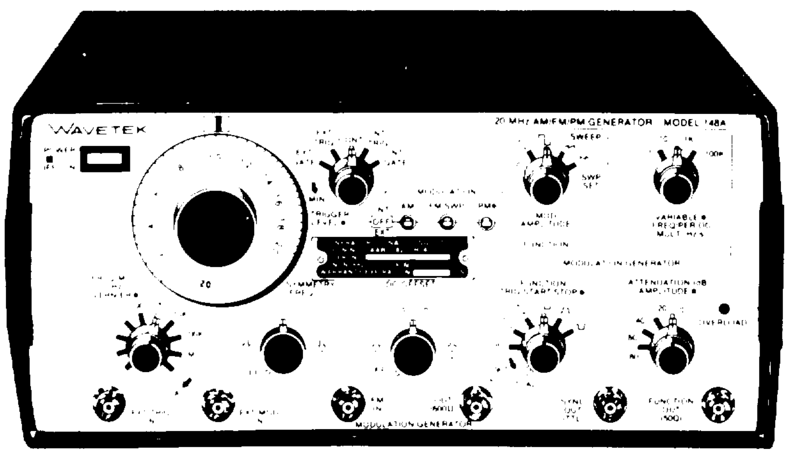
TM 11-6625-3051-40

TECHNICAL MANUAL

GENERAL SUPPORT MAINTENANCE MANUAL



SIGNAL GENERATOR SG-1171/U (NSN 6625-01-133-6160)

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HEADQUARTERS, DEPARTMENT OF THE ARMY

1 SEPTEMBER 1986

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

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

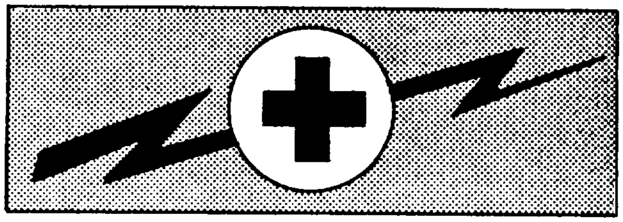
2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

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 used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is is another person nearly who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When 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.

Warning: Do not be misled by the term “low voltage”. Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration, refer to FM 21-11.

WARNING

A periodic review of safety precautions in TB 385-4, Safety Precautions for Maintenance of Electrical/Electronic Equipment, is recommended. When the equipment is operated with covers removed, DO NOT TOUCH exposed connections or components MAKE CERTAIN you are not grounded when making connections or adjusting components inside the test instrument.

WARNING

Hot equipment parts can cause serious burns Before working on equipment that has just been shut down, allow equipment to cool.

WARNING

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

CAUTION

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

ESD
CLASS 1

NOTE

The symbol for static sensitive devices in military inventory is as depicted in the caution block above.

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 PROCEDURES

Ž 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 METALIZED LAYER
- LABEL WITH SENSITIVE ELECTRONIC SYMBOL AND CAUTION NOTE

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 m 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-M 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 orginal shipping container untill installed.

STEP 6 When these devices and assembles 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 foilor 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. 11-6625-3051-40

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 September 1986

GENERAL SUPPORT MAINTENANCE MANUAL

SIGNAL GENERATOR SG-1171/U
(NSN 6625-01-133-6160)

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 procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to. Commander, US Army Communications — Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, NJ 07703-5000. A reply will be furnished direct to you

HOW TO USE THIS MANUAL

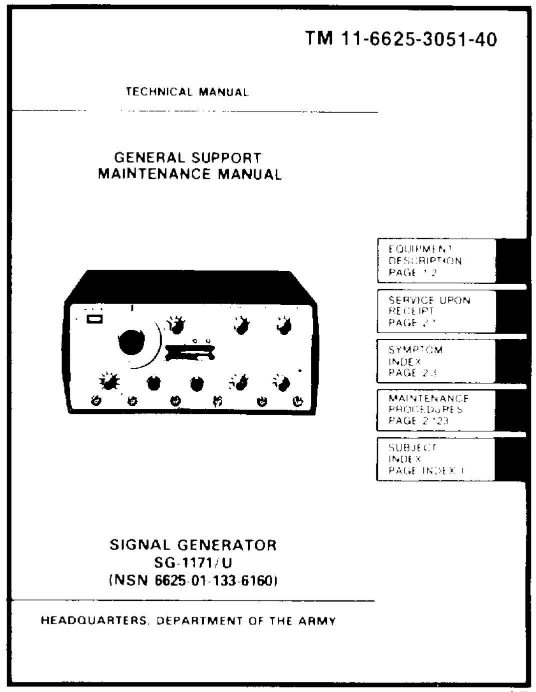
Spend a few minutes looking through this manual. It has a new look that is very different from the manuals you have been using. You will find the new look is a lot easier to use, and you can find what you are looking for a lot faster, We got rid of as many words as we could and put in pictures to aid in showing just about everything you will be doing to operate and maintain your equipment. So HOW DO YOU USE THIS MANUAL?

Like this:

1. Suppose you want to fix the signal generator.
2 Look at the cover and you will see index boxes near the right-hand edge with subject titles next to them You will find “SYMPTOM INDEX PAGE 2-3, ” You can skip over to page 2-3.

OR

3 Bend the pages a bit and look at the edges, You will see black bars on some of the pages that are lined up with the index boxes on the cover.
4 If you put your thumbnail on the black bar that is lined up with the box on the cover for SYMPTOM INDEX and open the manual, you will be on page 2-3.


TM 11-6625-3051-40

TECHNICAL MANUAL

GENERAL SUPPORT
MAINTENANCE MANUAL

EQUIPMENT DESCRIPTION PAGE 1-2

SERVICE UPON RECEIPT PAGE 2-1

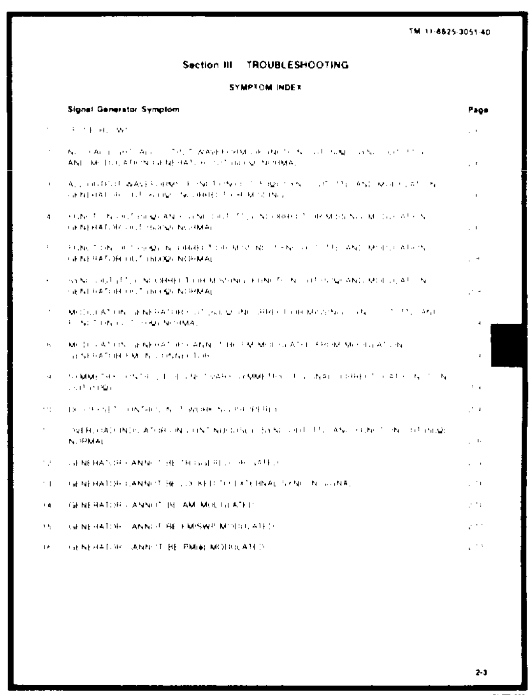
SYMPTOM INDEX PAGE 2-3

MAINTENANCE PROCEDURES PAGE 2-23

SUBJECT INDEX PAGE INDEX 1

SIGNAL GENERATOR
SG-1171/U
(NSN 6625-01-133-6160)

HEADQUARTERS, DEPARTMENT OF THE ARMY


TM 11-6625-3051-40

Section III TROUBLESHOOTING

SYMPTOM INDEX

Signal Generator Symptom | Page

2-3

5 On page 2-3, you will find the troubleshooting symptom index. Now you are ready to begin.
6. Look down the symptom column until you find the symptom, in this case “OVERLOAD indicator on continuously” and it gives you page 2-9.
7. Turn to page 2-9 and find the symptom “OVERLOAD indicator on continuously” and it will tell you what to check and what to do to fix it.

8. As you do the tests and corrective actions in the order listed, you get to "Replace appropriate resistor. See paragraph 2-86."

