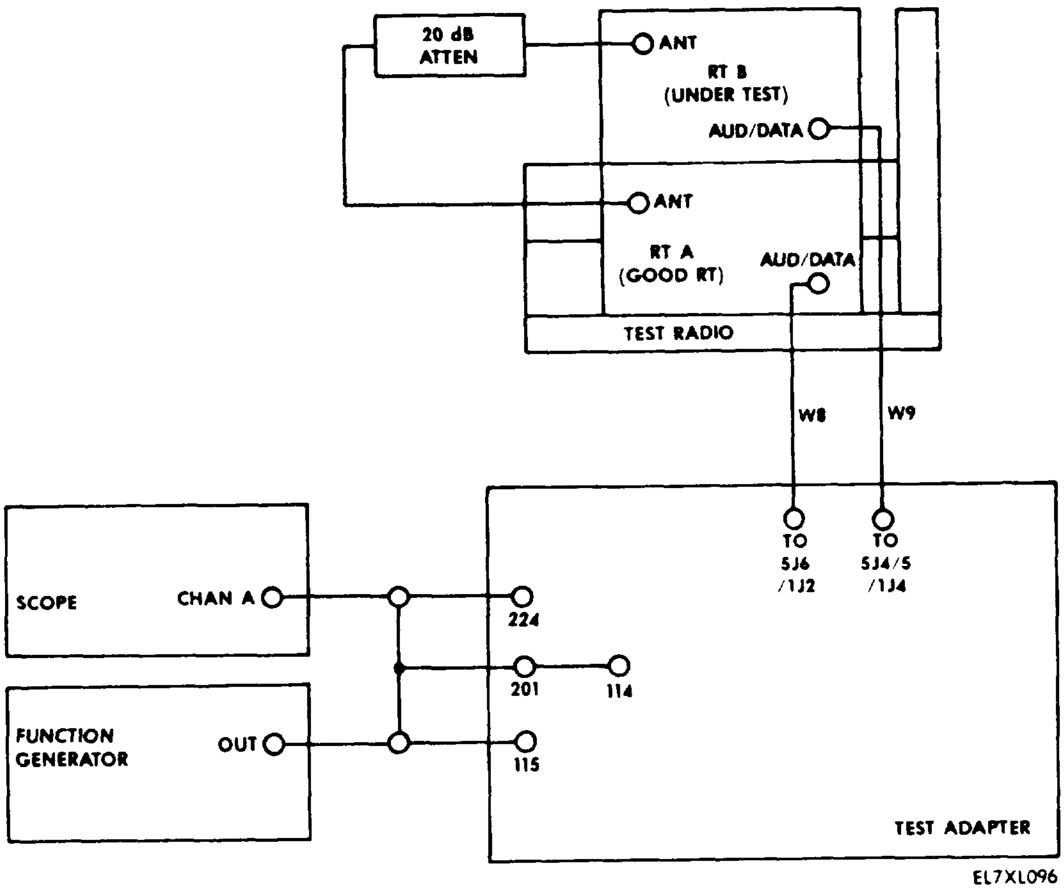
9-20. OPERATIONAL CHECKS. Continued

Step 1. SELF-TEST, RECEIVE, AND TRANSMIT CHECK Continued

Action	Response
w. Connect DMM (+) probe to cable W3 pin N and press handset PTT switch. Read DMM.	w. DMM reads -0.5 to 0.5 V dc. If not, go to chart 4.
x. Rt RF: PA Leave DMM (+) probe connected to cable W3 pin N and press rt handset PTT switch and read DMM. **WARNING** 200 V dc is present at cable W3 pin F. Use caution to avoid personal injury.	x. DMM reads 6.25 to 7.25 V dc. If not, go to chart 4.
y. Connect jumper cable between pins B and J of cable W3.	y. Sidetone is not present. If sidetone is present, go to chart 5.
z. Disconnect jumper cable from cable W3. Connect function generator lead (+) to cable W3 pin K. Connect function generator lead (-) to cable W3 pin A.	z. No response.
aa. Press handset PTT switch and read SIG display.	aa. SIG display segments 8 or 9 are lit. If not, go to chart 6.

Step 2. TRANSMIT/RECEIVE SC AUDIO CHECK

Action	Response
a. Connect test equipment as shown in figure 9-8.	a. Scope chan A displays 15 to 20 V p-p, 900 to 1100 Hz sine wave. If not, go to chart 7.
b. Connect test equipment as shown in figure 9-9.	b. Scope chan A displays 15 to 20 V p-p, 900 to 1100 Hz sine wave. If not, rt is bad. See chapter 2.
c. Set CHAN switch on rt A and rt B to each position (at the same time).	c. Scope chan A displays 15 to 20 V p-p, 900 to 1100 Hz sine wave for each channel. If not, rt is bad. See chapter 2.



EQUIPMENT PRESETS

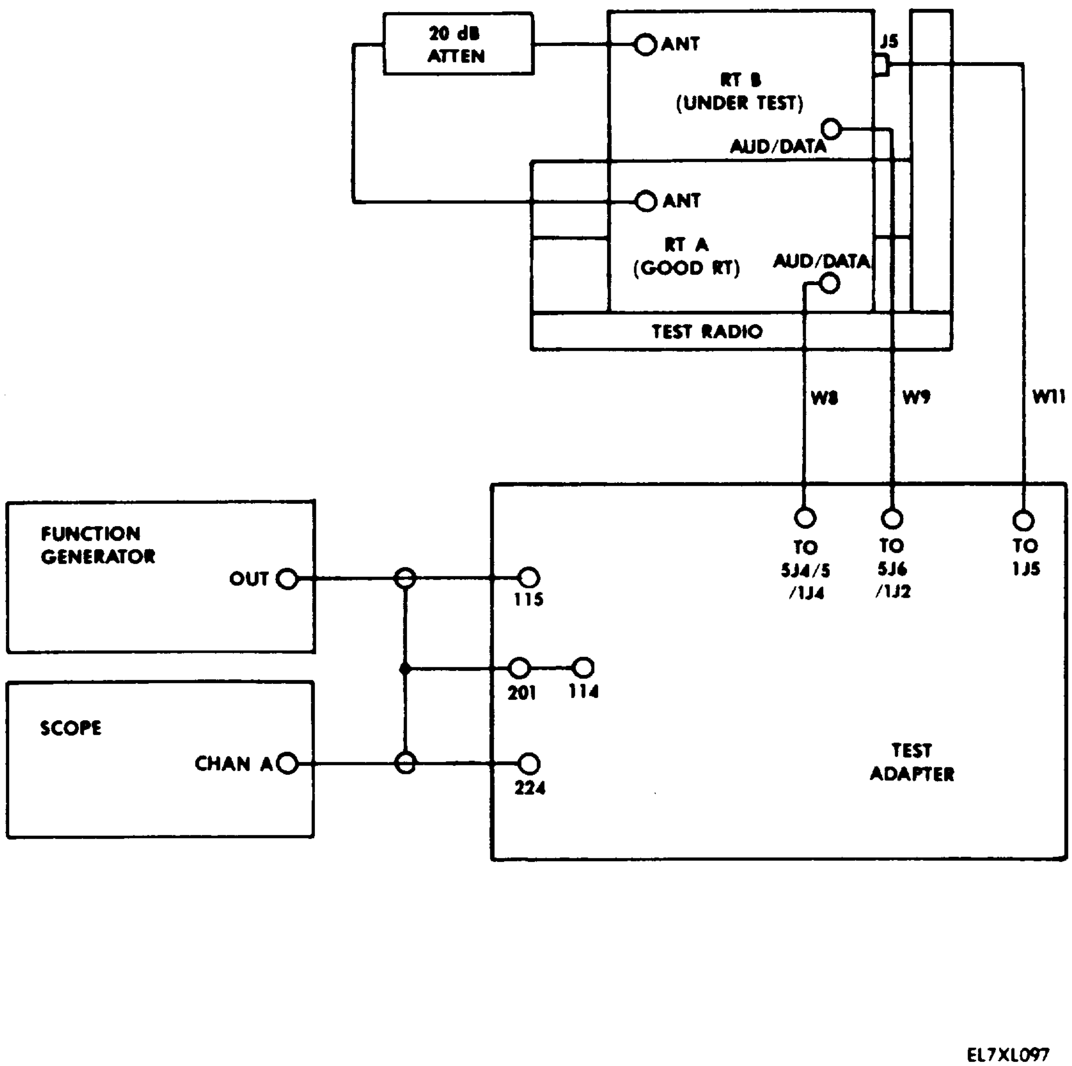
RT A AND B:
- RF: LO
- FCTN: SQ ON
- DATA: OFF

MODE: SC
CHAN: 1
ALL TEST FREQUENCIES LOADED

FUNCTION GENERATOR:
- FREQ: 1000 Hz (900 TO 1100 Hz)
- LEVEL: 140 mV P-P (130 TO 150 mV P-P)
- FUNCTION: SINE

TEST RADIO:
- CB1: ON

Figure 9-8. Transmit SC/FH Audio Test Set-Up Diagram



EQUIPMENT PRESETS

RT AND AND B:
RF: LO
FCTN: SQ ON
MODE: SC

DATA: OFF
CHAN: 1

FUNCTION GENERATOR:
FREQ: 1000 Hz (900 TO 1100)
LEVEL: 140 mV P-P (130 TO 150 mV P-P)
FUNCTION: SINE

TEST RADIO:
CB1: ON

Figure 9-9. Receive SC Audio Test Setup Diagram

9-20. OPERATIONAL CHECKS. Continued

Step 3. XMT DIGITAL DATA CHECK

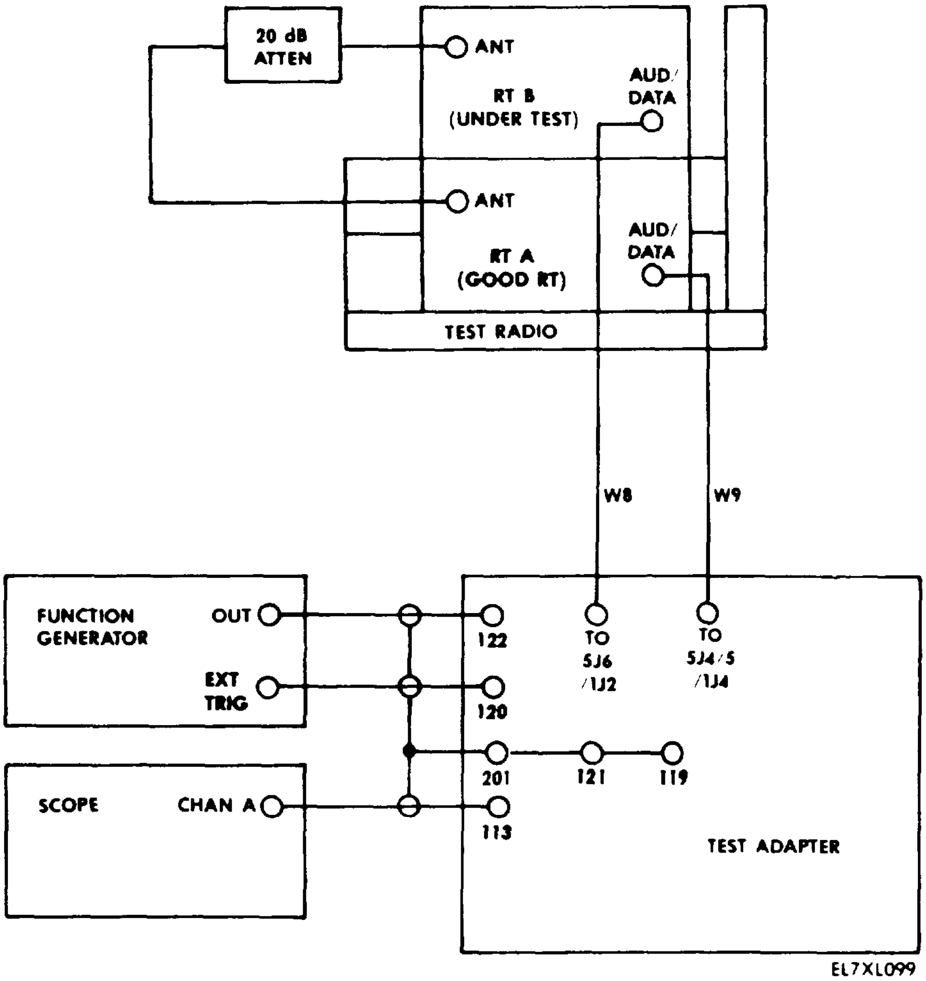
Action	Response
a. Connect equipment as shown in figure 9-10.	a. Scope chan A displays 9.5 to 10.5 V p-p, 2390 to 2410 Hz square wave. If not, rt is bad. See chapter 2.

Step 4. RCV SC 4.8K CHECK

Action	Response
a. Connect equipment as shown in figure 9-11.	a. Scope chan A displays 9.5 to 10.5 V p-p, 2390 to 2410 Hz square wave. If not, rt is bad. See chapter 2.
b. Connect scope chan A probe to TP226.	b. Scope chan A displays 9.5 to 10.5 V p-p, 4790 to 4810 Hz square wave. If not, rt is bad. See chapter 2.

Step 5. TRANSMIT AD2 CHECK

Action	Response
a. Connect equipment as shown in figure 9-12.	a. No response.
b. Connect jumper cable from TP114 to TP201.	b. Scope chan A displays 1.5 to 2.5 V p-p, 2390 to 2410 Hz sine wave (distorted). If not, rt is bad. See chapter 2.



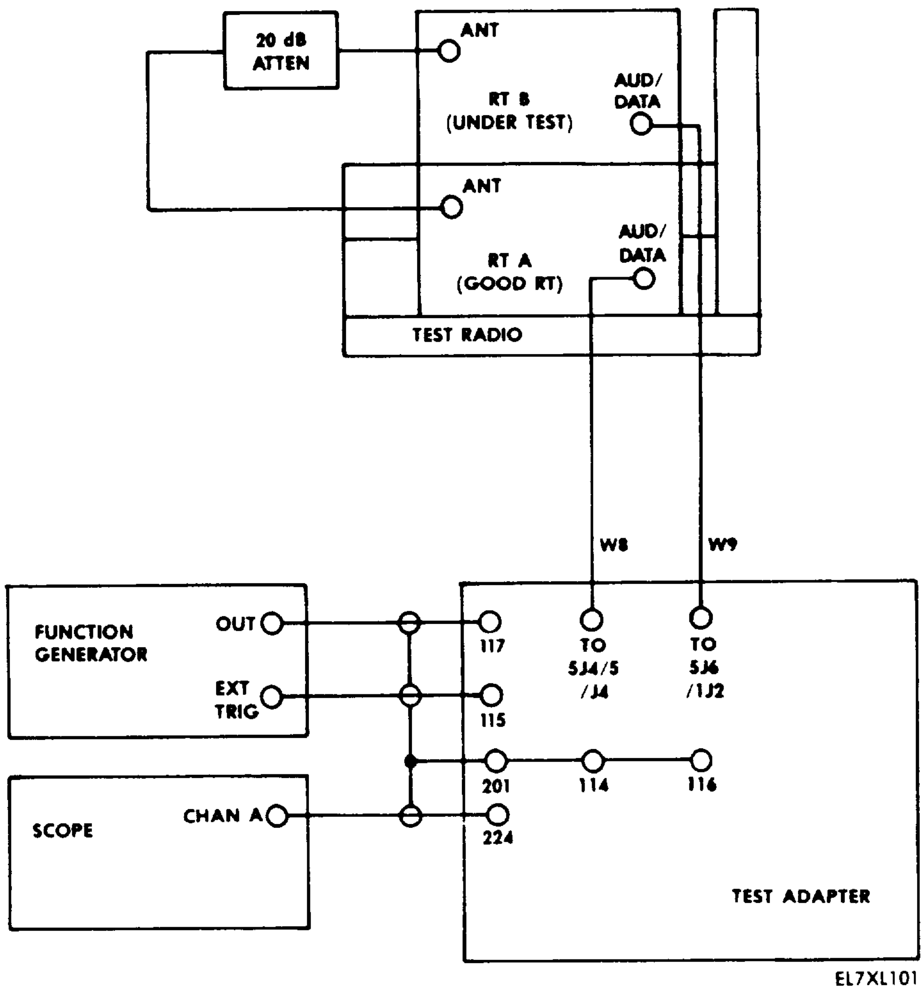
EQUIPMENT PRESETS

RT A AND B:
- RF: LO
- FCTN: SQ ON
- MODE: SC
- DATA: 4.8K
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 2400 Hz (2390 TO 2410 Hz)
- LEVEL: 10 V P-P (9 TO 11 V P-P)
- FUNCTION: SQUARE
- TRIGGER: EXT TRIG
- TRIG LEVEL: MID-RANGE

TEST RADIO:
- CB1: ON

Figure 9-10. Transmit Digital Data lest Setup Diagram



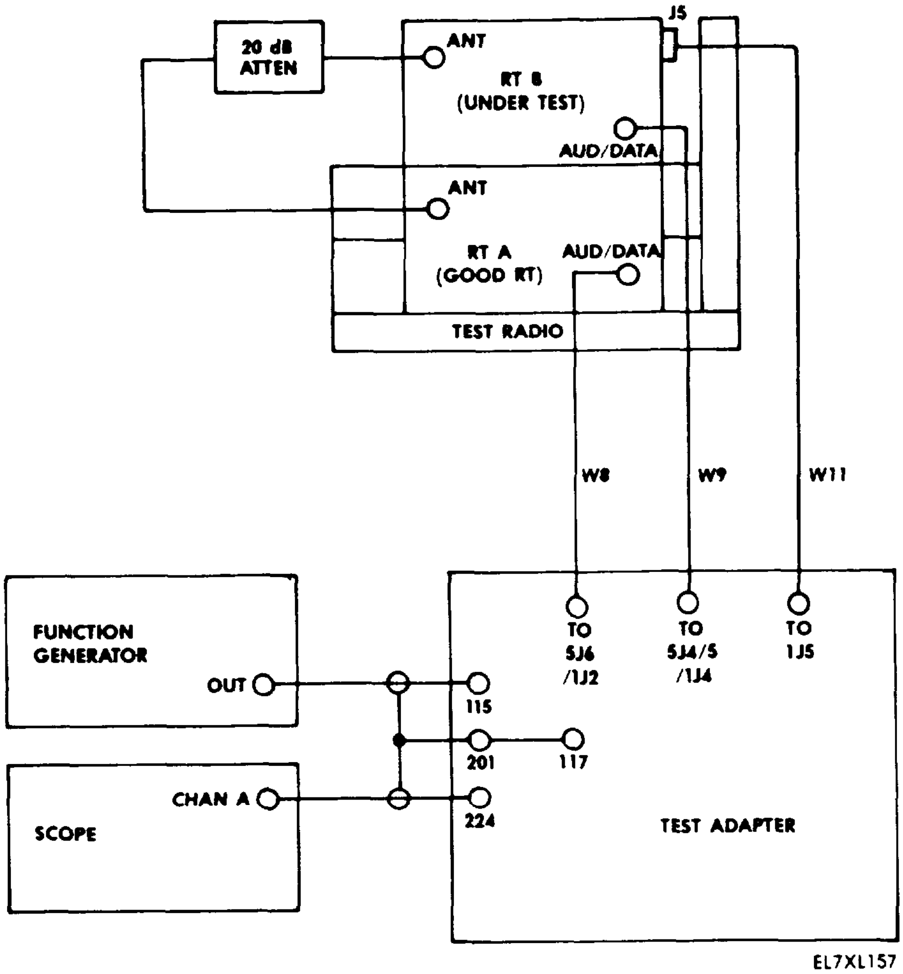
EQUIPMENT PRESETS

RT A AND B:
- RF: LO
- FCTN: SQ ON
- MODE: SC
- DATA: 4.8K
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 2400 Hz (2390 TO 2410 Hz)
- LEVEL: 10 V P-P (9 TO 11 V P-P)
- FUNCTION: SQUARE
- TRIGGER: EXT TRIG
- TRIG LEVEL: MID-RANGE