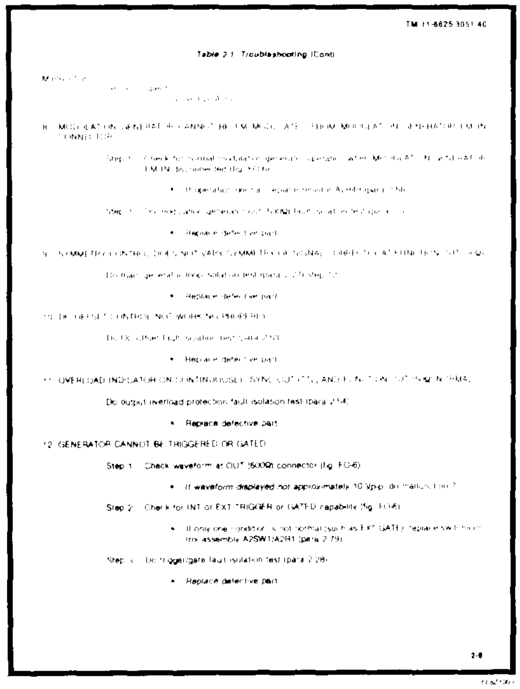

TM 11-6625-3051-40

Table 2-1. Troubleshooting (Cont)

Do output overload protection fault isolation test (para 2-14).

• Replace defective part.

12. GENERATOR CANNOT BE TRIGGERED OR GATED.

• Replace defective part.

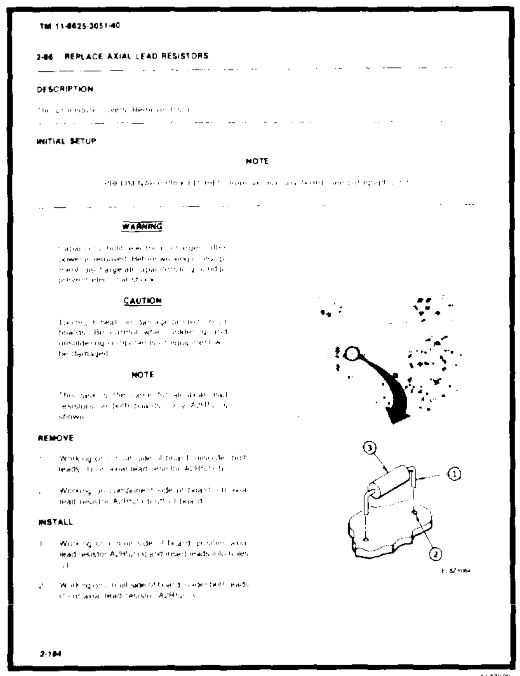
2-8

9. Turn to paragraph 2-86 and look at the procedure. The procedure is divided into modules with one or more steps and a picture to show you where to look and what to look at.

10. Notice the numbered arrows. These are called index numbers. As you read each step, we tell you where to look by including the index number (in parentheses) after the name of each item we call out.

11. Do the procedure, then check to see if you have fixed the symptom.

You can also use the Table of Contents in the front of the manual or the Subject Index in the back to find the information you want. Either one will lead you to the page number of the procedure you need.


TM 11-6625-3051-40

2-86 REPLACE AXIAL LEAD RESISTORS

DESCRIPTION

INITIAL SETUP

NOTE

WARNING

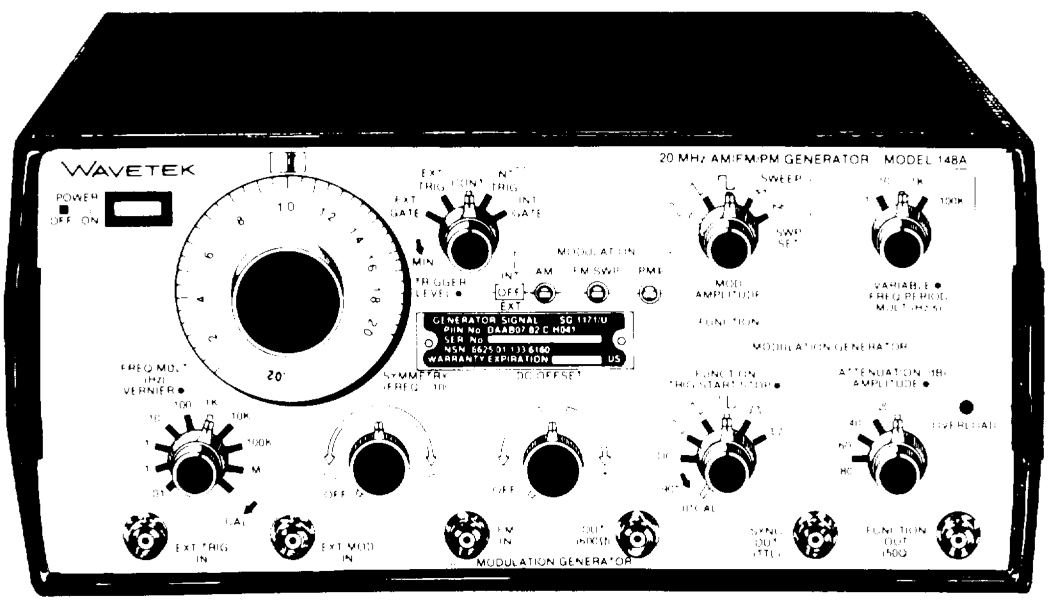
CAUTION

NOTE

REMOVE

INSTALL

2-184



EL8ZY005

Figure 1-1. Signal Generator SG-1171/U

CHAPTER 1

INTRODUCTION

Section 1. GENERAL INFORMATION

1-1. SCOPE.

a. *Type of Manual:* General Support Maintenance Manual.

b. *Equipment Name and Model Number:* Signal Generator SG-1171/U.

c. *Purpose of Equipment:* To provide precision source of sine, square, triangle, ramp and pulse waveforms for use in direct and general support of radio receivers, transmitters and associated electronic equipment.

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

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

1-3. MAINTENANCE FORMS, RECORDS AND REPORTS.

a. *Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used far 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 in AR 735-11-2/DLAR 4140.55/ NAVMATINST 4355.73B/AFR 400-54/MCO 4430.3H.

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/NAVSUPlNST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 450015.

1-4. CALIBRATION.

Procedures for Signal Generator SG-1171/U are found in TB 9-6625-2102-35.

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

Demolition and destruction of electronic equipment will be under direction of the commander and in accordance with TM 750-244-2.

1-6. PREPARATION FOR STORAGE OR SHIPMENT.

For Information and Instructions on packaging and administrative storage, refer to chapter 2, section V.

1-7. QUALITY ASSURANCE/QUALITY CONTROL.

Maintenance standards for Signal Generator SG-1171/U are given in the maintenance procedures By performing the maintenance procedures, quality control of the equipment will be maintained.

1-8. NOMENCLATURE CROSS-REFERENCE LIST.

Common names will be used when major components of the signal generator are mentioned in this manual

NOTE

Official nomenclature must be used when filling out report forms or looking up technical manuals.

Common Name	Official Nomenclature
Signal generator	Signal Generator SG-1171/U

1-9. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5023. We'll send you a reply.

1-10. WARRANTY INFORMATION.

The signal generator is warranted by Wavetek Corporation, Inc. for one year Warranty starts on the date of shipment to the original buyer and is on the Instrument name plate Promptly report all defects in material or workmanship to your supervisor who will take appropriate action.

Section II. EQUIPMENT DESCRIPTION.

1-11. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

For Information on equipment characteristics, capabilities, and features of Signal Generator SG-1171/U, refer to TM 11-6625-3051-12.

1-12. EQUIPMENT DATA.

For information on equipment data of Signal Generator SG-1171/U, refer to TM 11-6625-3051-12.

Section III. PRINCIPLES OF OPERATION

1-13. FUNCTIONAL BLOCK DIAGRAM ANALYSIS.

This section contains a list of all major functions in the signal generator by function number Each numbered item in the list contains functional operation data of major circuits and supportive block diagrams. An overall block diagram showing functional block interconnections is given in figure FO-2. Each functional block is numbered and given a common name for ease of identification and location.

1. **VOLTAGE CONTROLLED GENERATOR (VCG) SUMMING AMPLIFIER FUNCTION** (Figure 1-2). Produces variable voltage output that is sum of frequency control inputs. Inputs are from frequency dial pot, VERNIER pot and **22** MODULATION CONTROL function. Input descriptions are as follows

- Frequency Dial Pot: Gives man frequency control of man generator Frequency dial pot and VERNIER pot work together to set output frequency Setting on frequency dial pot IS multiplied by FREQ MULT range switch setting.

- VERNIER Pot: Gives fine frequency control of main generator Works with frequency dial pot to set output frequency.

- FM/SWP Input: Switch selected input from **22** MODULATION CONTROL function Can be from external source or from modulation generator.

- PM (ϕ) Input: Switch selected input from **22** MODULATION CONTROL function Can be from external source or from modulation generator Input differentiated prior to summing

Inputs to summing amplifier are summed by summing amplifier U1 into single voltage proportional to sum of inputs. Frequency dial pot accuracy set at top and bottom of ranges by TOD (Top Of Dial) frequency adjust and 1001 frequency adjust. High frequency symmetry is adjusted by VCG (Voltage Controlled Generator) null adjust

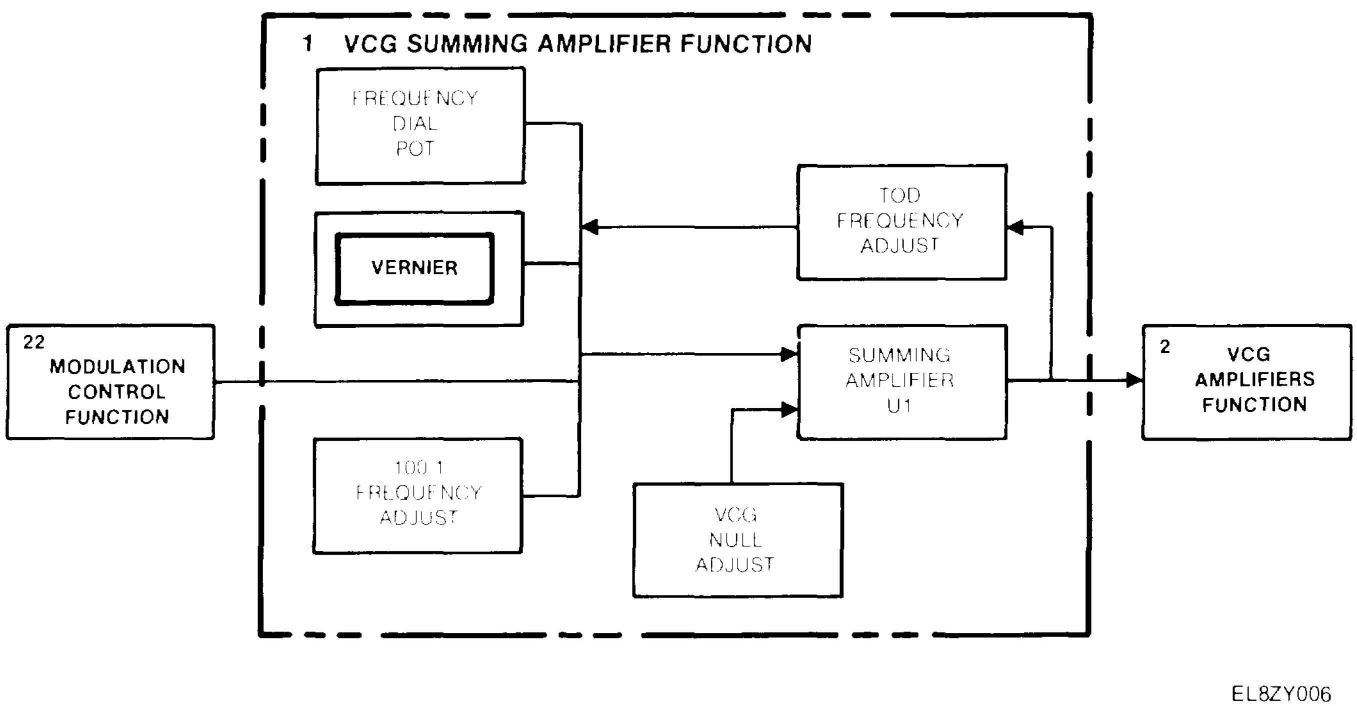


Figure 1-2. VCG Summing Amplifier Functional Block Diagram.

2. **VCG AMPLIFIER FUNCTION** (Figure 1-3). Receives voltage input from 1 VCG SUMMING AMPLIFIER function Produces two equal and opposite current outputs proportional to voltage input to 3 CURRENT SOURCE function and 4 CURRENT SINK function

Input voltage applied to voltage follower U4. Voltage follower U4 and current regulator Q2 form current sink. Feedback from current regulator Q2 to voltage follower U4 maintains current output proportional to voltage input. Current regulator Q2, SYMMETRY control, and current regulator Q1 form constant current path Voltage follower U2 and current regulator Q1 form current source referenced to ground Feedback from current regulator Q1 maintains control input to voltage follower U1 at zero volts Current source symmetry controlled by 1000:1 Symm adjust while current sink symmetry set by TOD (Top Of Dial) Symm adjust.

Using SYMMETRY control Increases resistance in constant current path and provides control voltage from **buffer amp U5. Increase in current path resistance causes drop in output frequency by factor of ten on any range. Applying control voltage changes ratio of current source to current sink output and provides variable control of pulse duty cycle, sawtooth ramps, and nonsymmetrical sine waves.**

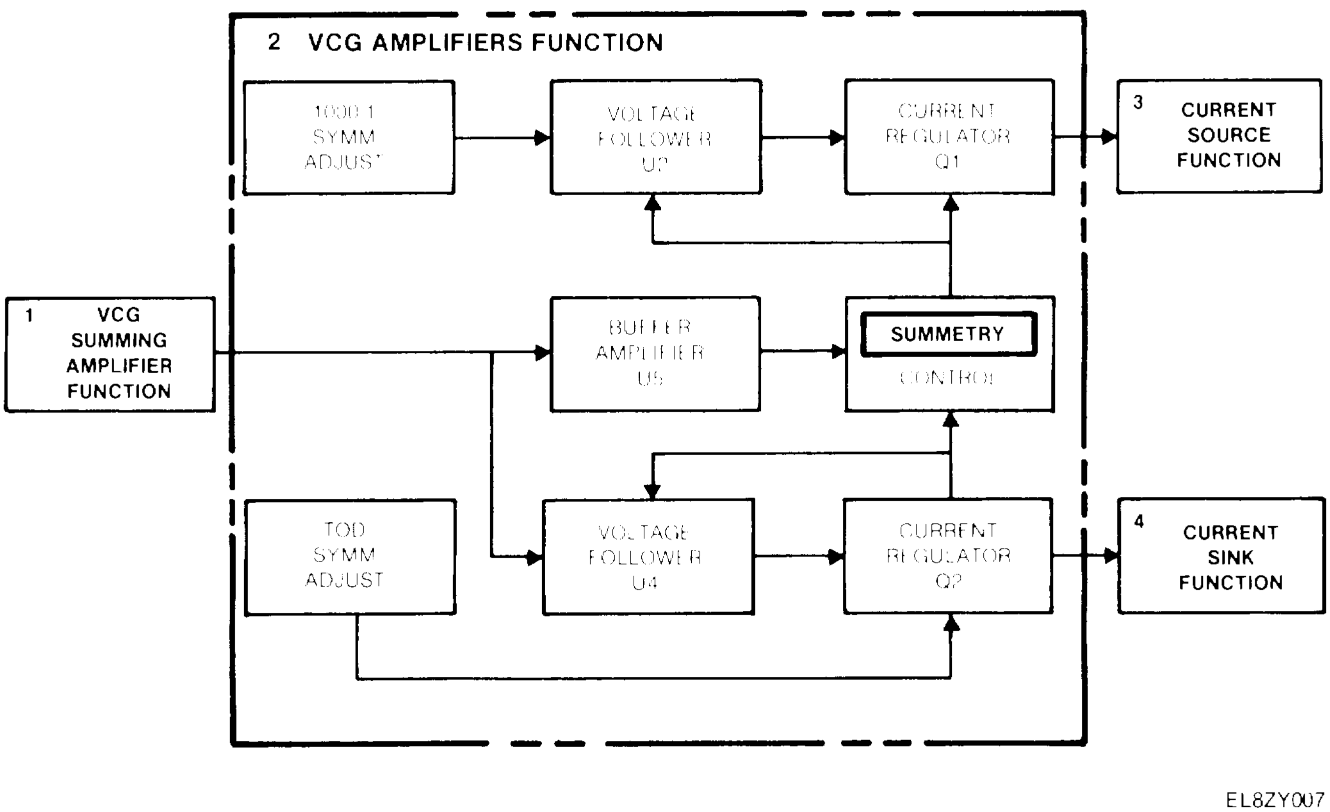


Figure 1-3. VCG Amplifier Functional Block Diagram.