TEST RADIO:
- CB1: ON

Figure 9-11. Receive SC 4.8K Test Setup Diagram



EQUIPMENT PRESETS

RT A AND B:
- RF: LO
- MODE: SC
- FCTN: SQ ON
- DATA: AD2
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 2400 Hz (2390 TO 2410 Hz)
- LEVEL: 350 mV P-P (340 TO 360 mV P-P)
- FUNCTION: SINE

TEST RADIO:
- CB1: ON

Figure 9-12. Transmit AD2 Test Setup Diagram

9-20. OPERATIONAL CHECKS. Continued

Step 6. RECEIVE AD2 CHECK

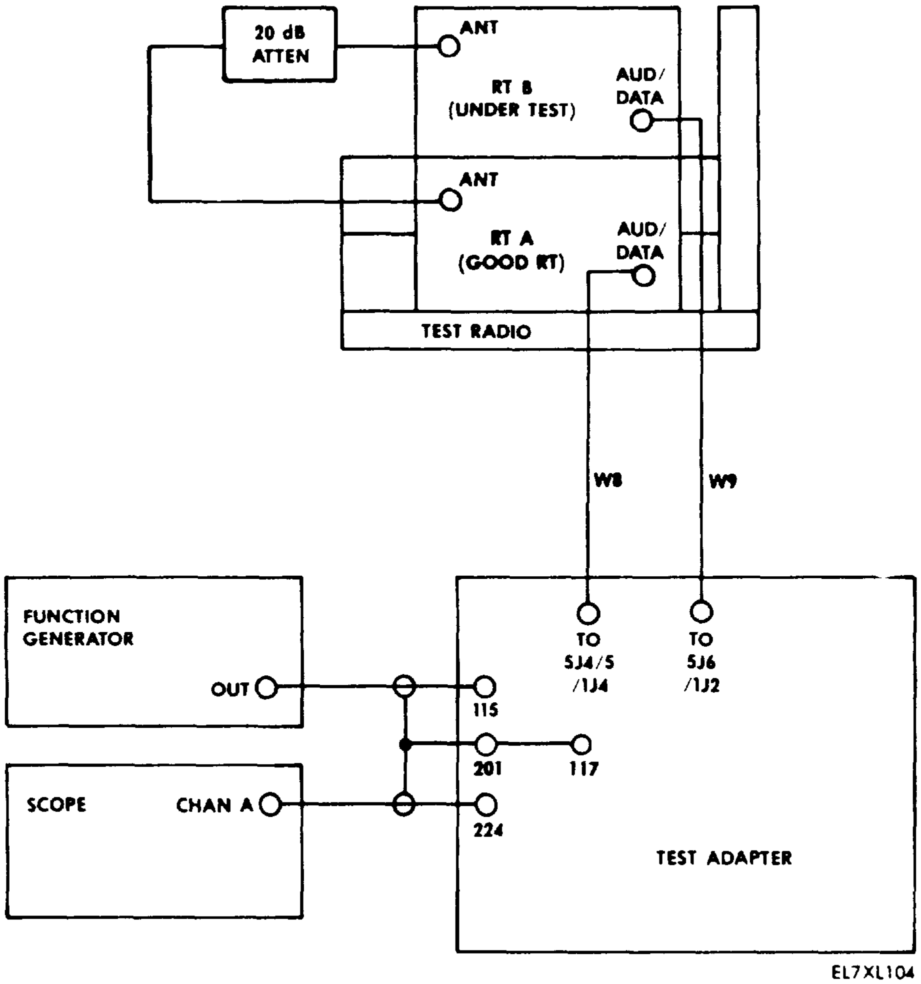
Action	Response
a. Connect equipment as shown in figure 9-13.	a. No response.
b. Connect jumper cable from TP114 to TP201.	b. Scope chan A displays 1.5 to 2.5 V p-p, 2390 to 2410 Hz sine wave (distorted). If not, rt is bad. See chapter 2.
c. Remove jumper cable from TP114.	c. No response.

Step 7. RECEIVE FH AUDIO CHECK

Action	Response
a. Connect ECCM fill device to rt AUD/FILL connector. Load rt with fill data.	a. Rt responds correctly. If not, rt is bad. See chapter 2.
b. Load both rt with the same time-of-day.	b. Rt under test responds correctly. If not, rt is bad. See chapter 2.
c. Connect equipment as shown in figuree 9-14.	c. Scope chan A displays greater than 15 V p-p, 900 to 1100 Hz sine wave with some distortion. If not, rt is bad. See chapter 2.

Step 8. TRANSMIT FH AUDIO CHECK

Action	Response
a. Connect equipment as shown in figure 9-8. Rt A and B: MODE: FH	a. Scope chan A displays greater than 15 V p-p, 900 to 1100 Hz sine wave (distorted). If not, rt is bad. See chapter 2.



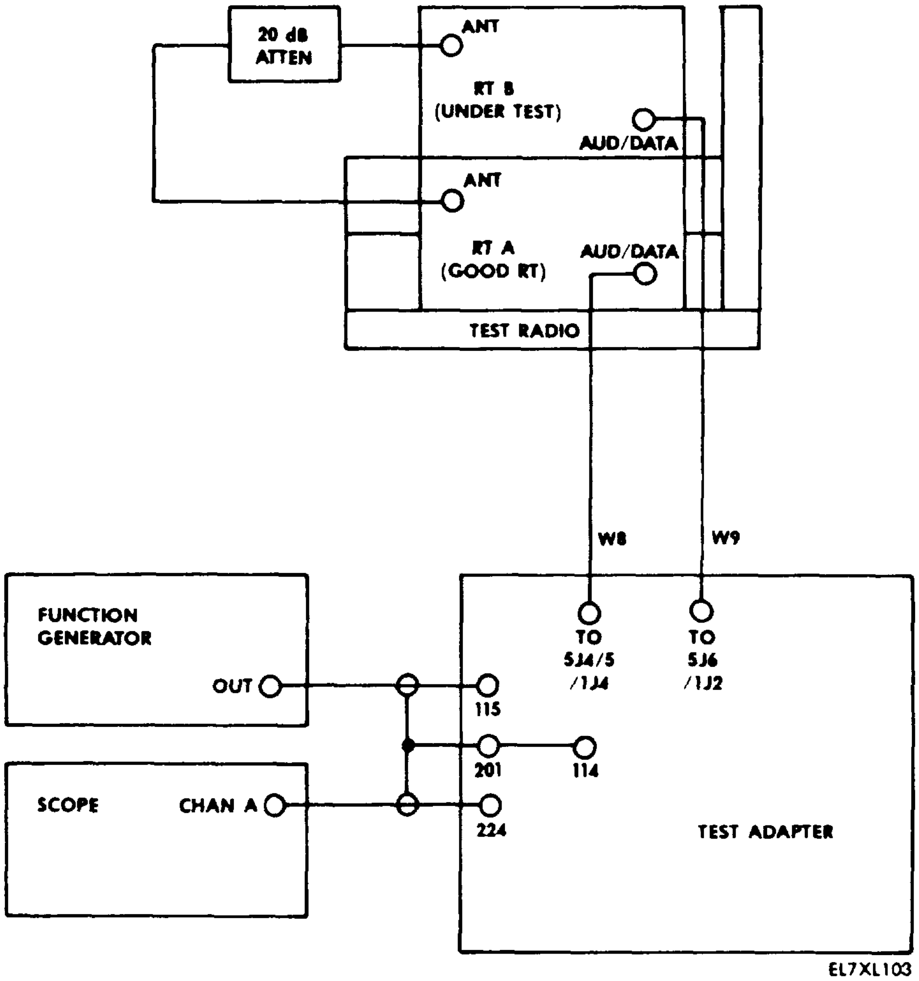
EQUIPMENT PRESETS

RT A AND B:
- RF: LO
- MODE: SC
- FCTN: SQ ON
- DATA: AD2
- CHAN: 1

FUNCTION GENERATOR:
- FREQ: 2400 Hz (2390 TO 2410 Hz)
- LEVEL: 350 mV P-P (340 TO 360 mV P-P)
- FUNCTION: SINE

TEST RADIO:
- CB1: ON

Figure 9-13. Receive AD2 Test Setup Diagram



EQUIPMENT PRESETS

RT A AND B:
- RF: LO
- MODE: FH
- FCTN: SQ ON
- DATA: OFF
- CHAN: CHANNEL WITH HOPSETS LOADED

FUNCTION GENERATOR:
- FREQ: 1000 Hz (900 TO 1100 Hz)
- LEVEL: 140 mV P-P (130 TO 150 mV P-P)
- FUNCTION: SINE

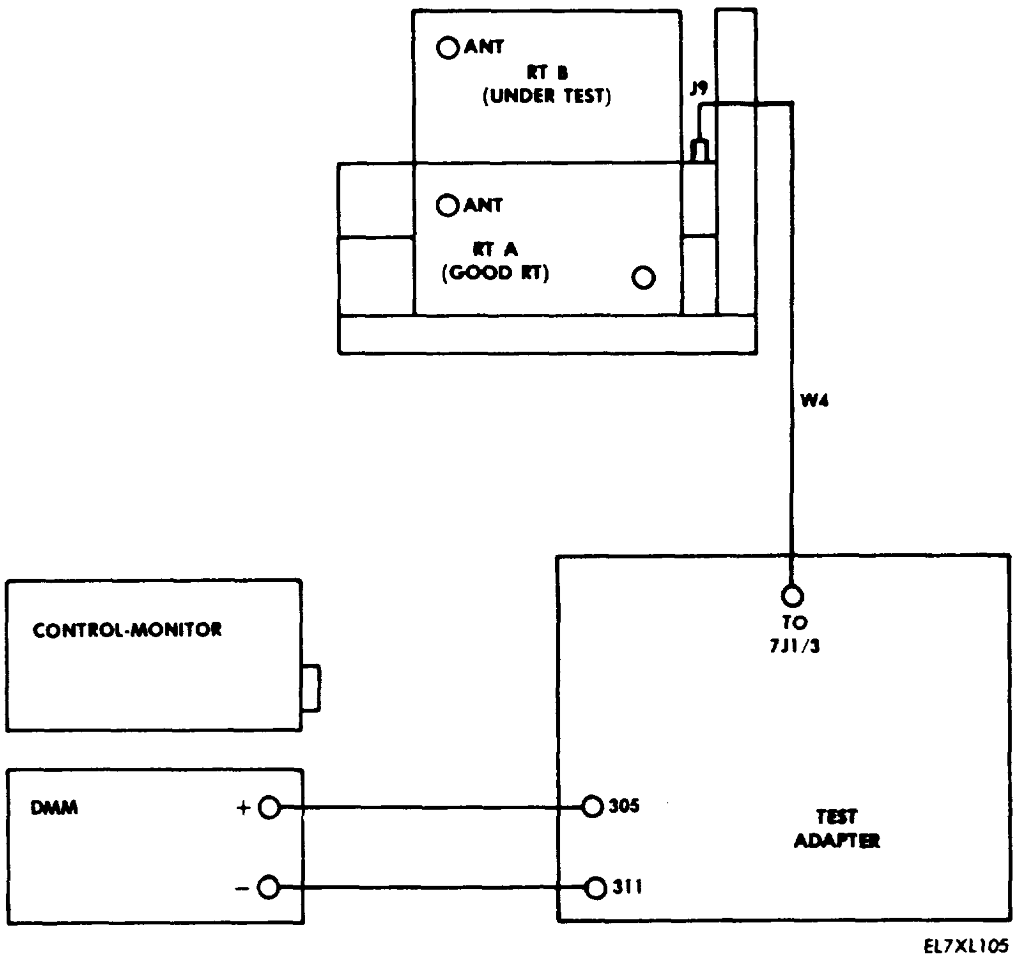
TEST RADIO:
- CB1: ON

Figure 9-14. Receive FH Audio Test Sot-up Diagram

9-20. OPERATIONAL CHECKS. Continued

Step 9. REMOTE OPERATION CHECK

Action	Response
a. Connect equipment as shown in figure 9-15.	a. DMM reading is 25 to 29 V dc. If not, mounting adapter is bad. See chapter 3.
b. Set CB1: OFF Connect DMM (+) probe to TP301. Connect DMM (-) probe to E2-A.	b. DMM reading is less than 1 Ω. If not, mounting adapter is bad. See chapter 3.
c. Connect DMM(+) probe to TP302. Connect DMM(-) probe to E1 -A.	c. DMM reading is less than 1 Ω. If not, mounting adapter is bad. See chapter 3.
d. Connect DMM(+) probe to TP303. Connect DMM(-) probe to E1-B.	d. DMM reading is less than 1 Ω. If not, mounting adapter is bad. See chapter 3.
e. Connect DMM(+) to TP304. Connect DMM(-) to E2-B.	e. DMM reading is less than 1 Ω. If not, mounting adapter is bad. See chapter 3.
NOTE Steps f through i require a good control-monitor. If one is not available, these steps are optional and may be skipped.	
f. Disconnect cable W4 from test adapter. Connect to connector J1 of control-monitor. CB1: ON	f. No response.
g. Move INIT to UP and release.	g. Rt display reads “87975”. If not, go to chart 8.
h. CB1: OFF Move rt under test to the lower slot of the mounting adapter. Set control-monitor; RADIO: 1 CB1: ON	h. No response.
i. Move INIT to UP and release.	i. Rt display reads “87975”. If not, mounting adapter is bad. See chapter 3.
j. Operational check is complete.	



EQUIPMENT PRESETS

RT A AND B:
- RF: LO
- MODE: SC
- FCTN: REM
- DATA: OFF
- CHAN: MAN

TEST RADIO:
- CB1 : ON
- RT A FCTN: OFF

CONTROL MONITOR
- RADIO: 2
- FCTN: CHAN
- DIM: FULL CW
- CONTROL DISPLAY SHOWS: M (WHEN CONNECTED)

Figure 9-15. Remote Operation Test Setup Diagram

9-21. REPAIR INSTRUCTIONS.

The following paragraphs are the replacement instructions for the interconnecting device components. Refer to Chapter 2 for the rt instructions. Refer to Chapter 3 for the mounting adapter instructions. Refer to Chapter 6 for the mounting base instructions. Threaded screw inserts are replaced as described in the next paragraph. Table 9-1 lists the threaded screw inserts included in the maintenance group. It also identifies where they are used in the equipment. Also see TM 11-5820-890-30P.

Table 9-1. Threaded Screw inserts

EQUIPMENT	LOCATION	SCREW INSERT TYPE	SIZE	QTY
Rt Chassis	where holding battery cover attaches	MA3330-102	M3x1	2
Rt Chassis	where top cover attaches	MA3330-102	M3x1	11
Rt Chassis	where bottom cover attaches	MA3330-102	M3x1	12
Rt Chassis	where the handle assembly attaches	MA3330-152	M3x1.5	4
Rt Chassis	where the ground assembly attaches	MA3330-152	M3x1.5	4
Rt Chassis	where keypad attaches to front panel	MA3330-100	M2.2x1	4
Amplifier-Adapter	where the power supply mounts	MA3330-152	M3x1.5	17
Amplifier-Adapter	where the access covers mount	MA3330-152	M3x1.5	12
Amplifier-Adapter	where the bottom access cover mounts	MA3330-152	M3x1.5	2
Amplifier-Adopter	where the power amplifier securing thumbscrew mounts	MA3330-209	M8x2	1
Amplifier-Adapter	on the bottom of the audio amplifier case where 3 screws of the bottom plate are secured	MA3330-152	M3x1.5	3
Amplifier-Adapter	on the bottom of the CB1 case where 2 screws of the bottom plate are attached	MA3330-152	M3x1.5	2
Amplifier-Adapter	where the audio amplifier access cover mounts	MA3330-152	M3x1.5	15
Control-Monitor	where rear cover mounts	MA3330-154	M4x1.5	6
Control-Monitor	where front panel mounts	MA3330-154	M4x1.5	6

9-22. THREADED INSERT REPLACEMENT PROCEDURE.

ITEM	ACTION	REMARK5
REMOVAL		
a. Threaded insert extractor (1)	Refer to figure 9-16. Place in hole. Tap extractor to seat in insert. Maintain steady pressure on extractor and unscrew insert. Remove insert from hole.	For recessed M3x1 inserts, use tool 1227-02. For all others, use tool 1227-6, or 1227-02 depending on the insert size.

9-22. THREADED INSERT REPLACEMENT PROCEDURE. Continued

ITEM	ACTION	REMARKS
b. Thread cleaning top (2)	Select proper size tap. insert and secure in brace (3). Start carefully in hole. Screw tap to bottom of hole. Unscrew top.	
INSTALLATION		
C. Prewinder (4)and insert (5)	Loosen stop collar (6) with Alien wrench. Extend threaded shaft beyond end of prewinder 1 thread longer than insert. Move stop collar to top of tool body and tighten. Retract threaded shaft. Place insert in prewinder with tang end toward prewinder tip. Rotate shaft until insert projects beyond the tip one full turn. Place tip in hole. Screw insert into hole until stop collar touches the tool body. Retract prewinder.	If insert is used with a captive screw, set prewinder with an extra 2 to 3 mm length.
d. Tang breakoff tool (7)	Place on tong. Break off tang by pressing down on tool. Remove tang breakoff tool. Remove broken tang from hole.	

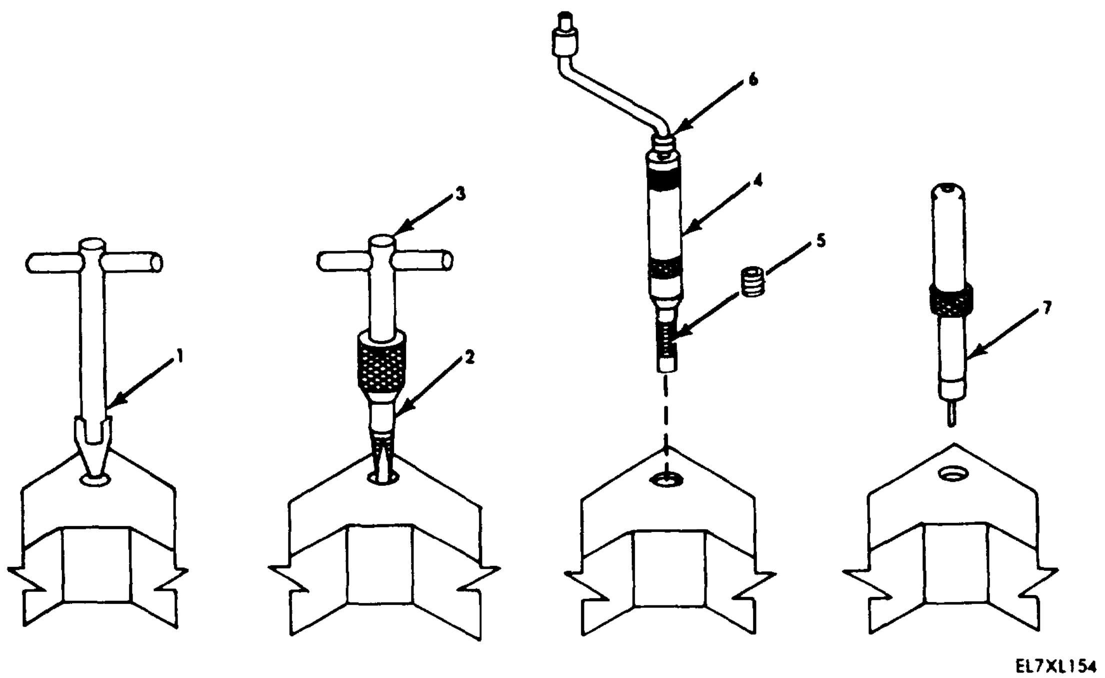


Figure 9-16. Threaded Screw insert Replacement.