3. **CURRENT SOURCE FUNCTION** (Figure 1-4). Receives voltage input from **2** VCG AMPLIFIERS function. Provides positive current signal to **5** CURRENT SWITCH function and compensation signal to **14** TRIGGER BASELINE COMPENSATION function.

Voltage follower U5 and current regulator Q4 form voltage-to-current converter Output of current regulator 04 directly proportional to voltage input of voltage follower U5. Sample of current through current regulator Q4 sent to **14** TRIGGER BASELINE COMPENSATION function. FREQ/MULT switch provides current regulator compensation on high frequency ranges.

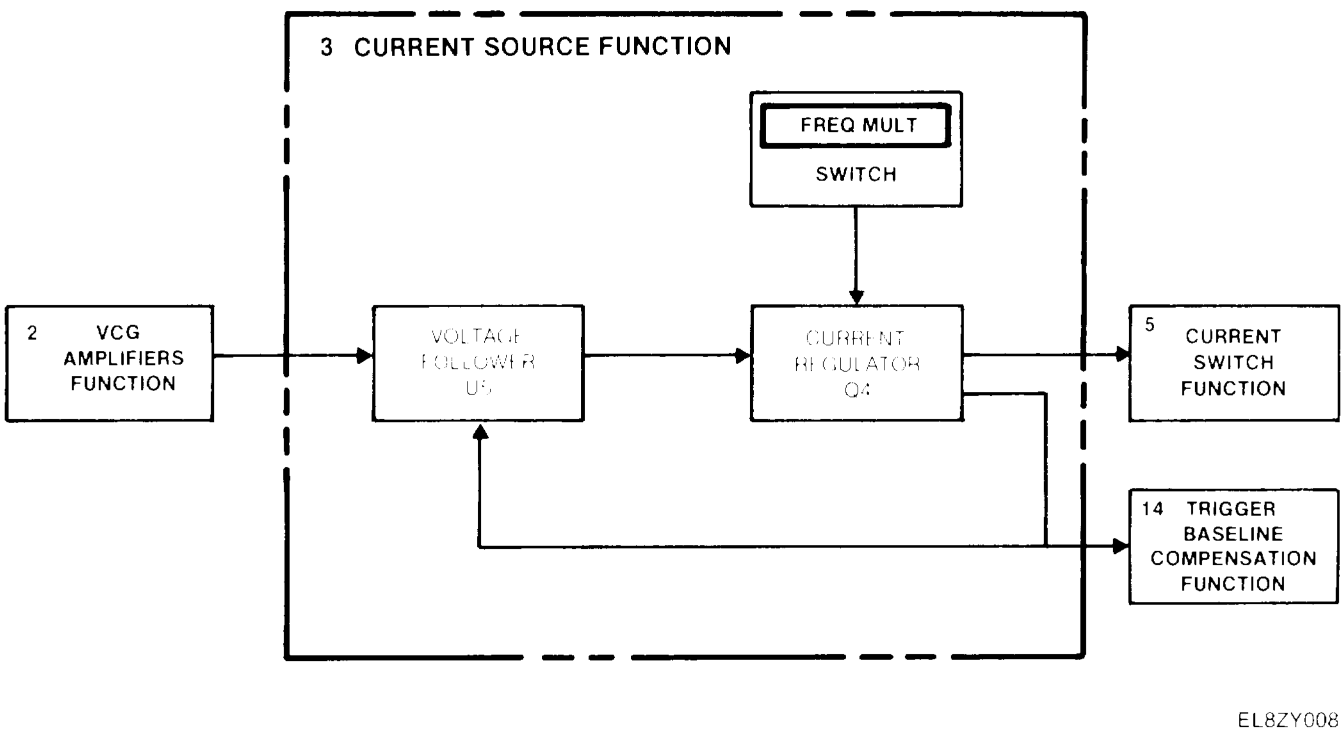


Figure 1-4. Current Source Function Block Diagram.

4. **CURRENT SINK FUNCTION** (Figure 1-5). Receives voltage input from 2 VCG AMPLIFIERS function. Provides negative current signal to 5 CURRENT SWITCH function.

Voltage follower U6 and current regulator Q5 form voltage-to-current converter that changes input control voltage to output current signal Output of current regulator Q5 is directly proportional to voltage input of voltage follower U6. FREQ/MULT switch provides current regulator with compensation on high frequency ranges.

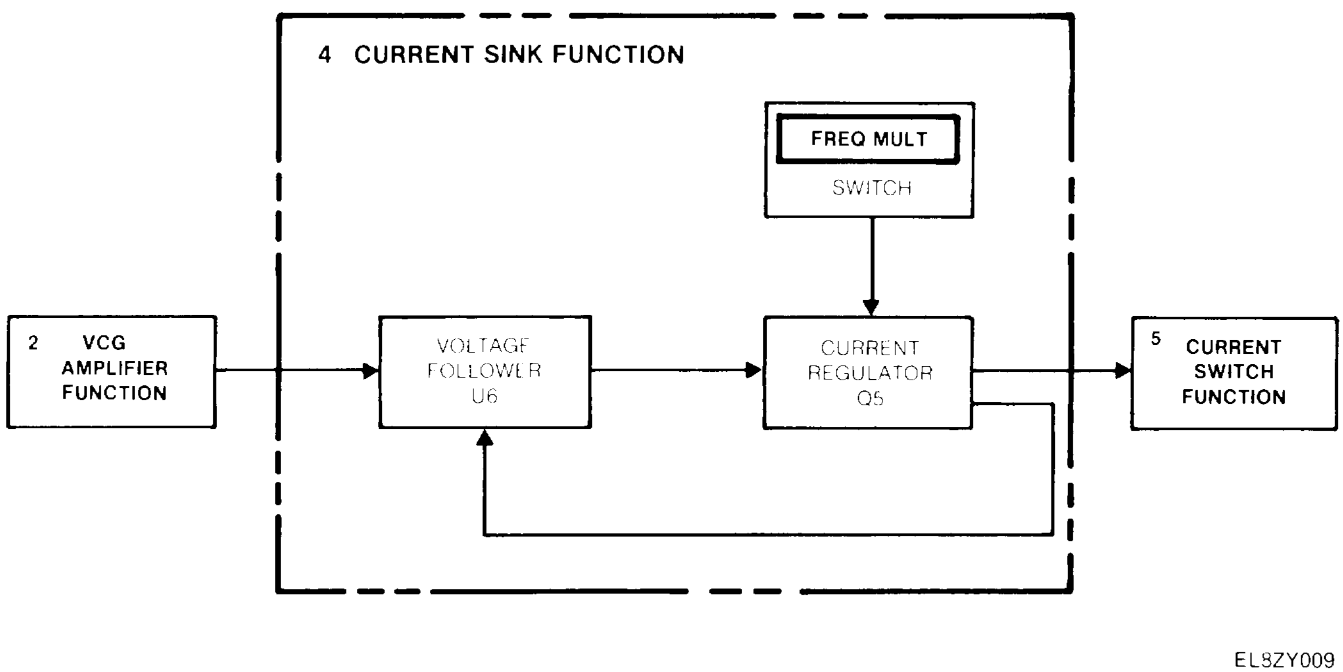


Figure 1-5. Current Sink Functional Block Diagram.