9-23. TEST ADAPTER REPAIR INSTRUCTIONS.

Tools:	Expendable Supplies:
Tool kit TK-105/G	Solder

ITEM	ACTION	REMARKS
a. Chassis (17).	Loosen and remove 10 screws and lockwashers that secure chassis to chest lid. See figure 9-17. Remove from lid.	
CONNECTOR 5P1 REPLACEMENT		
b. Wiring harness (8).	Unsolder wires connected to 5P1 (5).	
c. Four screws (7) and lockwashers (6) and bock plate (2).	Loosen and remove screws, lockwashers, and back plate. Remove connector.	
d. Connector (5).	Set in place and secure with four screws and lockwashers and back plate removed in Step c.	
e. Wiring harness.	Solder to connector. Use FO-18 as a guide.	
CONNECTOR 1P1 (1), 5J7/8 (26) 5J2/3 (25), 5J4/5/1J4 (24), 5J6/1J2 (23), 5J10 (22), 7J1/3 (21), 5J9/7J2 (20), OR 5J1 (19) REPLACEMENT		
f. Wiring harness.	Unsolder wires connected to connector.	
g. Connector and nut.	Loosen nut securing connector to chassis. Remove connector.	
h. Connector and nut.	Set connector in place and secure with nut.	
i. Wiring harness.	Solder to connector. Use FO-18 as a guide.	
CONNECTOR 1J5 (18) REPLACEMENT		
j. Wiring harness.	Unsolder wires connected to connector.	
k. Four screws (16), lockwashers (15), and washers (14).	Loosen and remove. Remove connector.	
l. Connector (18).	Set in place and secure with four screws, lockwashers, and washers removed in step k.	
m. Wiring harness.	Solder to connector. Use FO-18 as a guide.	

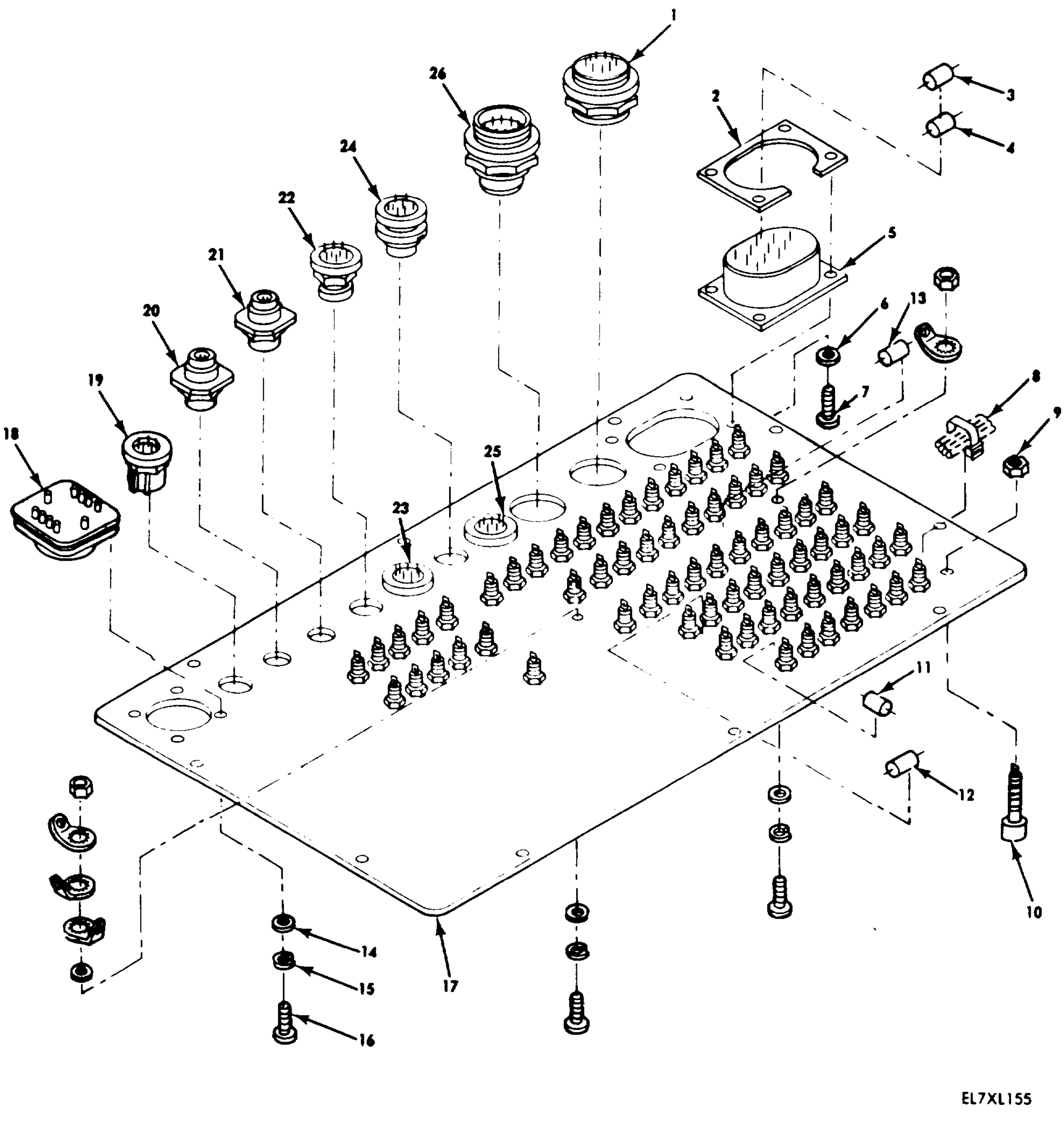


Figure 9-17. Test Adapter Front Panel Repair

9-23. TEST ADAPTER REPAIR INSTRUCTIONS. Continued

ITEM	ACTION	REMARKS
TIP JACK REPLACEMENT		
n. Wire.	Unsolder wire connected to tip jack (10).	
o. Tip jack (10) and nut (9).	Loosen and remove nut and bad tip jack.	
p. Tip jack and nut (9).	install good tip jack and tighten nut.	
q. Wire.	Solder wire removed in Step n to tip jack.	
RESISTOR REPLACEMENT		
r. Resistor (3. 4, 11, 12 or 13).	Unsolder at both ends and remove.	
s. Resistor.	Install and solder.	

9-24. CABLE REPAIR INSTRUCTIONS.

Tools:

Tool kit TK-105/G

Expendable Supplies:

Solder

ITEM	ACTION	REMARKS
a. Connector.	Disassemble.	
b. Cable.	Use DMM to fault isolate to cable or connector. See figure 9-2.	
CONNECTOR REPLACEMENT		
c. Connector.	Unsolder from cable. Solder new connector to cable.	
CABLE REPLACEMENT		
d. Connector.	Unsolder from old cable. Solder to new cable.	
e. Connector.	Assemble.	

Section VII. PREPARATION FOR STORAGE OR SHIPMENT

9-25. INTERCONNECTING DEVICE J-4404/GRC.

Prepare the interconnecting device for storage or shipment as follows:

a. Place all cables and adapters that are part of electronic equipment parts kit inside parts kit box. Secure lid to box. Place box inside chest.

b. Place all tools that are part of tool kit inside tool kit box. Close tool kit. Place tool kit inside chest.

c. Place all test cables inside chest.

d. Close and secure chest inner lid.

e. Attach and secure test adapter to chest.

CHAPTER 10

MOUNTING BASE, ELECTRICAL EQUIPMENT MT-6429/VRC MAINTENANCE INSTRUCTIONS

Section I. PRINCIPLES OF OPERATION

10-1. INTRODUCTION.

The COMSEC mount performs the following functions:

Physically supports the KY-57 COMSEC unit.

Electrically connects the KY-57 COMSEC unit to vehicular power.

10-2. ELECTRICAL FILTER ASSEMBLY.

The electrical filter assembly has three connectors as shown in figure 10-1. The power cable connects to J1. Power for a second device is available at J2.

The electrical filter assembly has no active circuitry. Filter FL1 filters the dc input power. The KY-57 plugs into J3. All connections are as shown in figure 10-1.

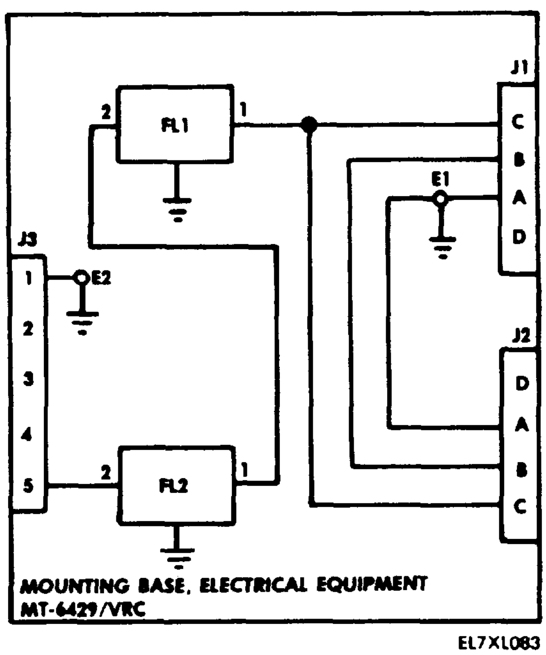


Figure 10-1. COMSEC Mount Schematic Diagram.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

10-3. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

10-4. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For the TMDE and support equipment required for I(DS), see the maintenance allocation chart. It is Appendix B in TM 11-5820-890-20-1 or -2.

10-5. REPAIR PARTS.

Repair parts are listed and illustrated in the repair parts and special tools list (TM 11-5820-890-30P) covering the I(DS) maintenance for this equipment.

Section III. TROUBLESHOOTING

10-6. TROUBLESHOOTING.

When a COMSEC mount is received from unit maintenance, inspect it for damage. Repair any damage following the instructions in section IV. If the COMSEC mount has an electrical problem, use the DMM and figure 10-1 to verify the fault. If there is a short or open circuit in the electrical filter assembly, repair it. Follow the instructions in section IV.

Section IV. MAINTENANCE PROCEDURES

10-7. INTRODUCTION.

Maintenance of the COMSEC mount consists of replacing defective parts. The electrical filter assembly can be removed by unit maintenance. Check it as described in section III. The repair procedure is in paragraph 10-9. Repair of the COMSEC mount is covered in paragraph 10-8. Inspect all of the parts and replace any that are defective.

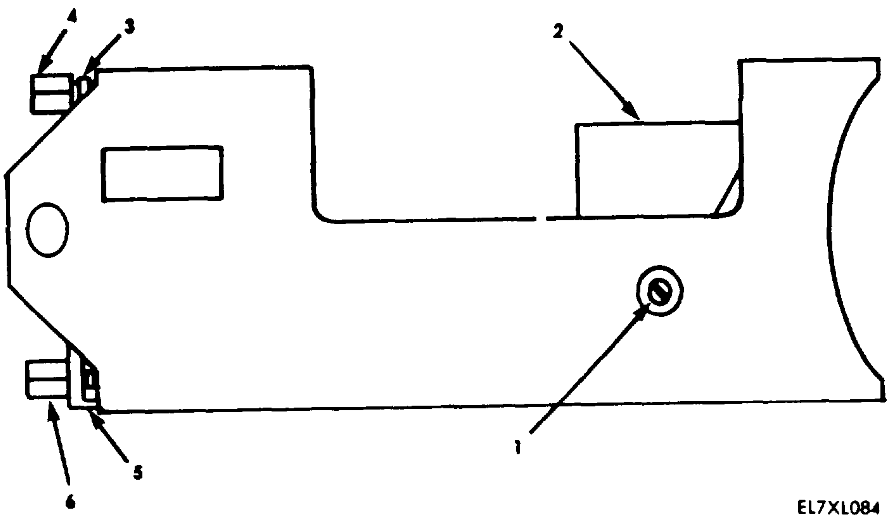
10-8. COMSEC MOUNT REPAIR PROCEDURE.

Tools:

Tool Kit TK-105/G

ITEM	ACTION	REMARKS
DISASSEMBLY		
a. Two screws and washers (1).	Loosen and remove two screws and two washers.	See figure 10-2 for parts identification.
b. Electrical filter assembly (2).	Pull assembly free from COMSEC mount.	
c. Clamp plate (3).	Fully loosen and remove two thumbscrews (4).	
d. Rim clenching clamp (5).	Fully loosen and remove thumbscrew (6).	

10-8. COMSEC MOUNT REPAIR PROCEDURE. Continued



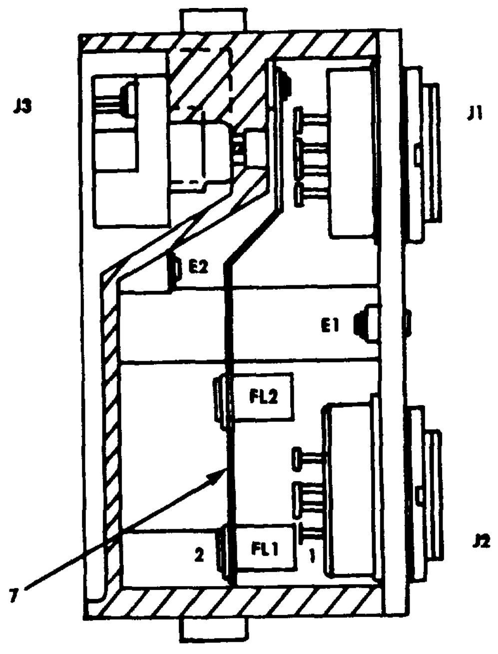


Figure 10-2. COMSEC Mount Component Locations.

10-8. COMSEC MOUNT REPAIR PROCEDURE. Continued

ITEM	ACTION	REMARKS
ASSEMBLY		
a. COMSEC mount.	Perform steps a through e in reverse. Install items removed. Tighten all screws to required torque limits.	

10-9. ELECTRICAL FILTER ASSEMBLY REPAIR PROCEDURE.

Tools:
- Tool kit TK-105/G
- Torque wrench
- Torque adopter

Expendable supplies:
- Solder

ITEM	ACTION	REMARKS
DISASSEMBLY		
a. Six captive screws.	Fully loosen. Lift cover off of case.	See figure 10-2 for parts identification.
b. Electrical connectors J1 and J2.	Unsolder wires. Loosen and remove locking rings on connectors. Remove from cover.	
c. Filter support plate (7).	Remove four screws and lift free of the case.	
d. Electrical connector J3.	Remove two screws and lift J3 free of case. Unsolder the wire attached to post 5.	
ASSEMBLY		
a. HCP Electrical filter assembly.	Perform steps a through d in reverse. Install all items removed. Tighten all screws. Torque to 12 in-lb.	Before and after soldering, clean wires and leads with Q tips and alcohol.

Section V. PREPARATION FOR STORAGE OR SHIPMENT

10-10. GENERAL INFORMATION.

Pack the COMSEC mount in an approved shipping container.

APPENDIX A
REFERENCES

(To be supplied by CECOM.)

APPENDIX B
TORQUE REQUIREMENTS

B-1. GENERAL INFORMATION.

Proper tightening of all threaded fasteners is on essential part of equipment maintenance. Not tightening enough can allow:

- Components to come loose.
- Water, dirt, or other substance to enter unit.
- Unwanted rf energy to enter and possibly damage unit.
- Rf energy to escape unit and possibly compromise security.

Trying to tighten a screw or nut too much con strip threads. Do not return equipments for use that have stripped or missing screws or nuts.

B-2. TORQUE REQUIREMENTS.

Unless stated otherwise in an assembly procedure, all screws and nuts should be torqued as follows:

Metric Screw (Thread) Size	Torque (in-lb)
M2.2 x 0.45	6
M3.0 x 0.50	12
M4.0 x 0.70	20

Metric Nut Size	Torque (in-lb)
M8.0 x 1.25	30

English (Thread Diameter)	Torque (in-lb)
1/4	12
3/8	20
1/2	30
5/8	50
3/4	60
7/8	70
1-1/16	80
1-1/8	90
1-1/4	100

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS FOR MAINTENANCE GROUP OA-9263/GRC

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists components of end item and basic issue items for Maintenance Group OA-9263/GRC to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End item and Basic Issue Items Lists are divided into the following sections:

a. Section II. Components of End Item List for Maintenance Group OA-9263/GRC. This listing is for informational purposes only and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. The list is divided into sublistings for each maintenance group. Illustrations are furnished to assist you in identifying the items.

b. Section III. Components of End Item List for Interconnecting Device J-4404/GRC. Same as a for Interconnecting Device J-4404/GRC.

c. Section IV. Components of End item list for Tool Kit, Electronic Equipment A3013828-1. Same as a for Tool Kit, Electronic Equipment M3013828-1.

d. Section V. Components of End Item list for Parts Kit, Electronic Equipment A3013827-1. Same as a for Parts Kit, Electronic Equipment A3013827-1.

e. Section VI. Basic Issue Items. These are the minimum essential items required to place the maintenance group in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the maintenance group during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

The following explains the columns found in the tabular listings.

a. Column (1). Illustration Number (Illus No.). This column indicates the number of the illustration showing the item.

b. Column (2), National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3), Description. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses), followed by the part number.

d. Column (4), Unit of Measure (U/M). This column indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

e. Column (5), Quantity Required (Qty Reqd). This column indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM LIST FOR MAINTENANCE GROUP OA-9263/GRC

(1) Illustration Number	(2) National Stock Number	(3) Description (FSCM) and Part Number	(4) U/M	(5) Quantity Required
See figure C-1				
1	5820-01-151-9916	Radio Set AN/VRC-87	ea	1
2	5975-01-188-8873	Mounting Base, Electrical Equipment MT-6352/VRC (80063) A3013367-1	ea	1
3	5820-01-200-9688	Interconnecting Device J-4404/GRC (80063) A3013825-1	ea	1
4	5895-01-188-8816	Fill Device, Electronic Counter-Countermeasures MX-10579/VRC (80063) A3013375-1	ea	1

Section III. COMPONENTS OF END ITEM LIST FOR INTERCONNECTING DEVICE J-4404/GRC

(1) Illustration Number	National Stock Number	(3) Description (FSCM) and Part Number	(4) U/M	(5) Quantity Required
See figure C-2				
1		Manual, Technical, 11-5820-890-30	ea	1
2		Manual, Technical, 11-5820-890-30P	ea	1
3	6625-01-204-5147	Adapter, Test (80063) A3013826-1	ea	1
4		Tablerunner, Static Control (80063) A3014484-1	ea	1
5		Strap, Wrist, Grounding, Small (80063) A3013062-1	ea	1
6		Strop, Wrist, Grounding, large (80063) A3013062-2	ea	1
7		Chest, Tool and Equipment Kit (80063) A3013163-1	ea	1
8		Parts Kit, Electronic Equipment (80063) A3013827-1	ea	1
9		Tool Kit (80063) A3013828-1	ea	1
10	5965-00-043-3463	Handset H-250 A/U (80058) H-250 A/U	ea	2

Section III. COMPONENTS OF END ITEM LIST FOR INTERCONNECTING DEVICE J-4404/GRC Continued