5. **CURRENT SWITCH FUNCTION** (Figure 1-6). Controlled by square wave input from 7 HYSTERESIS SWITCH function Receives positive and negative current inputs from **3** CURRENT SOURCE function and **4** CURRENT SINK function. Outputs selected current signal to **16** CAPACITANCE MULTIPLIER function and square wave to **13** TRIGGER LOGIC function.

Emitter followers Q24 and 025 apply control square wave to diode bridge CR13 thru CR16. Also outputs square wave to **13** TRIGGER LOGIC function. Diode bridge CR13 thru CR16 alternately switches either positive or negative current input to **16** CAPACITANCE MULTIPLIER function.

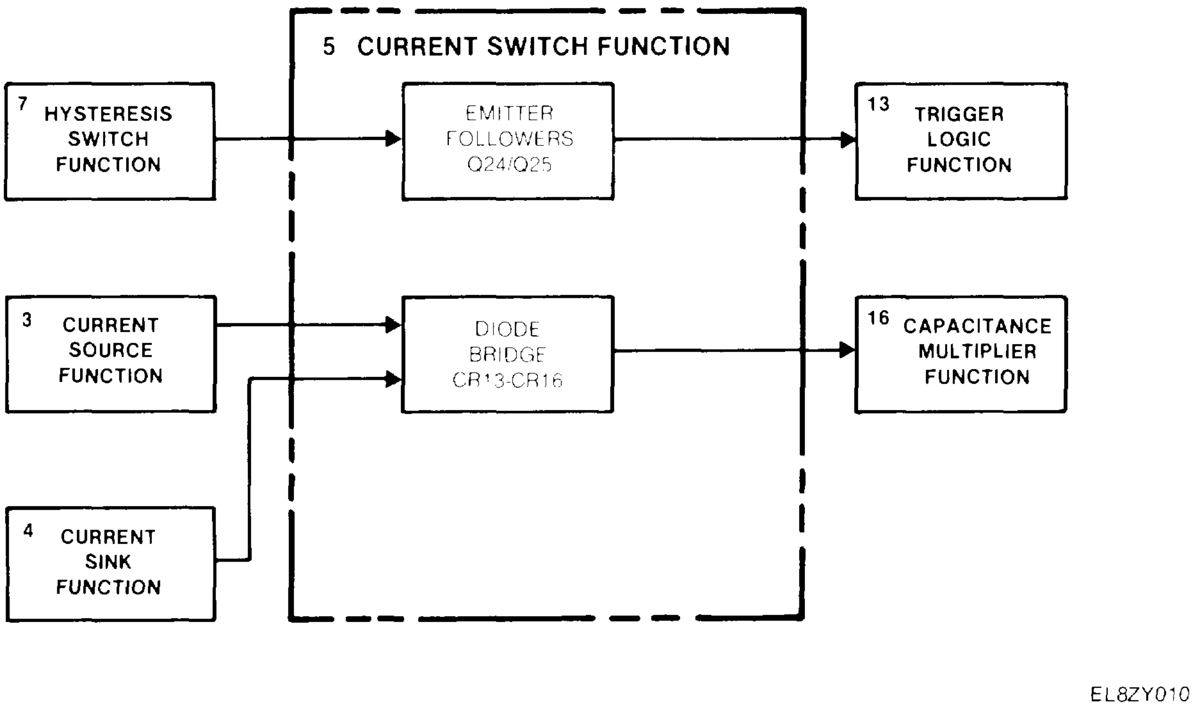


Figure 1-6. Current Switch Functional Block Diagram.

6. **TRIANGLE AMPLIFIER FUNCTION** (Figure 1-7). Receives capacitor charging voltage level from **16** CAPACITANCE MULTIPLIER and **5** CURRENT SWITCH function. Outputs triangle waveform to **7** HYSTERESIS SWITCH function and **8** TRIANGLE BUFFER function.

Capacitor charging voltage fed to source follower Q8. Source follower Q8 provides high Impedance for input signal Output of source follower Q8 is fed to emitter follower Q10. Emitter follower Q10 provides low impedance drive triangle waveform to 7 HYSTERESIS SWITCH function and **8** TRIANGLE BUFFER function. Triangle waveform also fed to emitter follower Q11. Emitter follower Q11 develops triangle waveform input compensation for **7** HYSTERESIS SWITCH function.

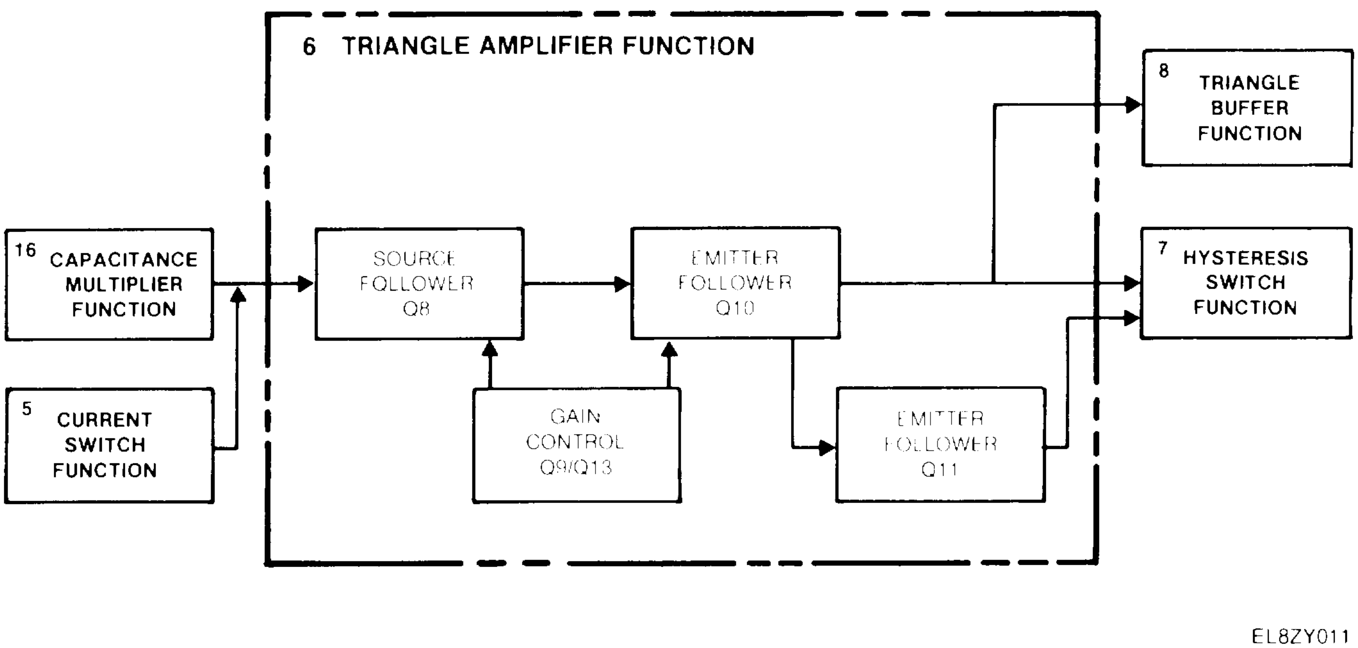


Figure 1-7. Triangle Amplifier Functional Block Diagram.

7. **HYSTERESIS SWITCH FUNCTION** (Figure 1-8). Receives triangle waveform from 6 TRIANGLE AMPLIFIER function arid external sync signal from **9** SYNC AMPLIFIER function Outputs control square wave to **5** CURRENT SWITCH function and buffered square wave to **9** SYNC AMPLIFIER function.

Triangle waveform from **6** TRIANGLE AMPLIFIER function fed to input network which provides positive and negative bias to double input comparator. Positive and negative transition limits set by peak adjusts R87 and R90. Double input comparator checks signal from input network and triggers output flip-flop Output flip-flop controls which input of double input comparator is active and also outputs control square wave to **5** CURRENT SWITCH function and buffered square wave to **9** SYNC AMPLIFIER function

Trigger signal from **9** SYNC AMPLIFIER function applied to double input comparator during external trigger operation.

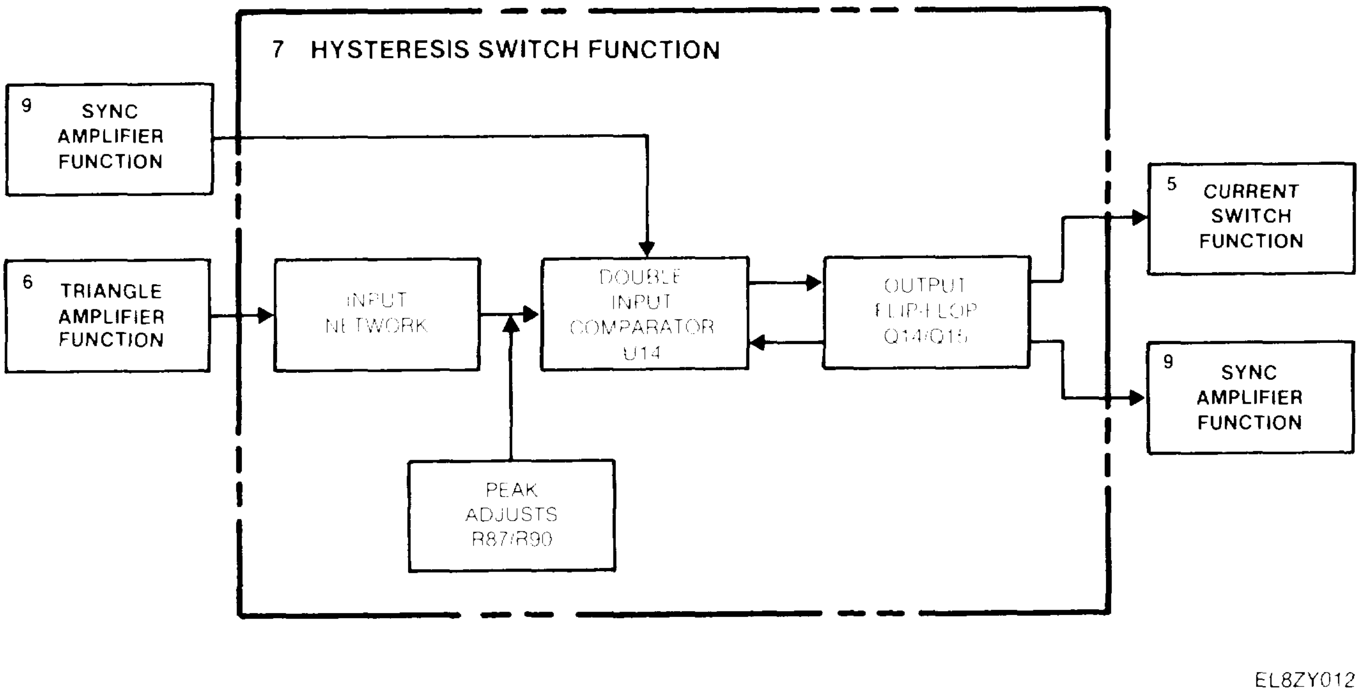


Figure 1-8. Hysteresis Switch Functional Block Diagram.

8. TRIANGLE BUFFER FUNCTION (Figure 1-9). Receives triangle waveform input from **6** TRIANGLE AMPLIFIER function Provides buffered triangle waveform output to **10** SIGNAL SHAPER function.

Differential amplifier Q17 and Q18, current source Q20, current sink Q19 and 2-stage emitter follower Q21 and Q22 form wide band dc amplifier. Differential amplifier Q17 and Q18 provide high impedance for input waveform and couple signal to current source Q20 and current sink Q19. Current source Q20 outputs to 2-stage emitter follower Q21 and Q22. 2-stage emitter follower Q21 and Q22 increases signal drive level and output to **10** SIGNAL SHAPER function. Portion of output is fed back (100 percent feedback) to differential amplifier Q17 and Q18 to set overall gain of function to one.

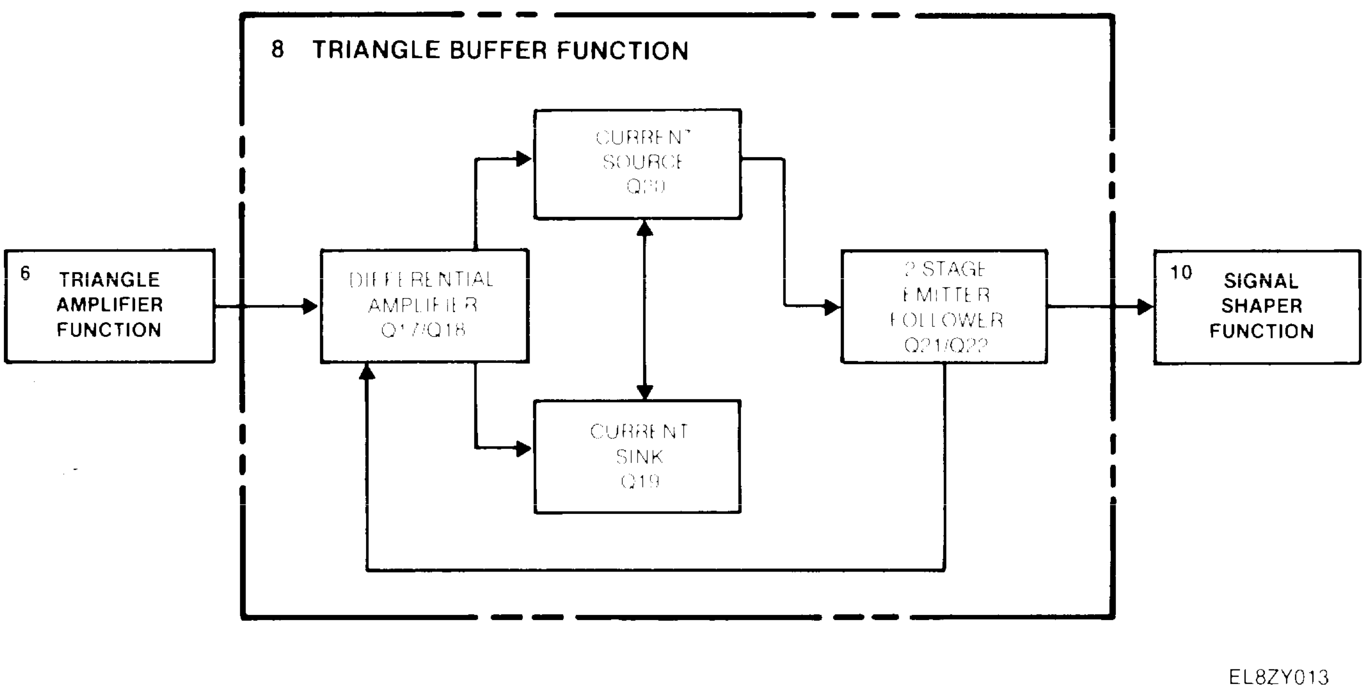


Figure 1-9. Triangle Buffer Functional Block Diagram.

9. **SYNC AMPLIFIER FUNCTION** (Figure 1-10). Receives external sync signal from SYNC IN rear panel connector, buffered square wave from **7** HYSTERESIS SWITCH function and disable signal from **10** SIGNAL SHAPER function. Outputs external sync signal to **7** HYSTERESIS SWITCH function and TTL level square wave signal to SYNC OUT front panel connector and to **10** SIGNAL SHAPER function.