Illustration Number	National Stock Number	(3) Description (FSCM) and Part Number	(4) U/M	(5) Quantity Required
11	5995-00-889-1253	Cable Assy, Power, Electrical CX-4720/VRC (12 FT) (80058) CX-4720/VRC-12 FT	ea	1
12	5995-01-202-8733	Cable Assy, Special Purpose, Electrical (80063) A3013892-1, (W6)	ea	1
13	6995-01-202-8729	Cable Assy, Special Purpose, Electrical (80063) A3013889-1, (W2)	ea	1
14	5995-01-202-8735	Cable Assy, Special Purpose, Electrical (80063) A3013894-1, (W8)	ea	1
15	5995-01-202-8736	Cable Assy, Special Purpose, Electrical (80063) A3013894-2. (W9)	ea	1
16	5995-01-202-8737	Cable Assy. Special Purpose, Electrical (80063) A3013894-3, (W10)	ea	1
17	5995-01-202-8738	Cable Assy. Special Purpose, Electrical (80063) A3013895-1, (W11)	ea	1
18	5995-01-202-8730	Cable Assy, Special Purpose, Electrical (80063) A3013890-1, (W3)	ea	1
19	5995-01-197-4357	Cable Assy, RF (80063) A3013902-3	ea	4
20	5995-01-202-8731	Cable Assy, Special Purpose, Electrical (80063) A3013891-1 (W4)	ea	1
21	5995-01-202-8732	Cable Assy, Special Purpose, Electrical (80063) A3013891-2, (W5)	ea	1
22	5995-01-204-0053	Cable Assy, Special Purpose, Electrical (80063) A3013888-1, (W1)	ea	1
23	5995-01-202-8734	Cable Assy, Special Purpose, Electrical (80063) A3013893-1, (W7)	ea	1
24	5995-00-823-3074	Cable Assy, Radio frequency CG-1773 B/U (9 FT) (80058) CG-1773 B/U-10 FT	ea	1

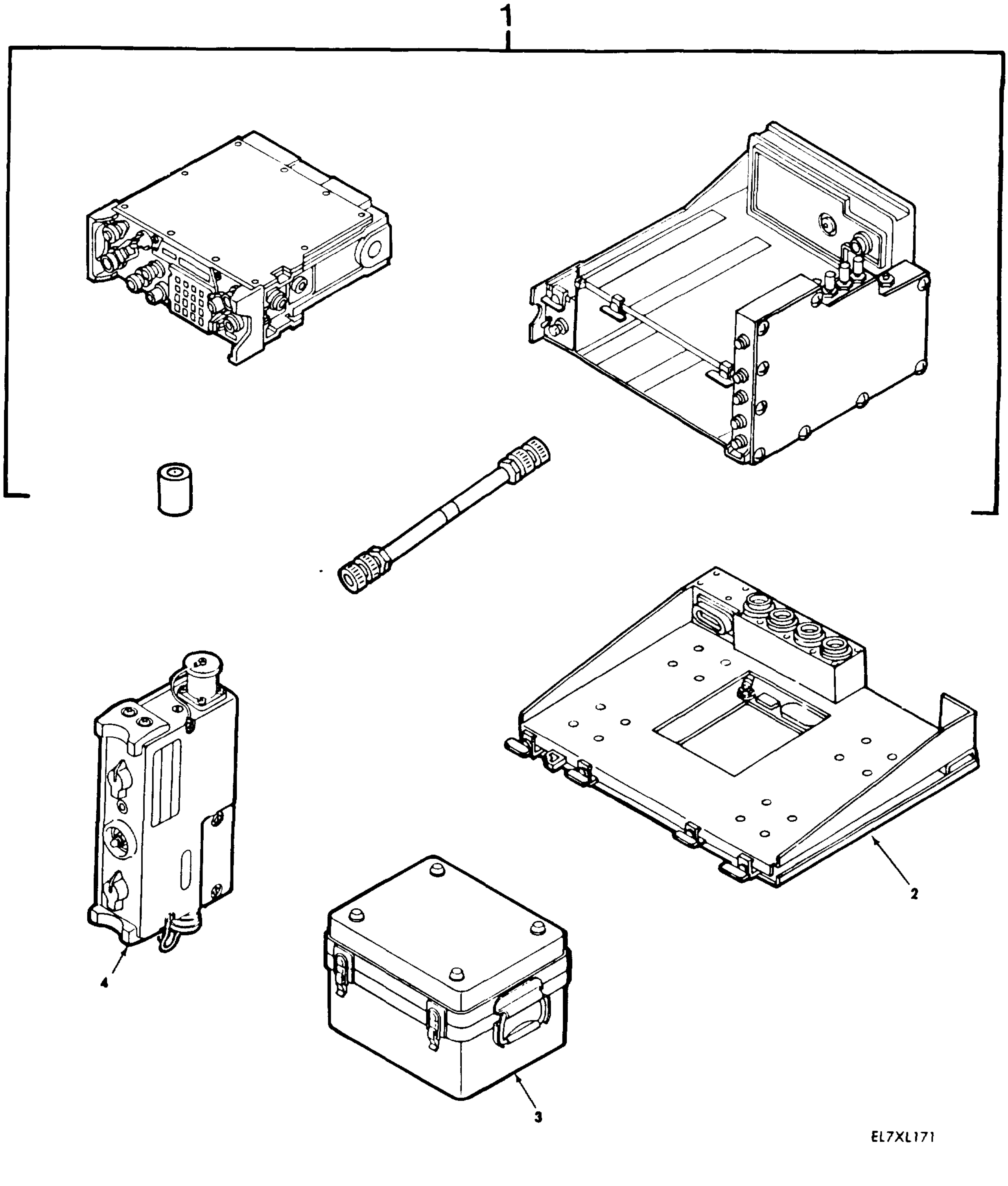


Figure C-1. Maintenance Group OA-9263/GRC

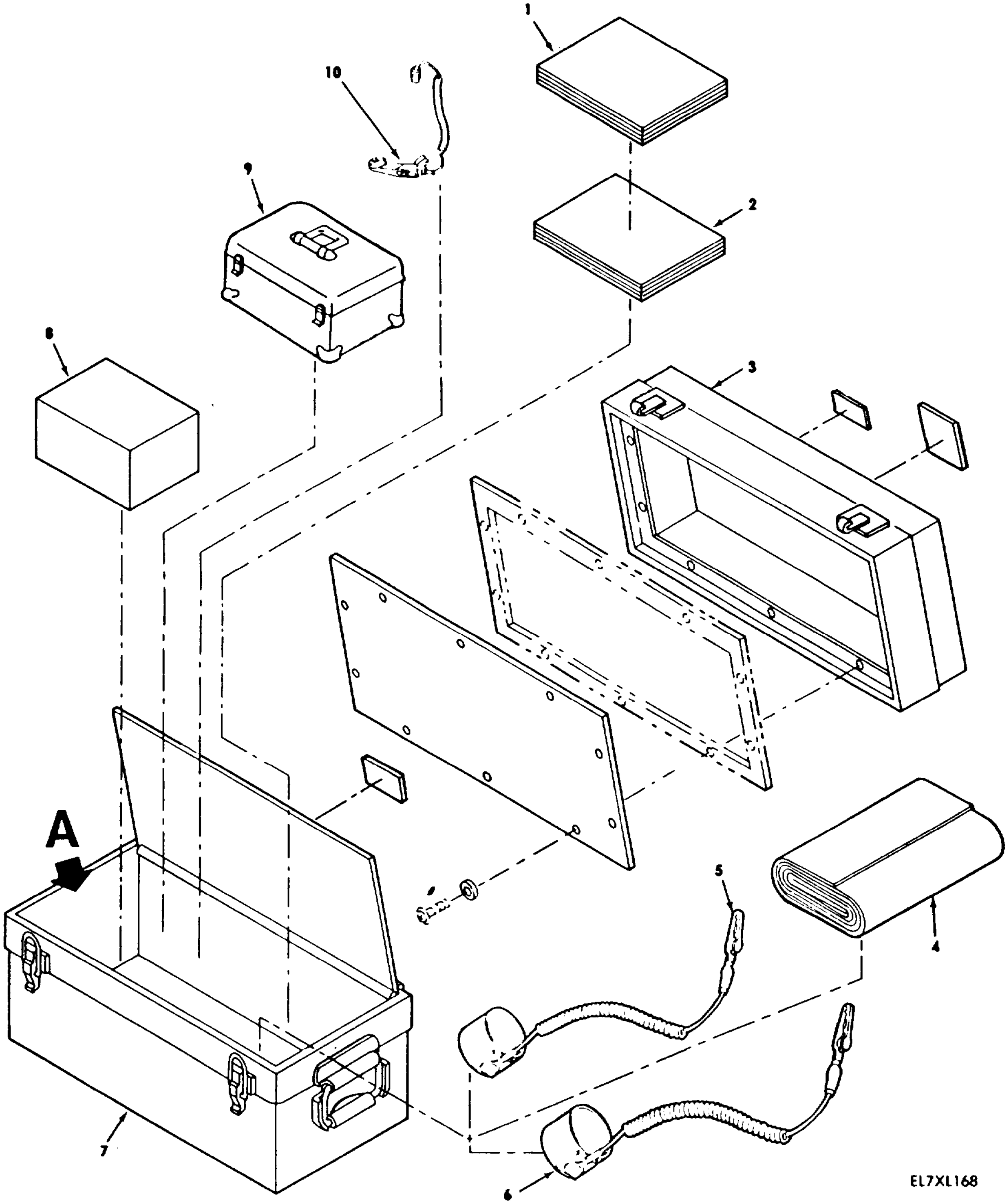


Figure C-2. Interconnecting Device J-4404/GRC (Sheet 1 of 2)

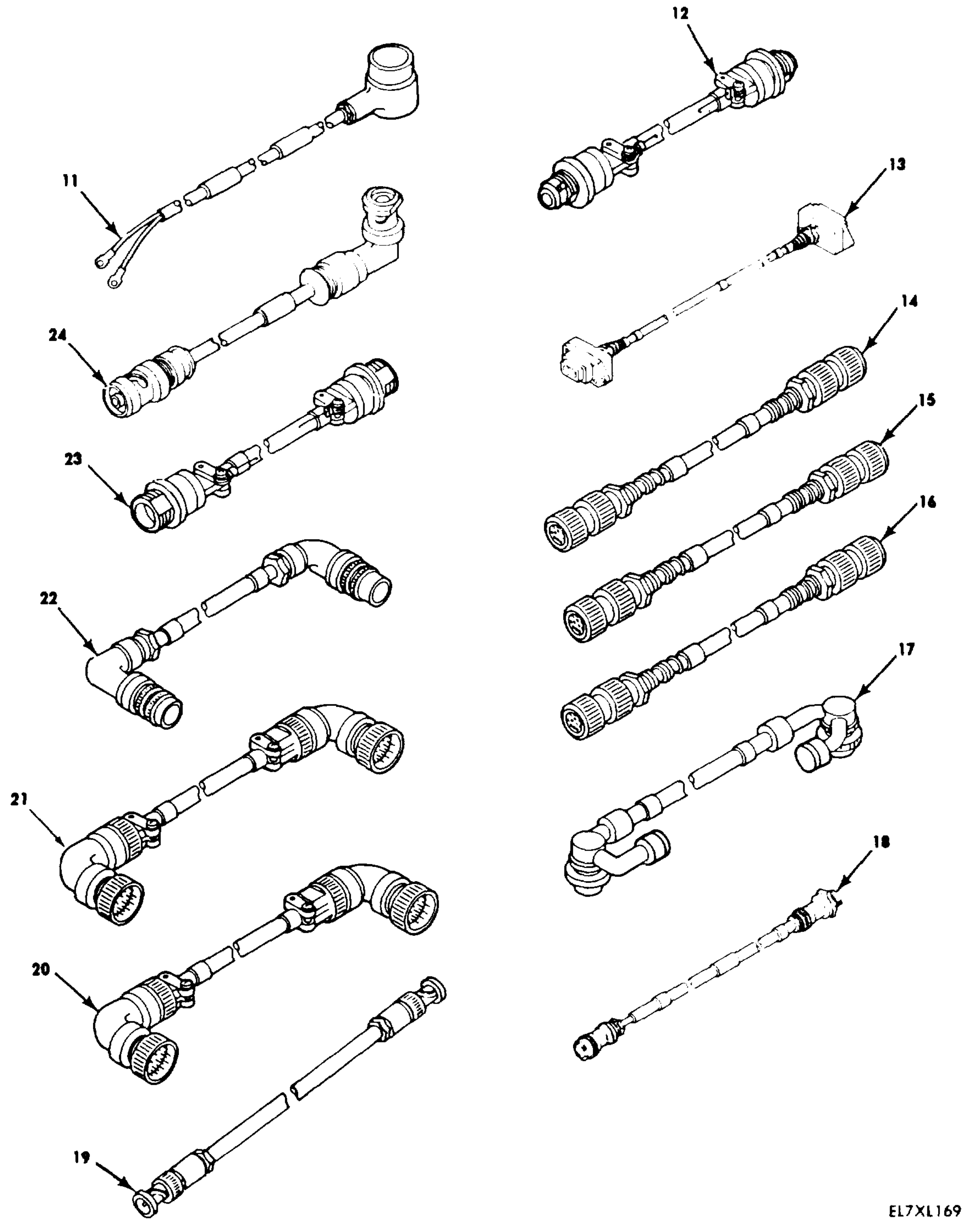


Figure C-2. Interconnecting Device J-4404/GRC (Sheet 2 of 2)

Section IV. COMPONENTS OF END ITEM LIST FOR TOOL KIT, ELECTRONIC EQUIPMENT

(1) Illustration Number	(2) National Stock Number	(3) Description (FSCM) and Port Number	(4) U/M	(5) Quantity Required
See figure C-3				
1		Tool Box, Portable (81348) GGGT558-1	ea	1
2		Tong Breakoff Tool, Screw Thread Insert - M2.2 (80063) A3018039-1	ea	1
3	5820-01-151-9916	Inserter, Screw Thread - M2.2 (80063) A3018037-1	ea	1
4		Inserter, Screw Thread Insert - M3.0 (80063) A3018037-2	ea	1
5		Inserter, Screw Thread Insert - M4.0 (80063) A3018037-3	ea	1
6		Inserter, Screw Thread Insert - M5.0 (80063) A3018037-4	ea	1
7		Inserter, Screw Thread Insert - M8.0 (80063) A3018037-5	ea	1
8		Tong Breakoff Tool, Screw Thread Insert - M8.0 (80063) A3018039-5	ea	1
9		Tong Breakoff Tool, Screw Thread insert - M5.0 (80063) A3018039-4	ea	1
10		Tong Breakoff Tool, Screw Thread Insert - M4.0 (80063) A3018039-3	ea	1
11		Tong Breakaff Tool, Screw Thread Insert - M3.0 (80063) A3018039-2	ea	1
12		Insert, Screw Thread - M2.2 x 1.0 Dia. (81343) MA3330-100	ea	25
13		Insert, Screw Thread - M3.0 x 1.0 Dia. (8 1343) MA3330-102	ea	50
14		Insert, Screw Thread - M3.0 x 1.50 Dia (81343) MA3330-152	ea	50
15		Insert, Screw Thread - M4.0 x 1.0 Dia. (81343) MA3330-104	ea	25
16		Insert, Screw Thread - M4.0 x 1.5 Dia. (81343) MA3330-154	ea	25

Section IV. COMPONENTS OF END ITEM LIST FOR TOOL KIT, ELECTRONIC EQUIPMENT Continued

(1) Illustration Number	(2) National Stock Number	(3) Description (FSCM) and Part Number	(4) U/M	(5) Quantity Required
17		Insert, Screw Thread - M5.0 x 1.0 Dia. (81343) MA3330-105	ea	25
18		Insert, Screw Thread - M8.0 x 2.0 Dia. (81343) MA3280-209	ea	25
19		Extractor, Screw Thread Insert - M5.0-M10.0 (80063) A3018038-3	ea	1
20		Extractor, Screw Thread Insert - M2.5 - 4.5 (80063) A3018038-2	ea	1
21		Extractor, Screw Thread Insert - M2.2 (80063) A3018038-1	ea	1
22		Socket, Socket Wrench 1-1/16 in. (80063) A3018045-6	ea	1
23		Socket, Socket Wrench - 1-1/8 in (80063) A3018045-7	ea	1
24		Socket, Socket Wrench - 5.5 mm (80063) A3018047-2	ea	1
25		Socket, Socket Wrench - 13 mm (80063) A3018047-1	ea	1
26		Socket, Socket Wrench - 7/8 in. (80063) A3018045-4	ea	1
27		Socket, Socket Wrench - 1/2 in. (80063) A3018045-1	ea	1
28		Wrench, Torque, 0-100 in/lb (80244) GGG-W-686 TY1 C, List B	ea	1
29		Bit. Screwdriver - 1 Point (80063) A3018041 -2	ea	1
30		Bit, Screwdriver - Flat Tip (80063) A3018041-4	ea	1
31		Top, Thread Cutting - M2.2 (80063) A3018040-1	ea	1
32		Spanner Attachment, Socket Wrench - 3/4 in. (80063) A3018049-2	ea.	1
33		Spanner Attachment, Socket Wrench- 1- 1/4 in. (80063) A3018049-4	ea	1

Section IV. COMPONENTS OF END ITEM LIST FOR TOOL KIT, ELECTRONIC EQUIPMENT Continued

(1) Illustration Number	National Stock Number	(3) Description (FSCM) and Part Number	(4) U/M	(5) Quantity Required
34		Handle - Tap, Thread Cleaning - M8.0 (80063) A3018046-2	ea	1
35		Handle - Tap, Thread Cleaning - M2.2-M6.0 (80063) A3018046-1	ea	1
36		Tap, Thread Cutting - M8.0 (80063) A3018040-5	ea	1
37		Tap, Thread Cutting - M5.0 (80063) A3018040-4	ea	1
38		Tap, Thread Cutting - M4.0 (80063) A3018040-3	ea	1
39		Tap, Thread Cutting - M3.0 (80063) A3018040-2	ea	1
40		Extractor, Electrical Card - Assy of (80063) A3013669-1	ea	1
41		Wrench, Box and Open End, Combination-5.5 mm (80063) A3018043-1	ea	1
42		Adapter, Socket - 3/8 to 1/2 in. (80063) A3018042-1	ea	1
43		Adapter, Socket - 3/8 to 1/4 in. (80063) A3018042-2	ea	1
44		Alignment Tool, Connector, Battery Box (80063) A3018423-1	ea	1