External sync signal fed from rear panel connector to waveform shaping network and conditioned for use in **7** HYSTERESIS SWITCH function.

Buffered square wave from **7** HYSTERESIS SWITCH function fed to sync differential amplifier Q16 and Q23 and to square wave differential amplifier Q57 and Q58. Both differential amplifiers provide high impedance for input signals Sync differential amplifier Q16 and Q23 feeds TTL level square wave to SYNC OUT front panel connector. Square wave differential amplifier Q57 and Q58 feeds TTL level square to **10** SIGNAL SHAPER function when not disabled by input from **10** SIGNAL SHAPER function.

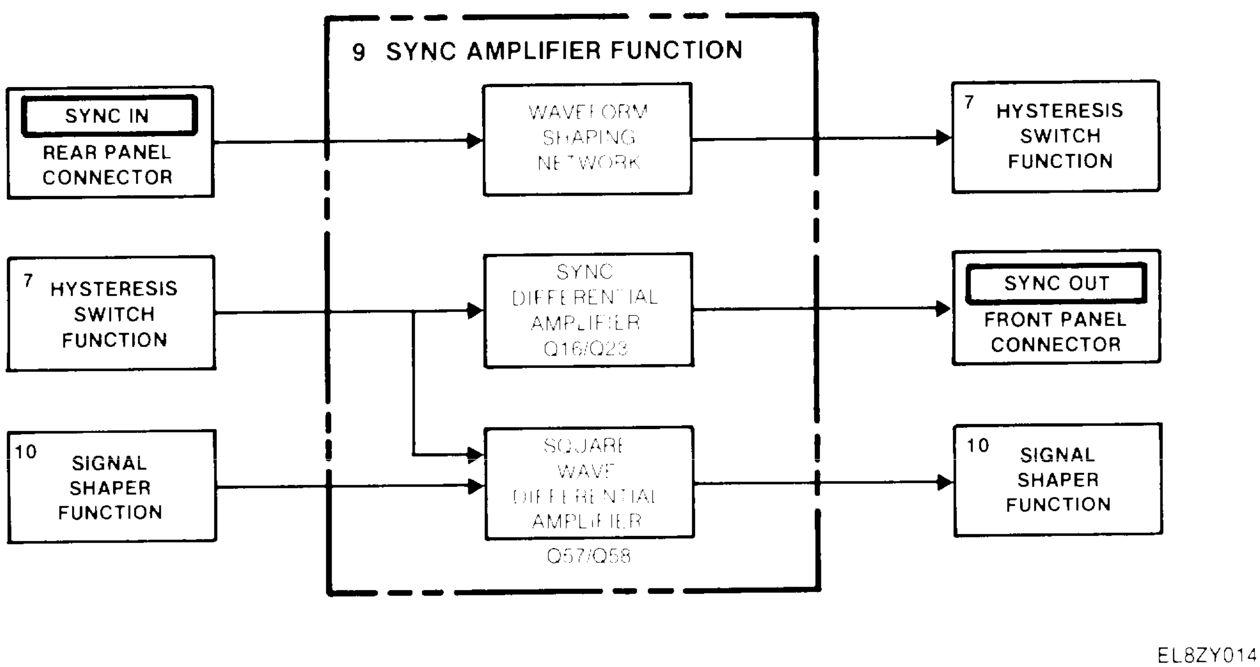


Figure 1-10. Sync Amplifier Functional Block Diagram.

10. SIGNAL SHAPER FUNCTION (Figure 1-11). Receives buffered triangle waveform from **8** TRIANGLE BUFFER function and TTL square wave from **9** SYNC AMPLIFIER function. Outputs square wave disable signal to **9** SYNC AMPLIFIER function and function selected signal to **11** MULTIPLIER function.

Triangle and square wave signals fed to section A of FUNCTION switch FUNCTION switch section A selects either triangle wave or square wave for processing. Output from section A fed to diode network CR28 thru CR35. Diode network CR28 thru CR35 selectively biased by sections C and D of FUNCTION switch for desired output waveform. Section E of FUNCTION switch will either bypass diode network CR28 thru CR35 during triangle waveform selection or provide proper output loading during all other function selections.

Square wave input provides square wave, positive pulse and negative pulse outputs. Triangle waveform inputs provide triangle waveform and sine wave outputs. Ground input provides dc output.

Section B of FUNCTION switch provides disable signal for **9** SYNC AMPLIFIER function during dc, sine and triangle wave selection.

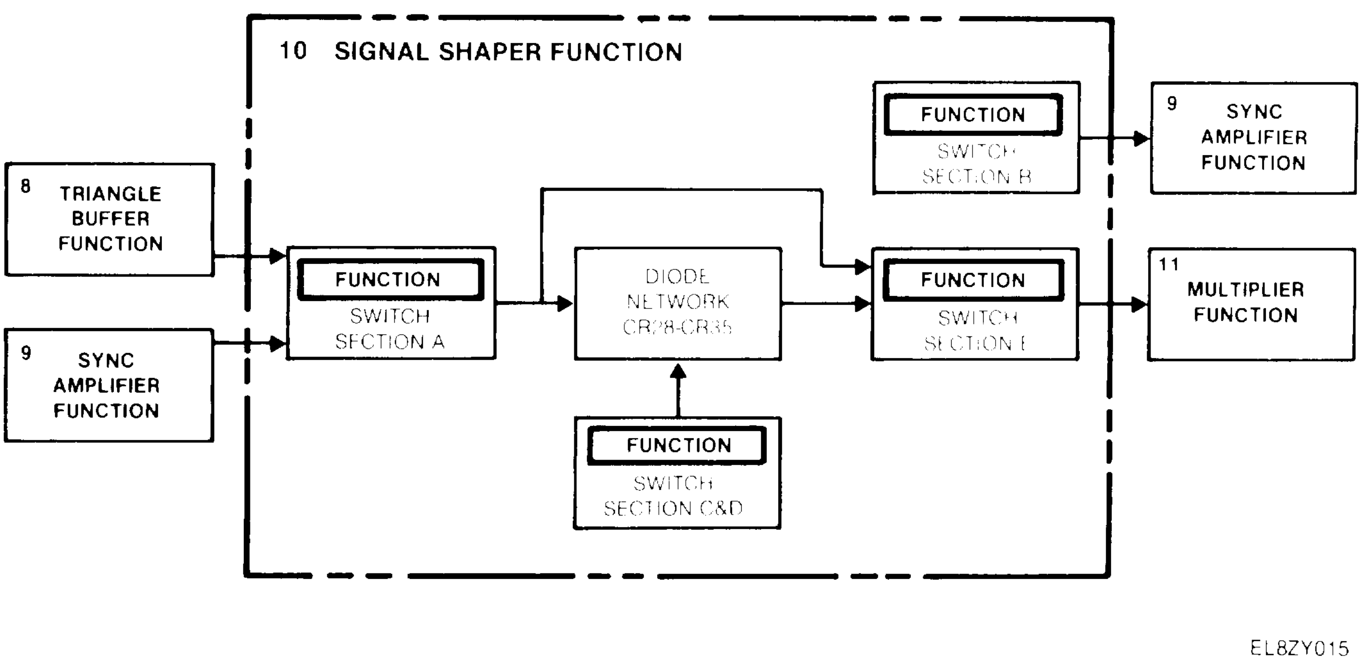


Figure 1-11. Signal Shaper Functional Block Diagram.

11. MULTIPLIER FUNCTION (Figure 1-12). Receives shaped function waveform from **10** SIGNAL SHAPER function and modulation signal from **22** MODULATION CONTROL function Outputs modulated function waveform to **17** PREAMPLIFIER function.

Modulation signals from **22** MODULATION CONTROL function sent to control amplifier U18. Control amplifier U18 develops ether dc amplitude control signal or ac modulation signal for mixing in transconductance multiplier U15. Output of transconductance multiplier U15 fed to **10** SIGNAL SHAPER function. Transconductance multiplier U15 parameters set by multiplier adjustments Current mirror Q50 and Q52 effectively doubles transconductance multiplier U15 output and feeds composite signal to 17 PREAMPLIFIER function.