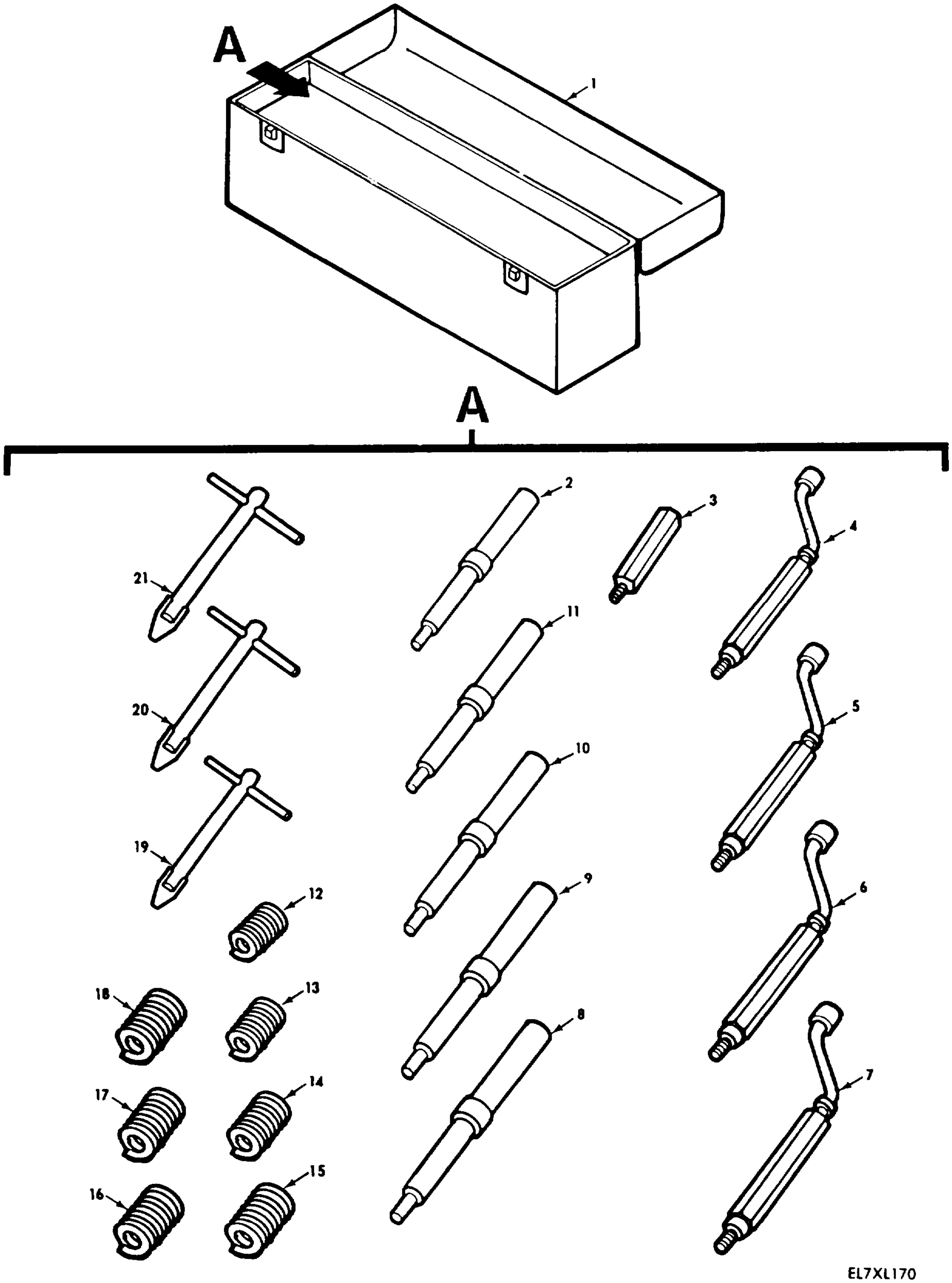


Figure C-3. Electronic System Tool Kit (Sheet 1 of 3)

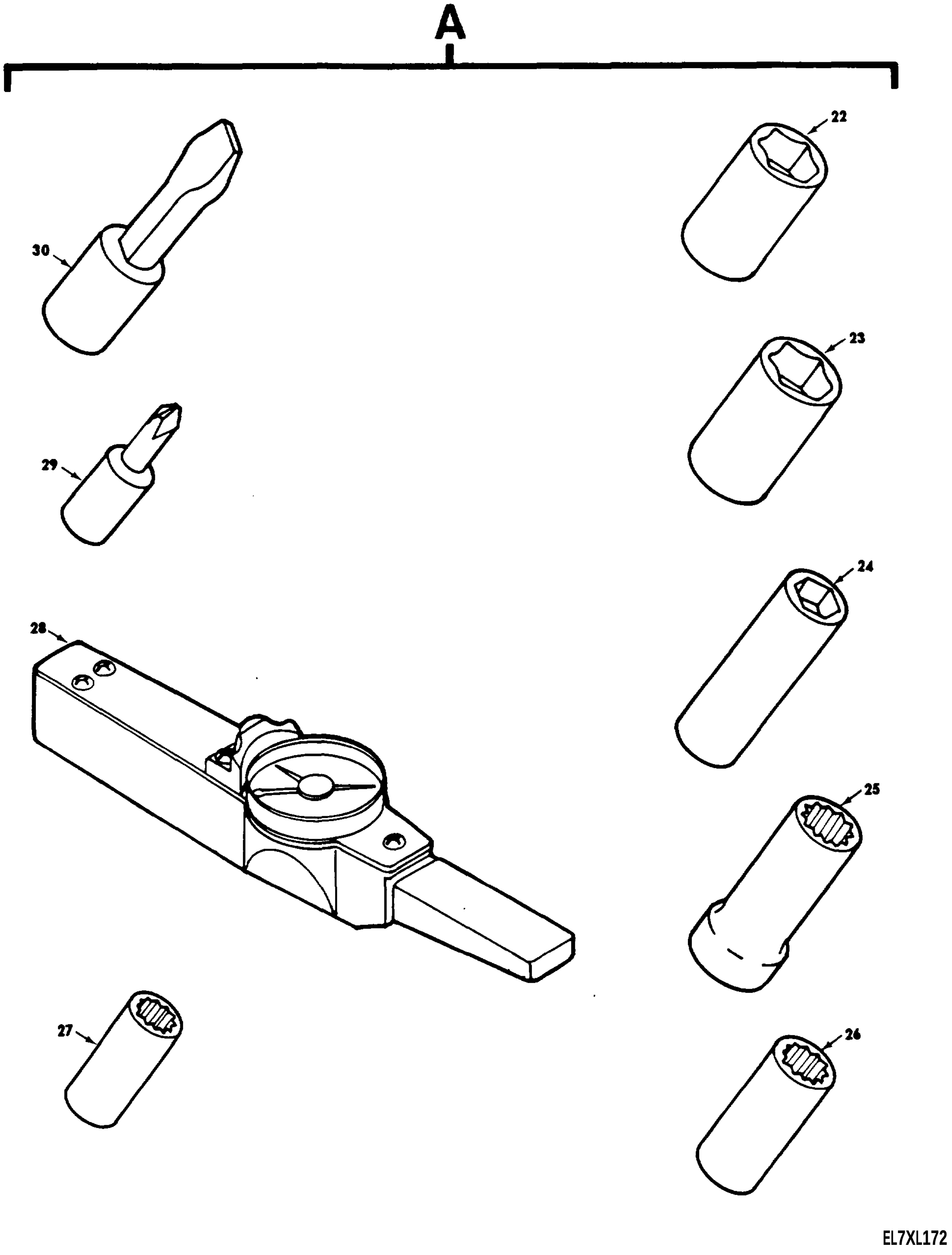


Figure C-3. Electronic System Tool Kit (Sheet 2 of 3)

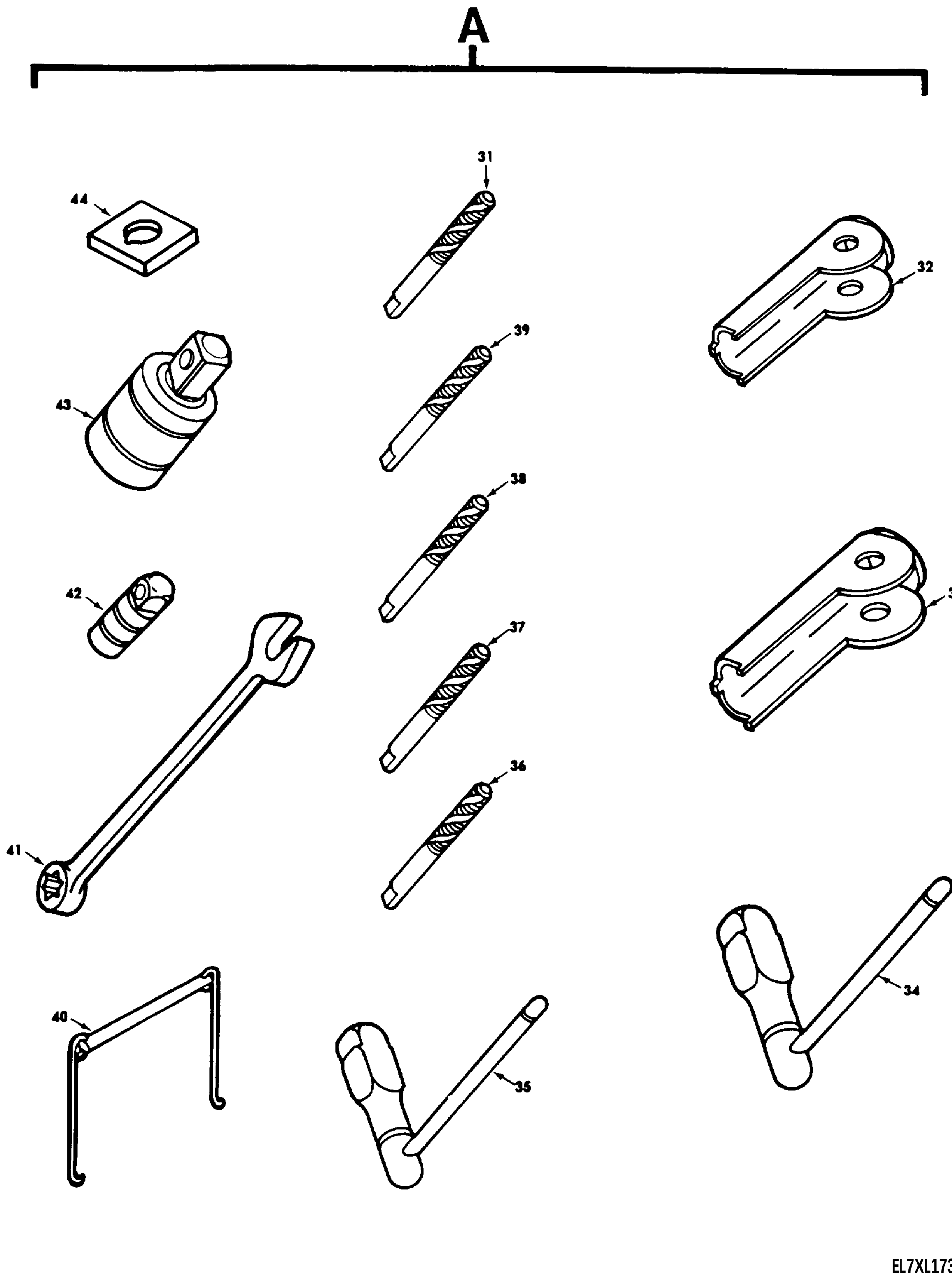


Figure C-3. Electronic System Tool Kit (Sheet 3 of 3)

Section V. COMPONENTS OF END ITEM LIST FOR PARTS KIT, ELECTRONIC EQUIPMENT

(1) Illustration Number	(2) Notional Stock Number	(3) Description (FSCM) and Part Number	(4) U/M	(5) Quantity Required
See figure C-4				
1		Cable Assy, Radio Frequency (80063), A3013903-1	ea	2
2		Lead, Test, red (80063), A3013905-1	ea	4
3		Lead, Test, black (80063), A3013905-2	ea	4
4		Lead Assy, Electrical (80063), A3013904-1	ea	2
5		Lead, Electrical - Jumper (80063), A3018466-1	ea	1
6		Container, Shipping and Storage (80063), A3013071-1	ea	1
7		Connector - TEE (BNC) (81349), M55339/17-00274	ea	2
8		Connector, Electrical, Plug, Tip (81349), M28901/3-1	ea	4
9		Connector - Barrel (BNC) (81349), M55339/16-00914	ea	2
10		Adapter, Conn - BNC to Double Banana (80063), A3013034-1	ea	3
11		Cable Assy, Radio Frequency (80063), A3018583	ea	1

Section VI. BASIC ISSUE ITEMS

(1) Illustration Number	(2) National Stock Number	(3) Description (FSCM) and Part Number	(4) U/M	(5) Quantity Required
		None		

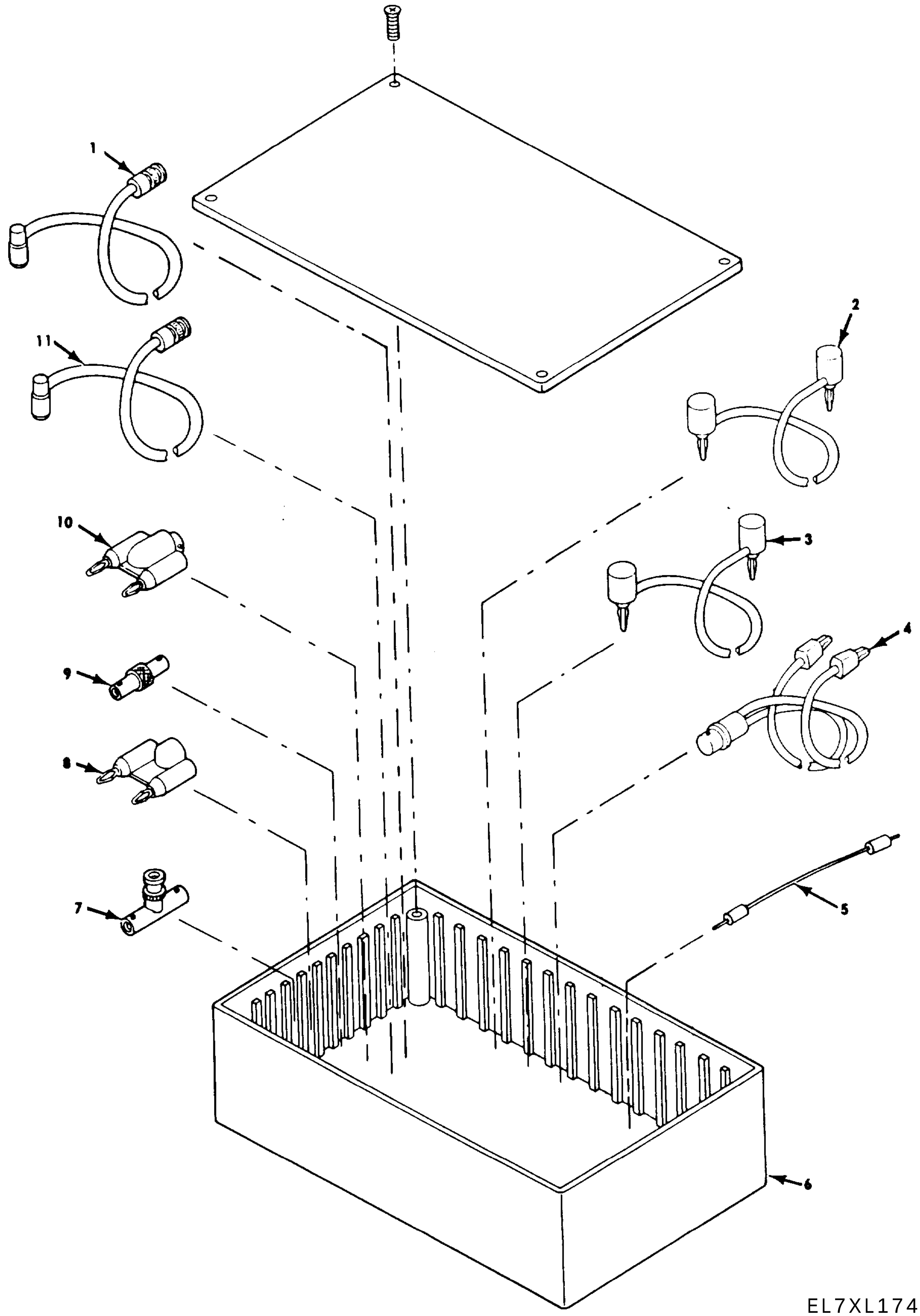


Figure C-4. Electronic Equipment Parts Kit

APPENDIX D
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE.

This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Ports, and Heraldic Items), or CTA 8-100, Army Medical Deportment Expendable/Durable Items.

D-2. EXPLANATION OF COLUMNS

The following explains the columns found in the tabular listing.

a. **Column (1), Item Number.**

b. **Column (2), National Stock Number.** Indicates the National Stock Number (NSN) assigned to the item and will be used for requisitioning purposes.

c. **Column (3), Description.** Indicate the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

d. **Column (4), Unit of Measure.** Indicates the measure used in performing the actual maintenance function, This measure is expressed by a two character alphabetical abbreviation (e.g., en, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES LIST Continued

(1) ITEM NO.	(2) NSN	(3) DESCRIPTION	(4) U/M
1	8040-01-136-1116	Adhesive, RTV (81349), Type 1 Clear	AR
2	6810-00-753-4993	Alcohol, Isopropyl, Grade A MIL-A-2048	AR
3	6515-00-303-8250	Swabs, Cotton	AR
4	8030-00-753-4599	Sealing Compound, Proseal 890, (8327) MIL-S-8802	AR
5	6850-00-927-9461	Silicone Compound, (81349), MIL-S-8660 Clear	AR

GLOSSARY

SECTION I ABBREVIATIONS

Abbreviation	Description
AC	Alternating current
AD	Analog data
A/D	Analog to digital
ADMC	Analog/digital mode control
AGC	Automatic gain control
ALC	Automatic level control
ANLG	Analog
ANT	Antenna
AR	Analog receive
AR	Audio receive
AT	Analog transmit
AT	Audio transmit
AUD	Audio
AUX	Auxiliary
AVAIL	Available
BCD	Binary-coded decimal
BS	Bit sync
BTRY	Battery
CB	Circuit breaker
CB1	Circuit breaker 1
CCA	Circuit card assembly
CCTS	Circuits
CCW	Counter-clockwise
CHAN	Channel
CLK	Clock
CLOS	Closure
CLR	Clear
CM	Control-monitor
CNTL	Control
COM	Common
CT	Cipher text
CVSD	Continuously variable slope delta
CW	Clockwise
DC	Direct current
DDCO	Digital data clock out
DDI	Digital data input
DDMC	Digital data mode control
DDR	Digital data receive
DDT	Digital data transmit
DEMOD	Demodulated
DET	Detector
DGT	Digital
DMM	Digital multi-meter
DRA	Digital rate adapter
DSPL	Display
DSQ	Digital squelch
EMP	Electra-magnetic pulse
ENBL	Enable
ERF	ECCM remote fill
ETM	Elapsed time meter
EXT	External
FCTN	Function
FH	Frequency hopping
FH/M	Frequency hopping/master
FREQ	Frequency
FSK	Frequency shift keying
FCTN	Function
GND	Ground
HI	High
HLDG	Holding
HPF	High pass filter
HZ	Hertz
I/D	Integrate and dump
I/O	Input/output
IF	Intermediate frequency
INFO	Information
INHB	inhibit
INP	Input
KB/S	Kilobit per second
L	Low
LD	Load
LD-V	Load-variable
LE	Late entry
LO	Local oscillator
LPF	Low pass filter
LVL	Level
M	Medium
M/V RT	Manpack/vehicular receiver-transmitter
MDL	Module
MEM	Memory
MOD	Modulated
MV	Milli-volt
N	Not
N/C	No contact
OFST	Offset
OP CHECK	Operational Check
OUT	output
P-P	Peak-to-peak
PA	Power amplifier
PLL	Phase locked loops
PN	Part number
POT	Potentiometer
PR	Preset
PRE	Present
PRI	Primary
PT	Plain text
PTT	Push-to-talk
PTTR	Push-to-talk receive
PWR	Power
PWR SPLY	Power supply
RAM	Random access memory

GLOSSARY
SECTION I ABBREVIATIONS

Abbreviation	Description
RCA	Remote control adapter
RCV	Receive
RED	Red
REM	Remote
REQ	Request
RF	Radio frequency
RM	Remote mode
RMS	Remote mode select
ROM	Ready only memory
RTN	Receiver/transmitter
RTN	Return
RXMT	Retransmit
SC	Single channel
SEL	Select
SEQ	Sequential
SIG	Signal
SIG STR RCV	Signal strength receive
SNAP	Steerable null antenna processor
SP	Speed
SQ	Squelch
ST	Sidetone
STR	Strobe
STW	STOW
SW	Switch
SYNC	Synchronize
TD	Time delay
TOD	Time of day
TR	Transmit/receive
TST	Test
V	Volt
VAR	Variable
VCO	Voltage controlled oscillator
VCOX	Voltage controlled crystal oscillator
VOL	Volume
VSO	Variable select zero
VSWR	Voltage standing wave ratio
WB	Waveband
WHSP	Whisper
XMT	Transmit
Z-A	Zero all

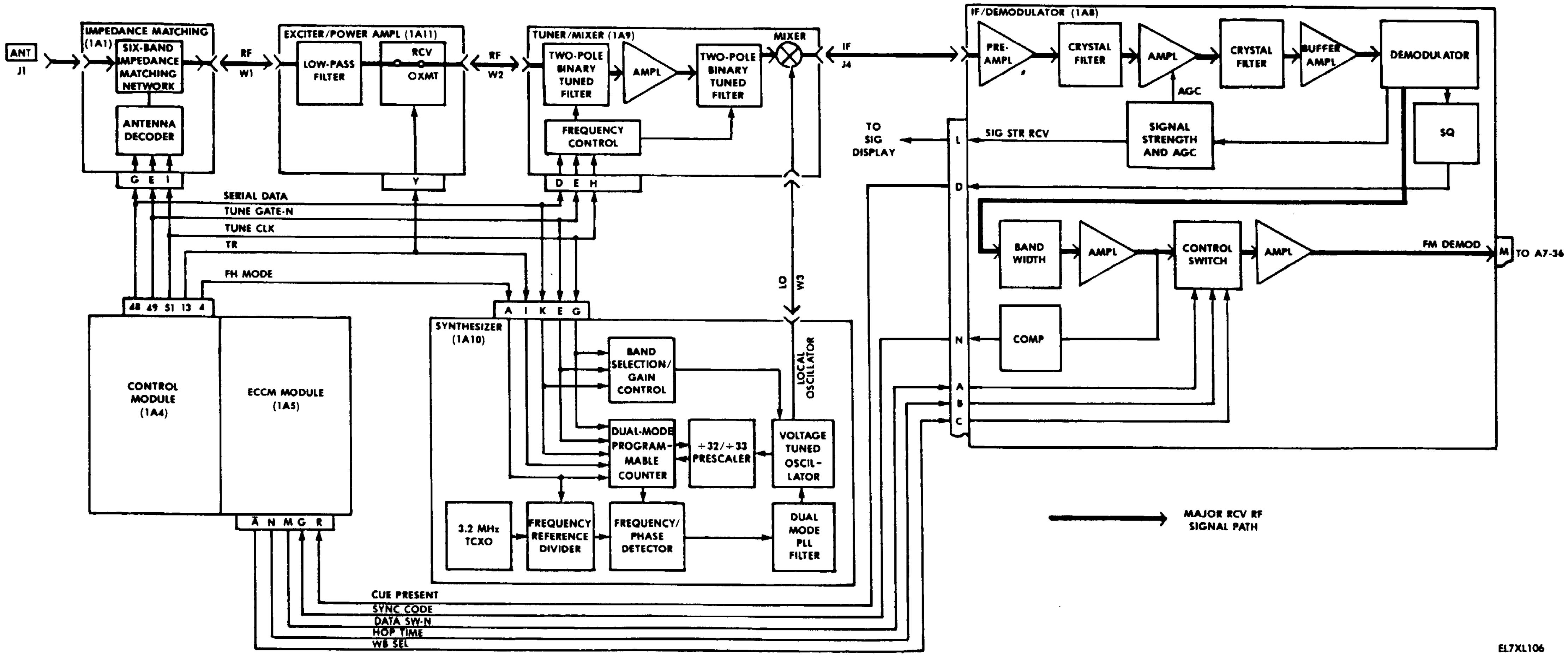
GLOSSARY
SECTION II UNUSUAL TERMS

Term	Definition
Bit synchronized	Alinement of incoming data bits with internal clocks
Black signals	Signals that are buffered by the audio power supply to isolate the COMSEC signals in the audio/data section
Carrier	The rf frequency to which the rt is tuned and onto which the information signal is modulated
Deinterleave	A signal is stripped of data speed or frequency hopping control information, leaving only the information signal, and collapsed it down to its original signal speed
Interleave	Insert data speed or frequency hopping control information into a signal by creating gaps in the information flow and inserting the control data into the gaps. The process will increase a signal's data speed
Receiver sensitivity	The lowest power signal the rt can receive
Red signals	Signals in the audio/data section of the rt that may contain COMSEC coding
Sidetone	Feedback of the operator's into the handset receiver when transmitting
Squelch tone	150 Hz tone accompanying received signals, necessary to break squelch

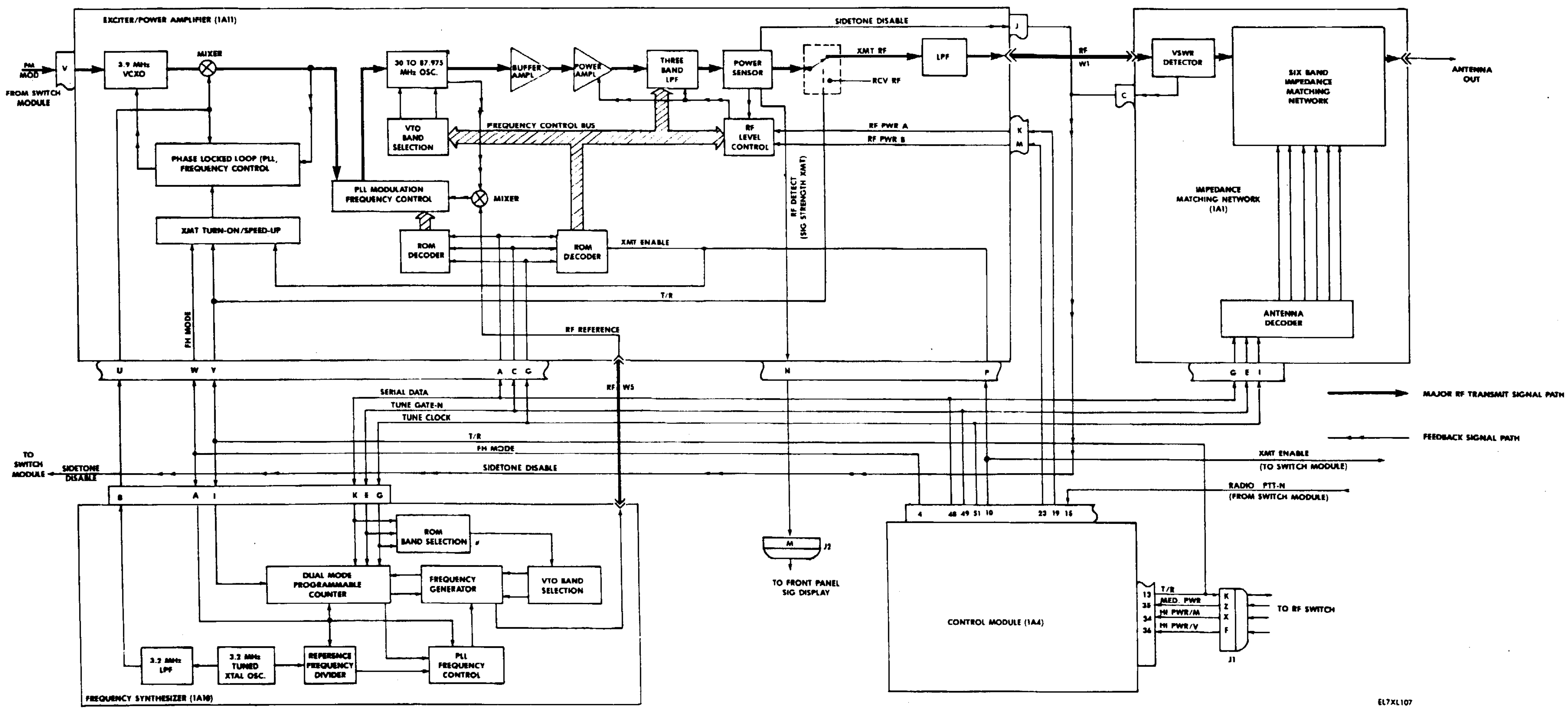
ALPHABETICAL INDEX

ALPHABETICAL INDEX Continued

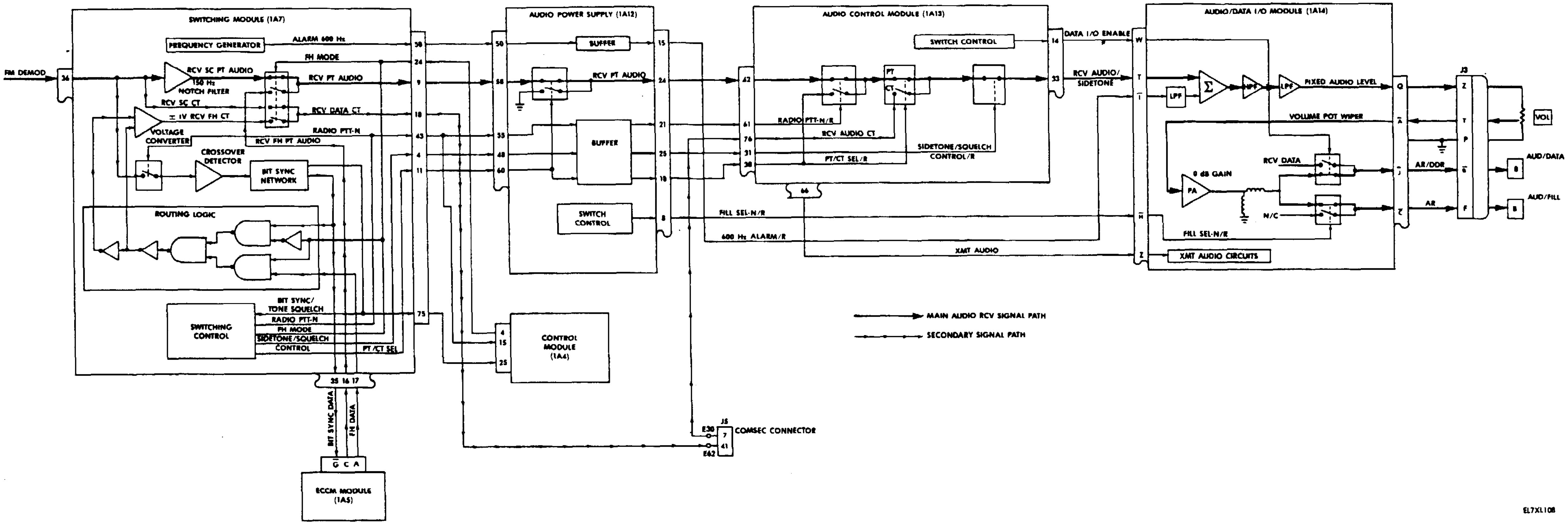
ALPHABETICAL INDEX Continued



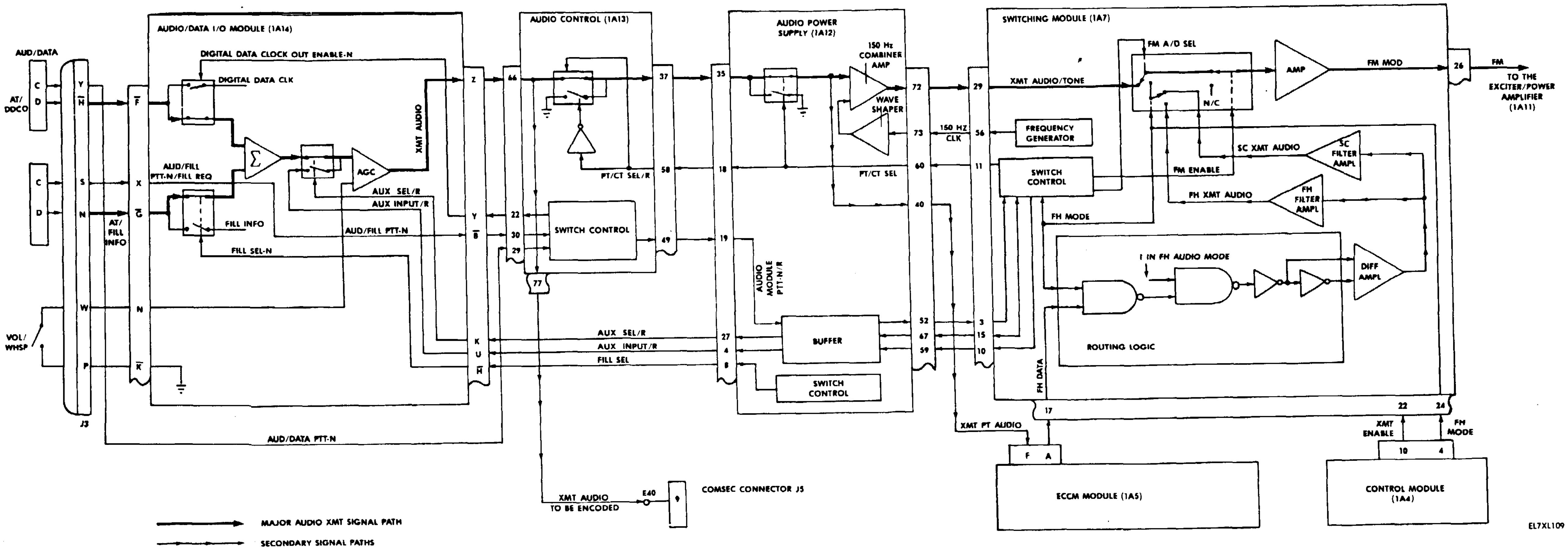
FO-1. RT RF RECEIVE Signal Path Functional Block Diagram



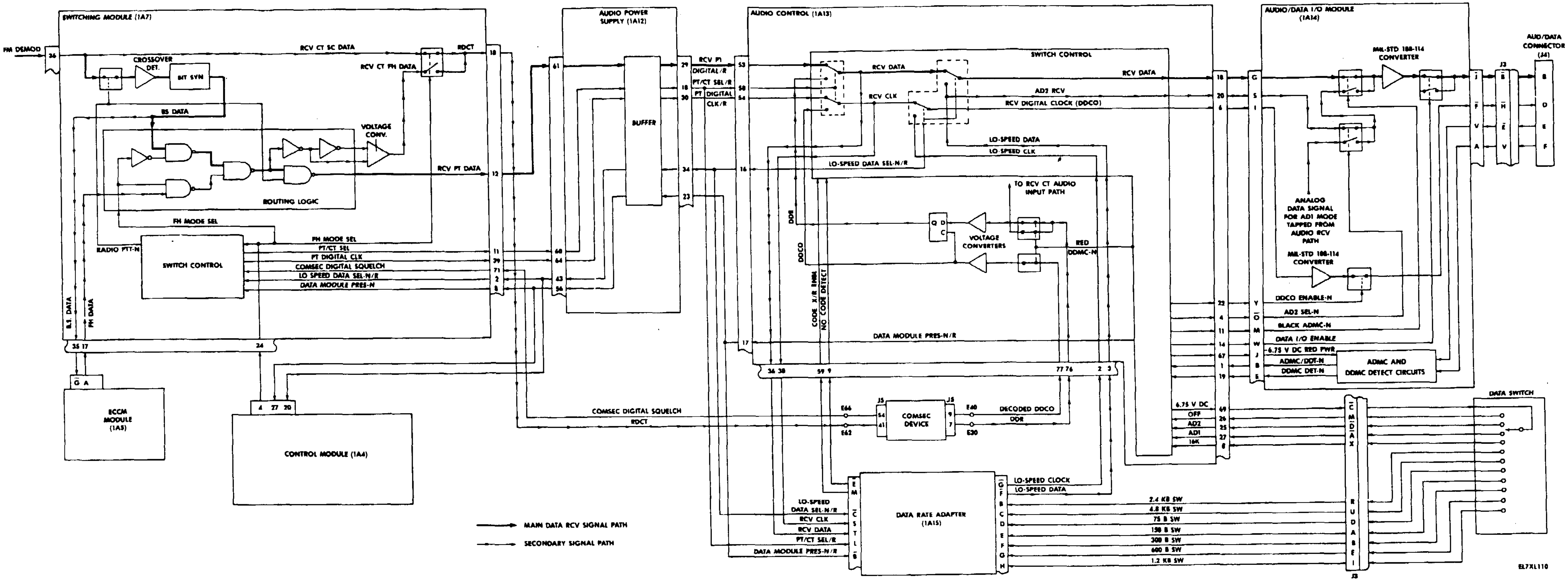
FO-2. RT RF Transmit Signal Path Functional Block Diagram
FP-3/FP-4 Blank



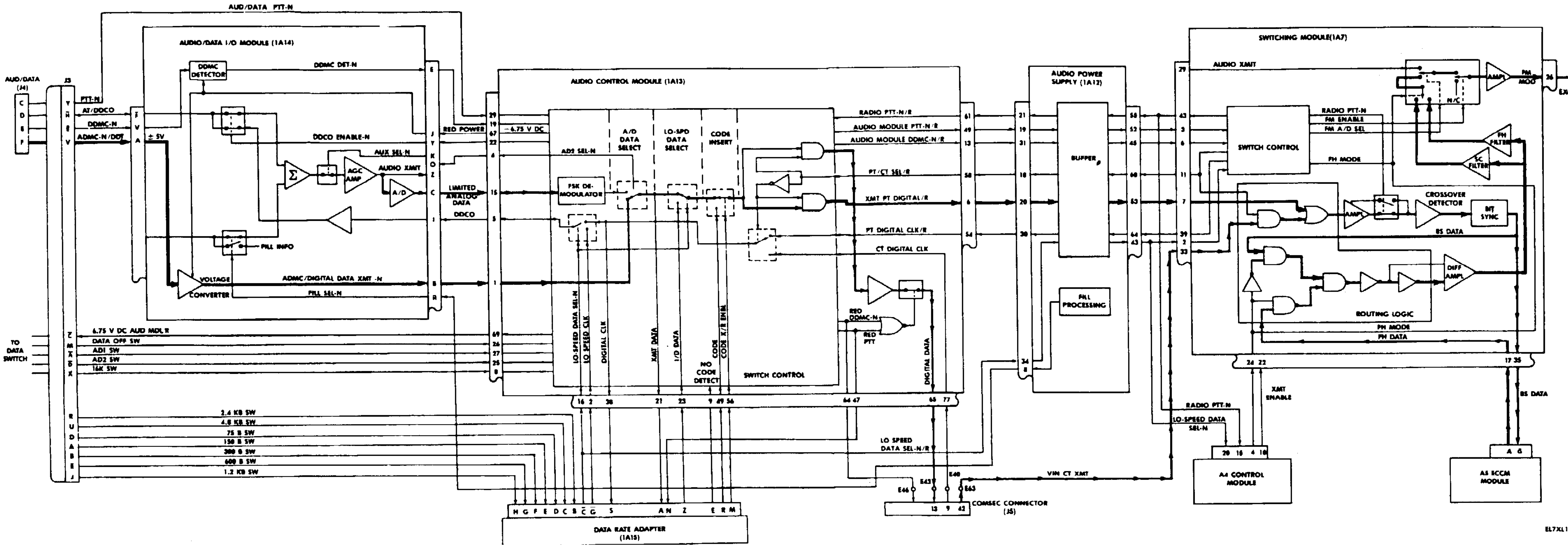
FO-3. RT Audio Receive Signal Path Functional Block Diagram



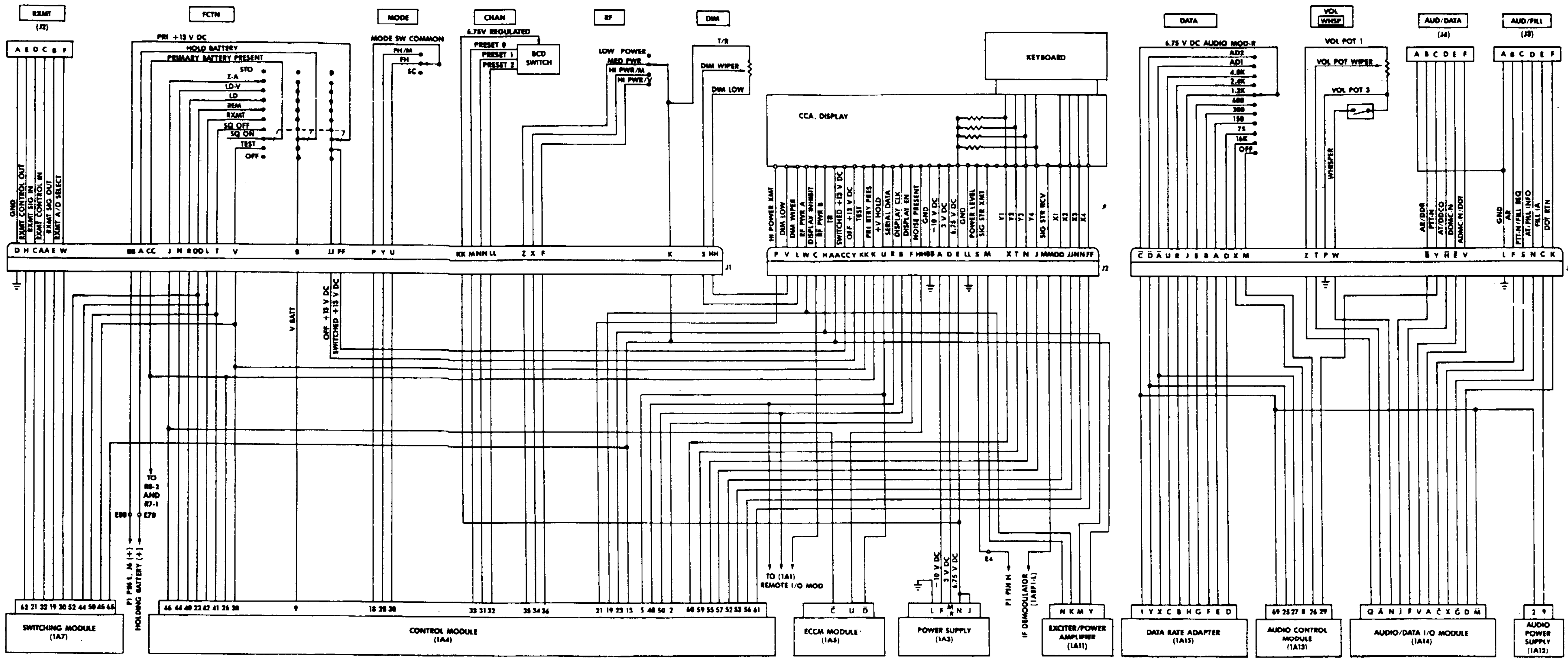
FO-4. RT Audio Transmit Signal Path Functional Block Diagram



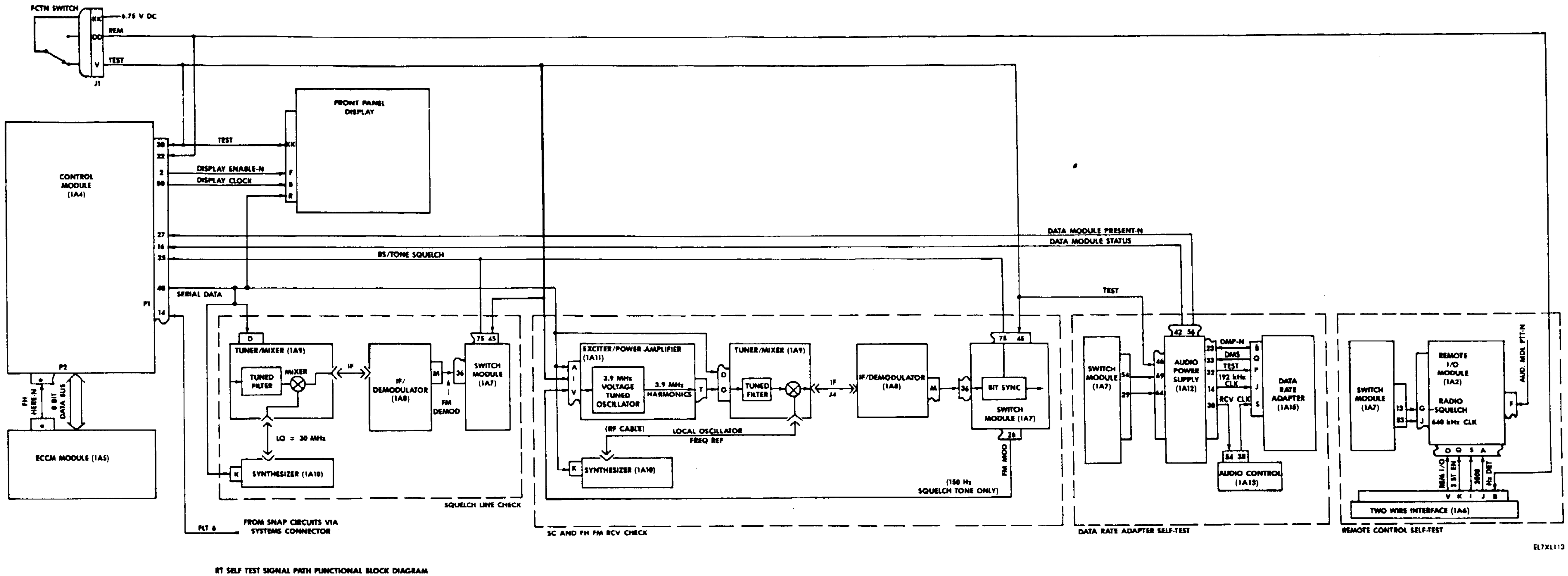
FO-5. RT Data Receive Signal Path Functional Block Diagram



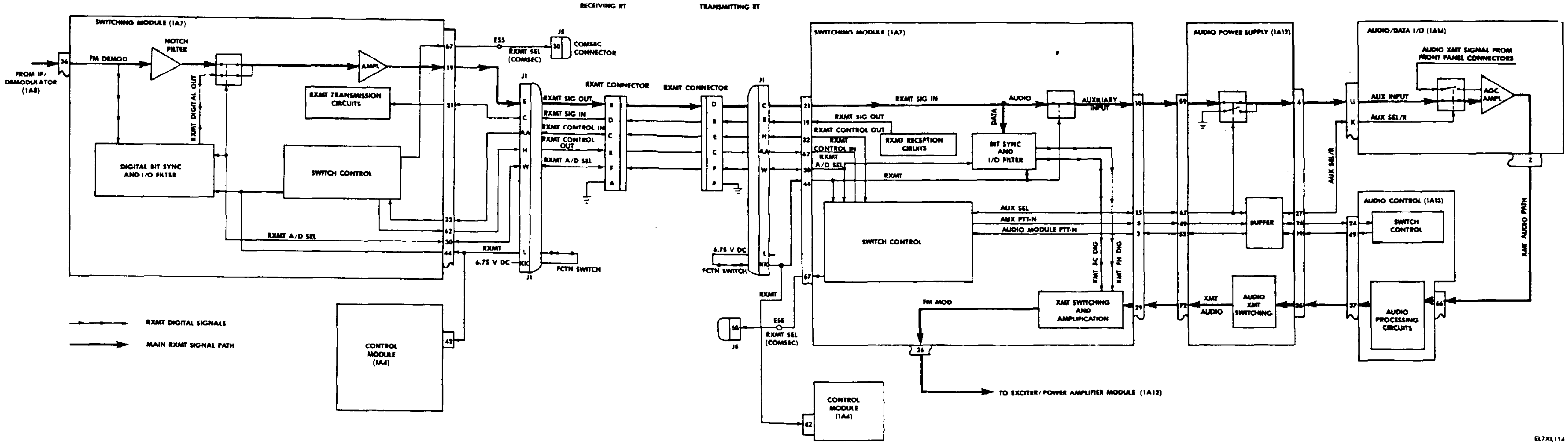
FO-6. RT Data Transmit Signal Path Functional Block Diagram



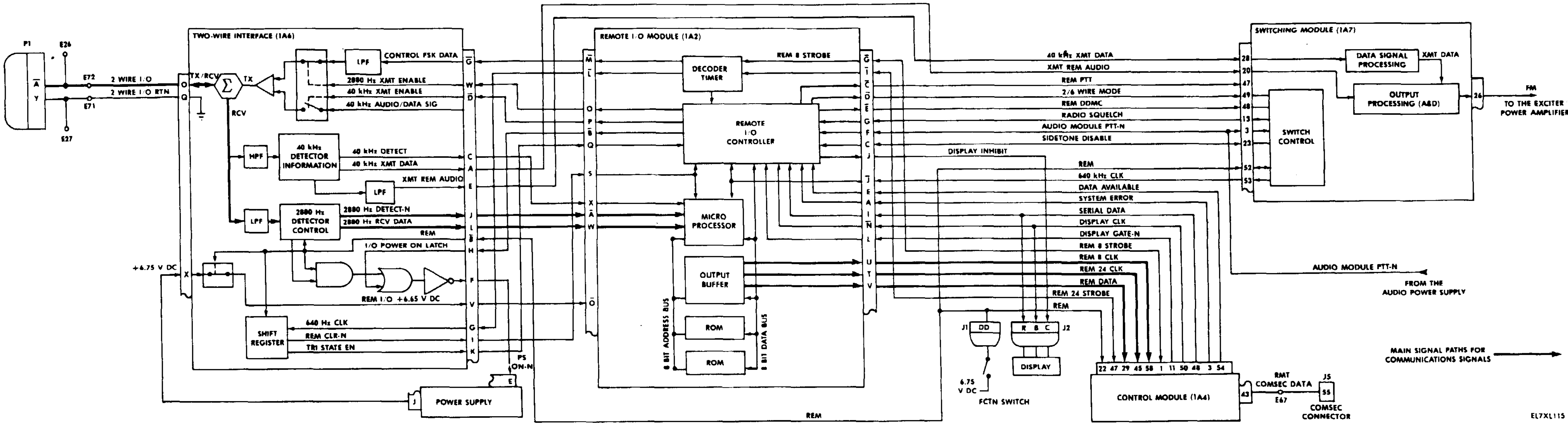
FO-7. RT Primary Control Signals



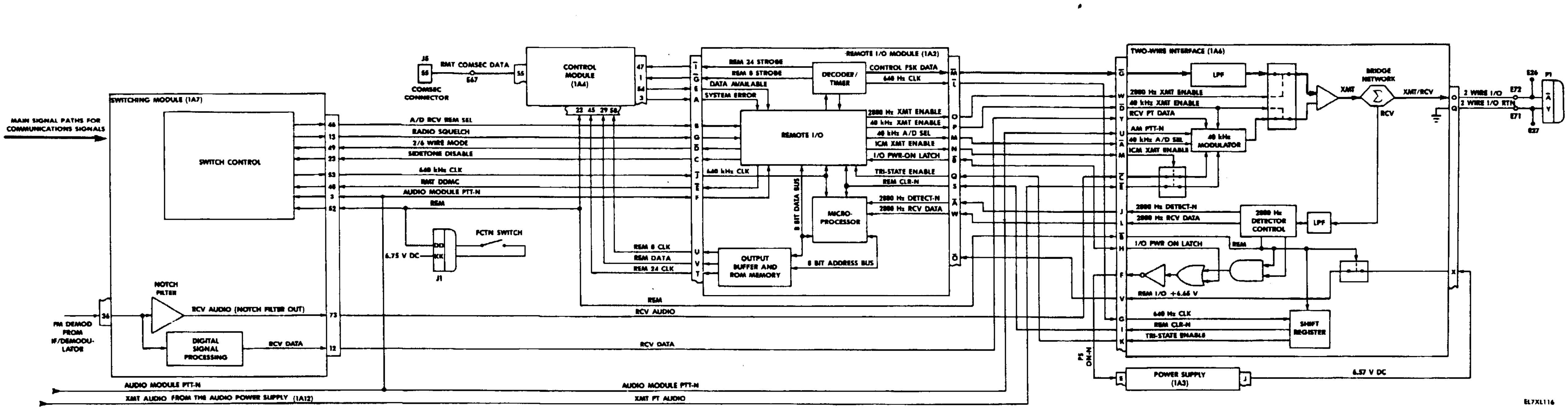
FO-8. RT Self Test Signal Path Functional Block Diagram



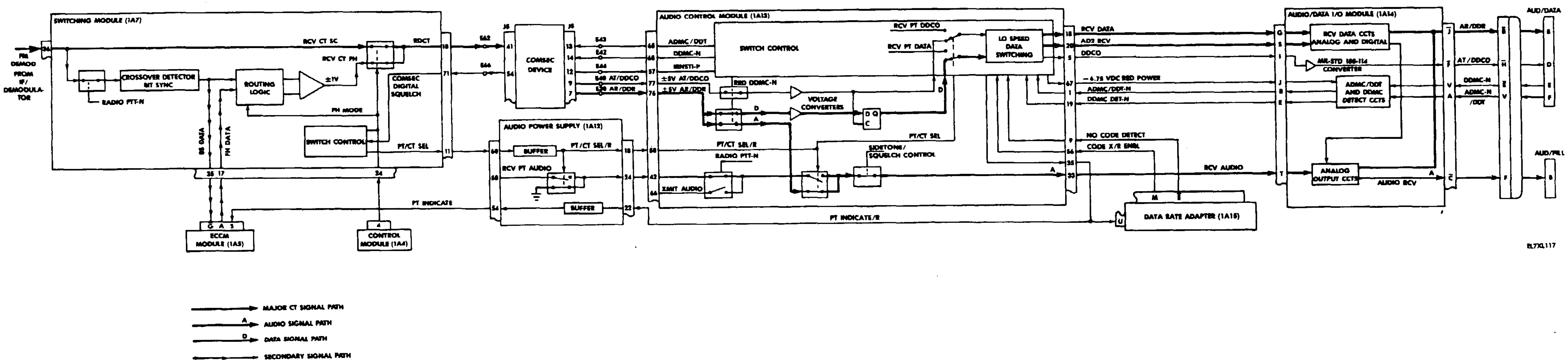
FO-9. RT Retransmit Signal Path Functional Block Diagram



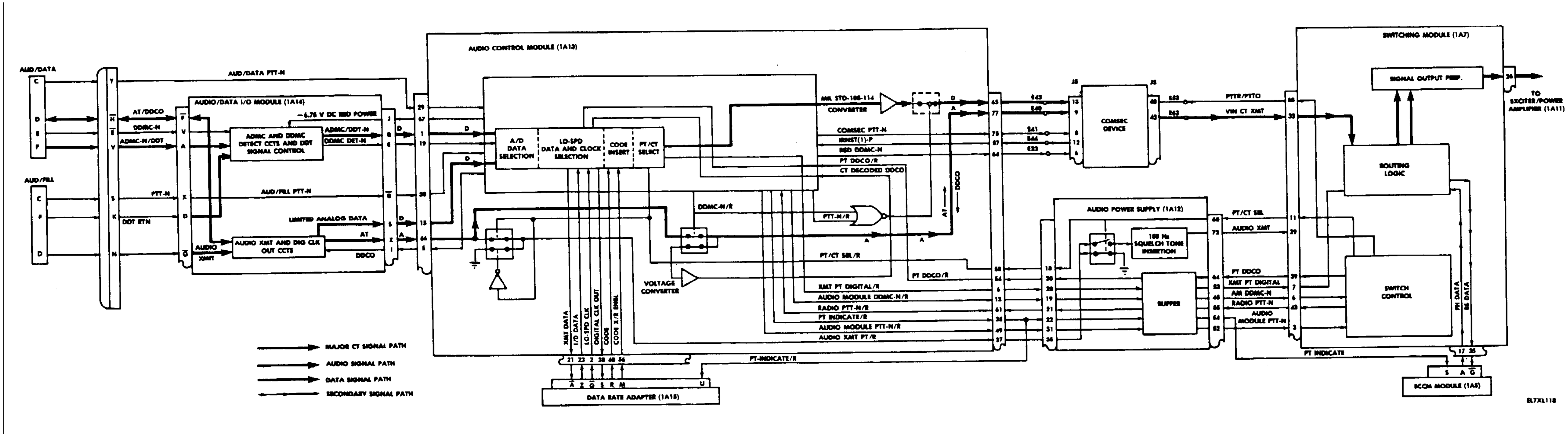
FO-10. RT Remote Control Receive Signal Path Functional Block Diagram (Sheet 1 of 2)



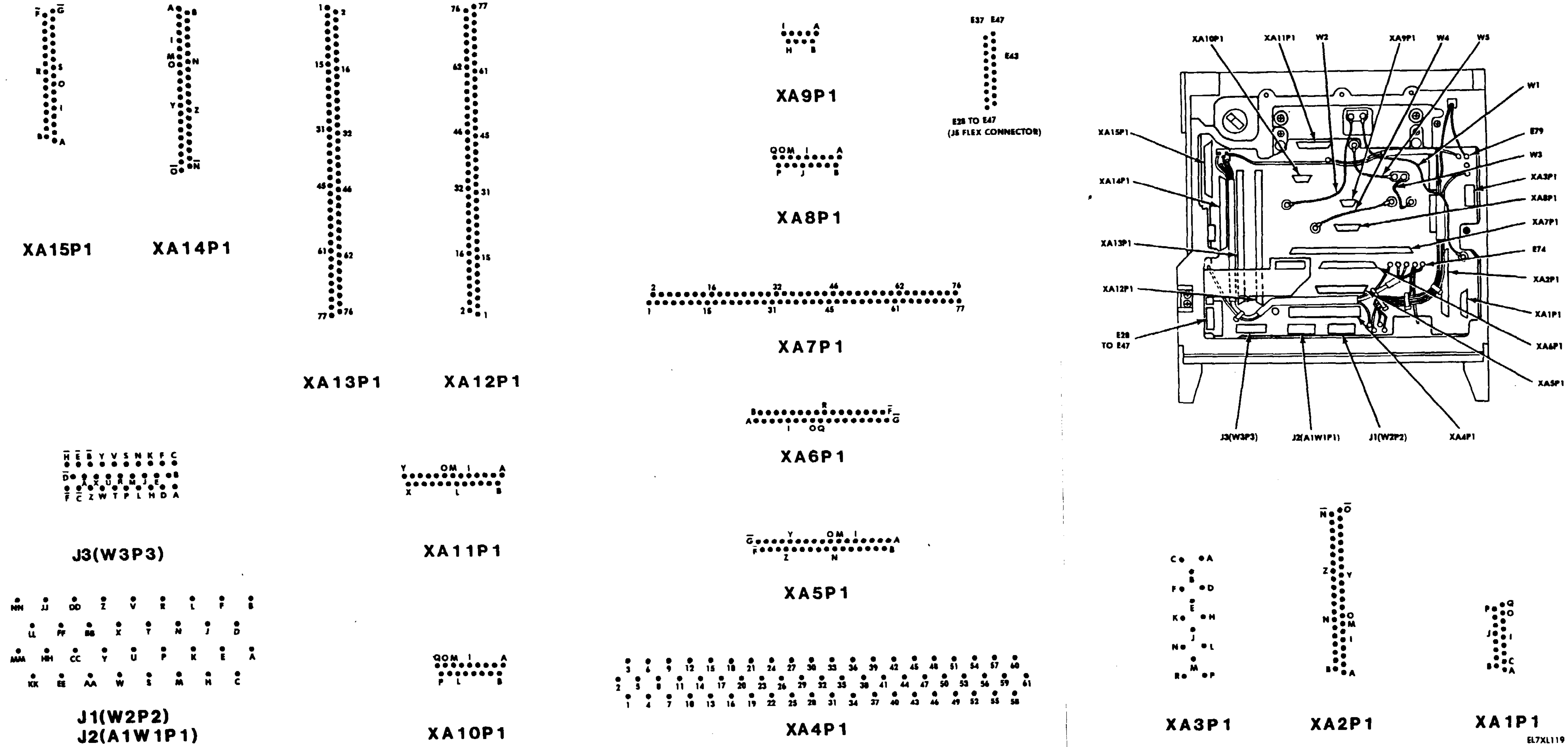
FO-10. RT Remote Control Transmit Signal Path Functional Block Diagram (Sheet 2 of 2)



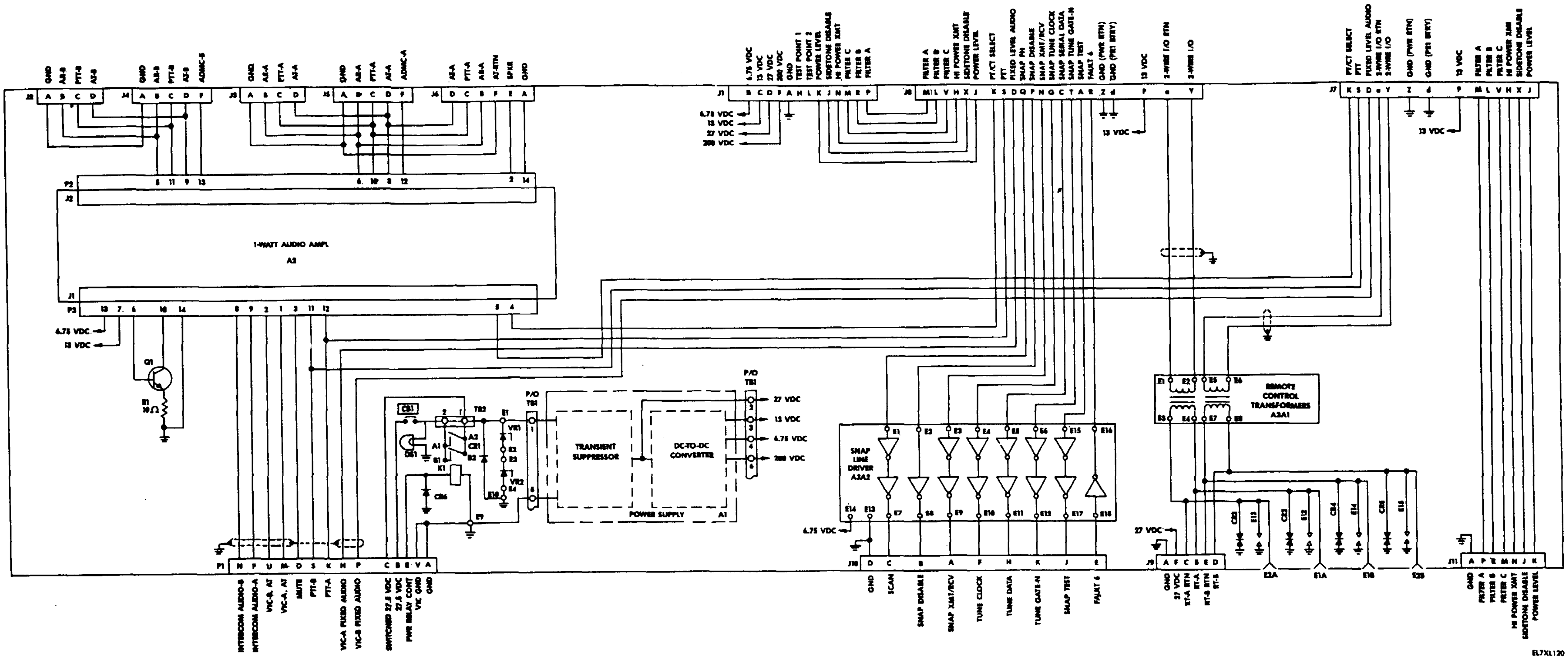
FO-11. RT Cipher Text Receiver Signal Path Functional Block Diagram
FP-23/(FP-24 Blank)



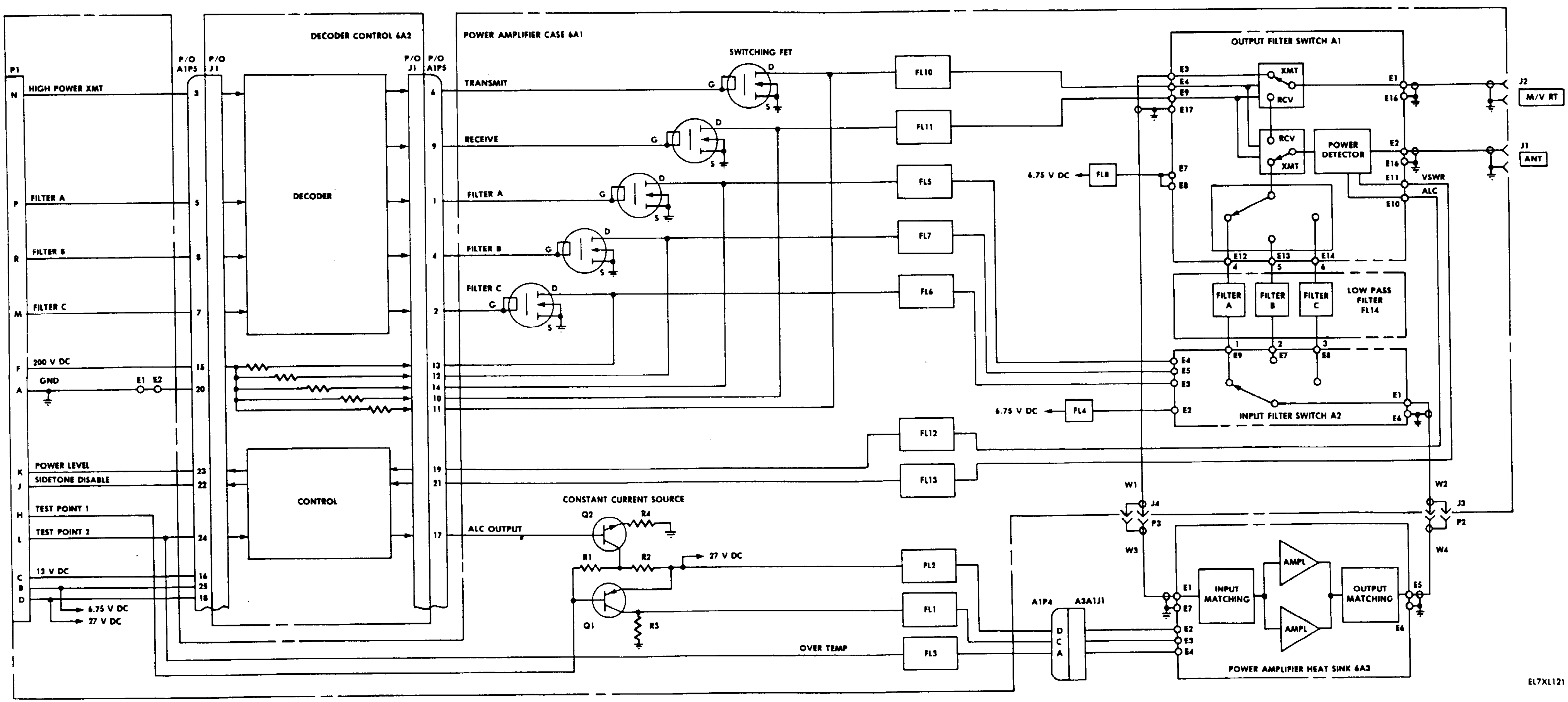
FO-12. RT Cipher Text Transmit Signal Path Functional Block Diagram



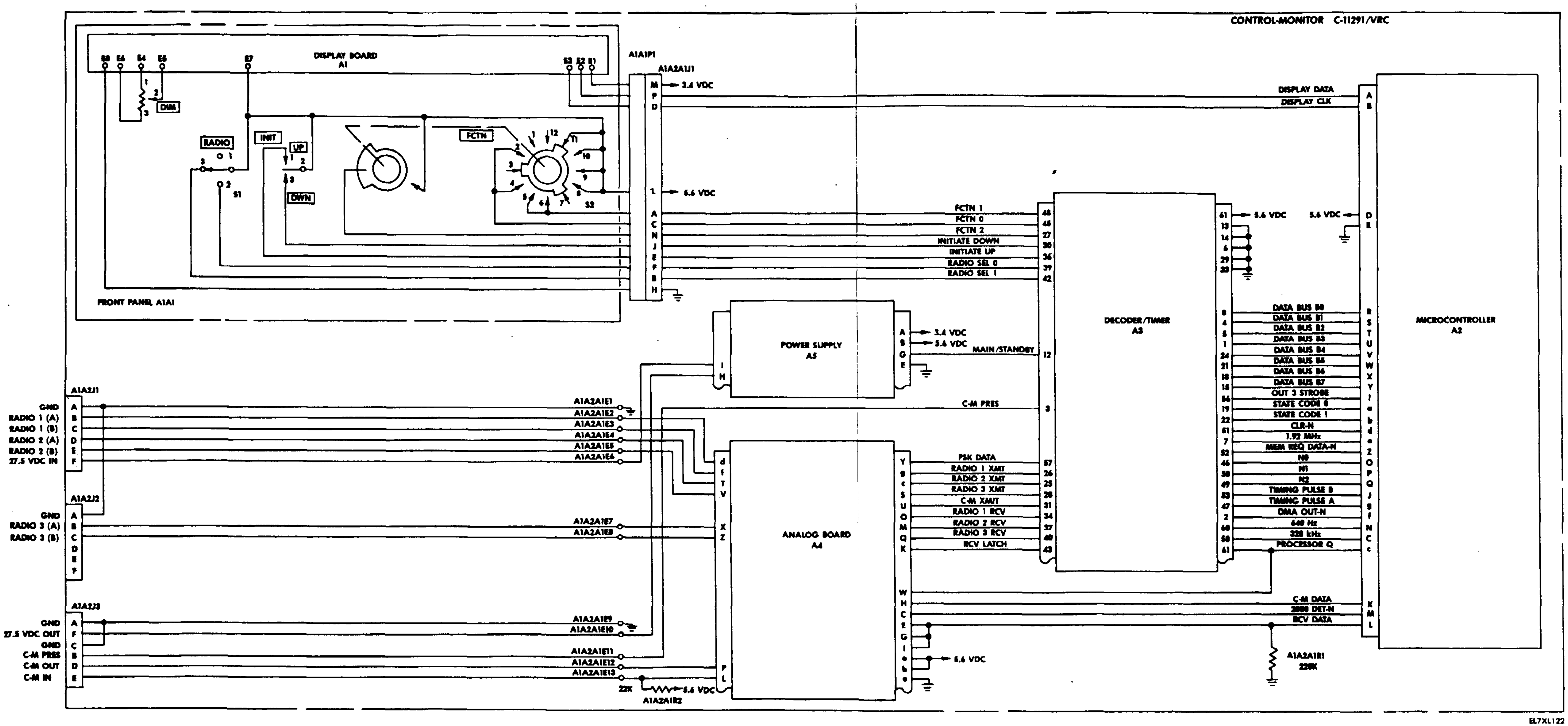
FO-13. RT Parent Board Connectors



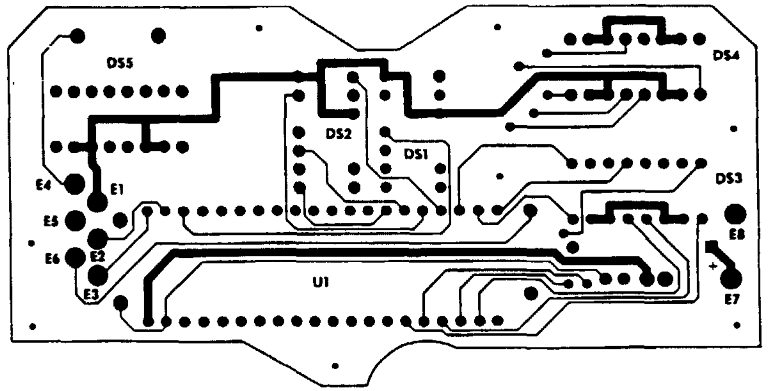
FO-14. Amplifier-Adapter, Vehicular AM-7239/VRC Schematic Diagram



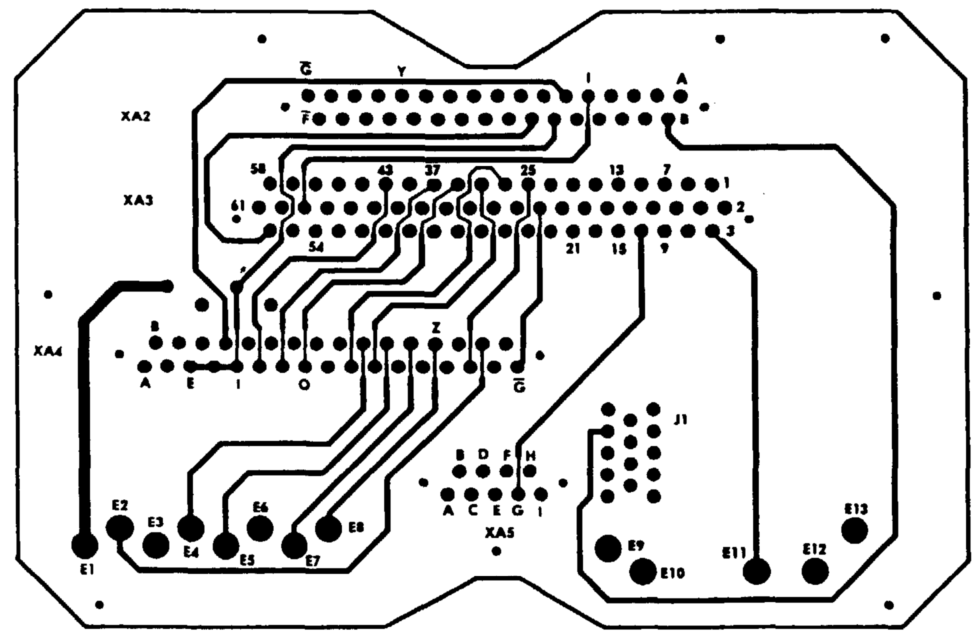
FO-15. Power Amplifier Block Diagram



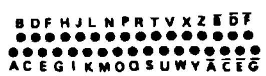
FO-16. Control-Monitor C-11291/VRC Schematic Diagram



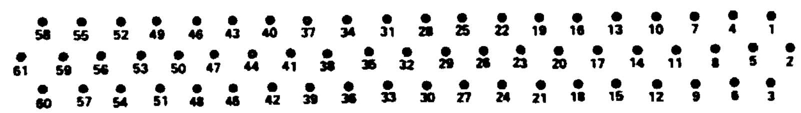
DISPLAY BOARD



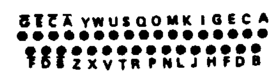
PARENT BOARD



XA4

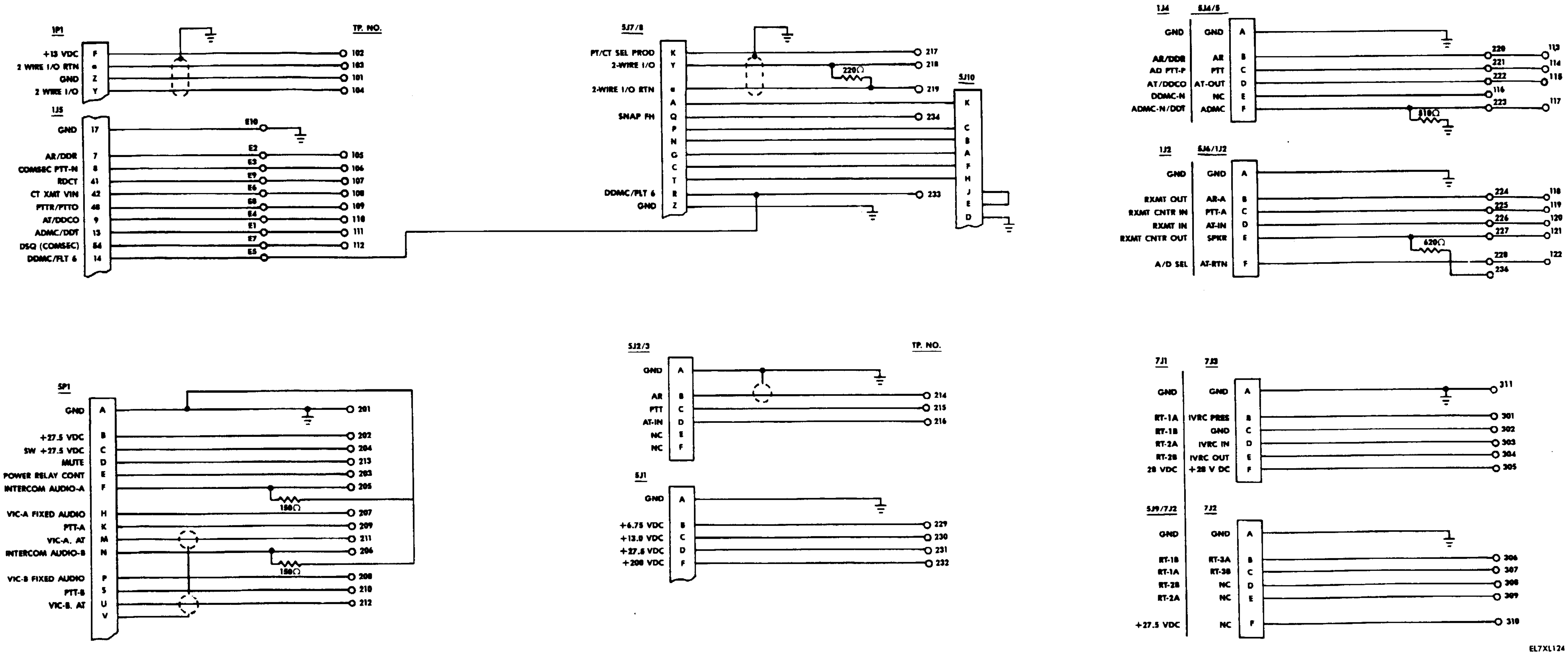


XA3



XA2

FO-17. Control-Monitor Parent Board and Display Board



FO-18. Test Adapter Schematic
FP-37/(FP-38 Blank)

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General, United States Army
Chief of Staff

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2^{o} IFF antenna lag rather than 1^{o}. REASON: Experience has shown that with only a 1^{o} lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2^{o} without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		FO3		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

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