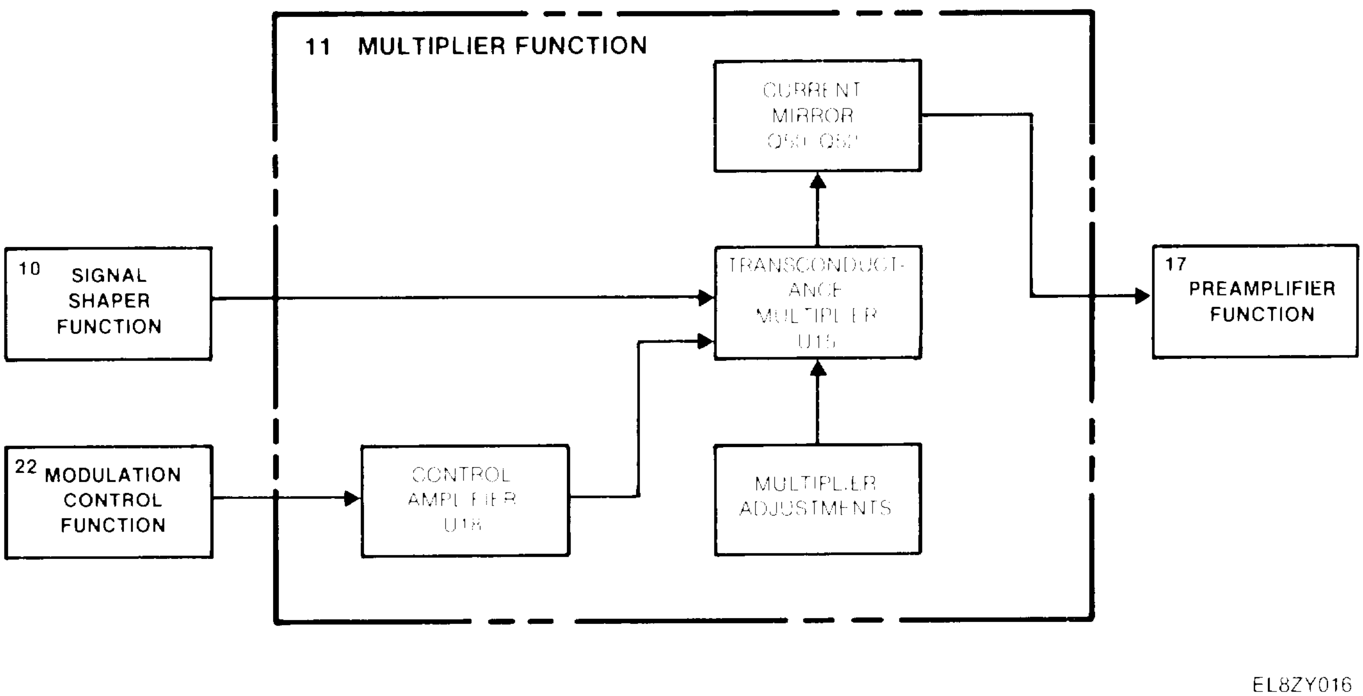


Figure 1-12. Multiplier Functional Block Diagram.

12. TRIGGER SIGNAL LIMITER FUNCTION (Figure 1-13). Receives buffered signal from **21** FUNCTION BUFFER function and trigger signal from EXT TRIG IN front panel connector. Outputs limited trigger signal to 13 TRIGGER LOGIC function

External trigger signal and output from **21** FUNCTION BUFFER function fed to MODE switch for selection, Output of MODE switch level controlled by TRIGGER LEVEL adjustment and fed to diode clipper CR1 and CR2. Clipped and limited trigger signal fed to high impedance differential amplifier Q1 and Q2. Differential amplifier Q1 and Q2 feed emitter follower Q3. Emitter follower Q3 outputs trigger signal to **13** TRIGGER LOGIC function. Portion of output trigger signal returned to differential amplifier Q1 and Q2 providing hysteresis cancellation

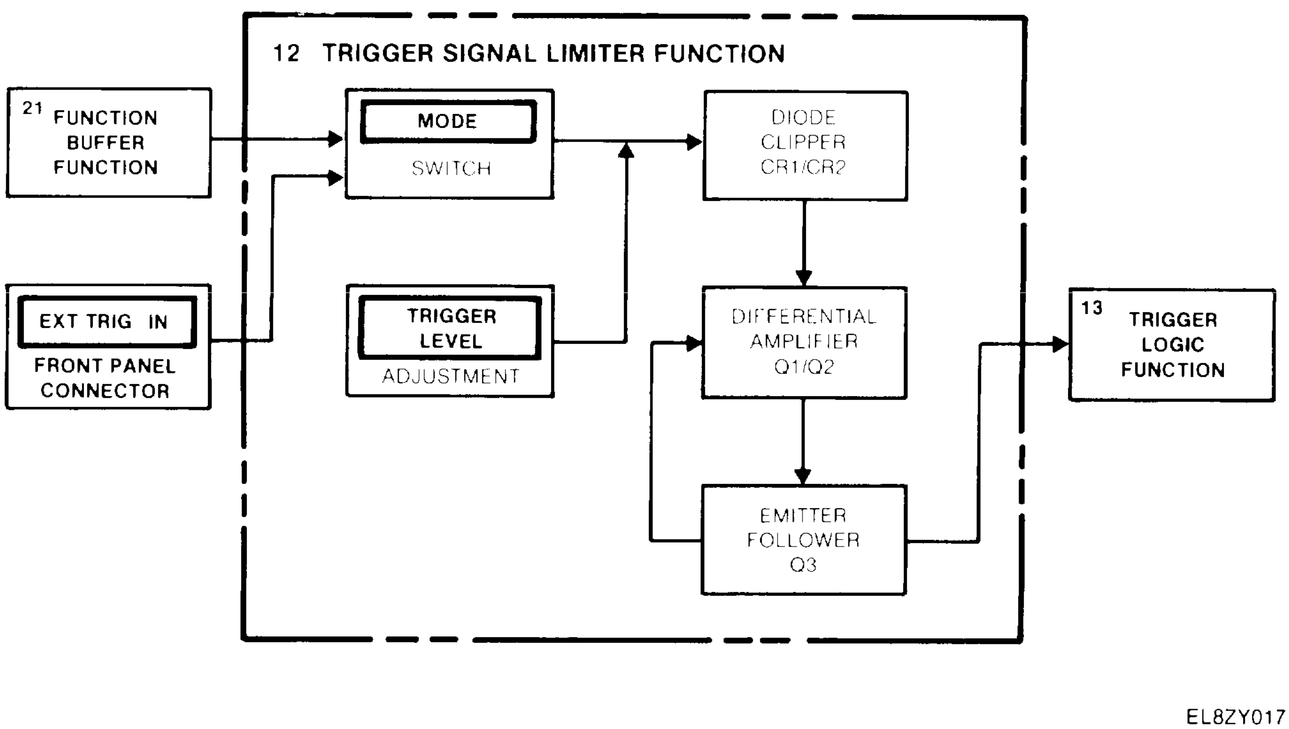


Figure 1-13. Trigger Signal Limiter Functional Block Diagram.

13. TRIGGER LOGIC FUNCTION (Figure 1-14). Receives selectable ground signal from **12** TRIGGER SIGNAL LIMITER function, square wave from **5** CURRENT SWITCH function and current sink signal from **15** TRIGGER AMPLIFIER function Outputs trigger signal to **15** TRIGGER AMPLIFIER function and Inhibit signal to **16** CAPACITANCE MULTIPLIER function.

Square wave from **5** CURRENT SWITCH function fed to TTL translator Q26 for conversion to TTL voltage levels Output of TTL translator Q26 sent trigger flip-flop U12 and diode gate CR21 and CR25.

Selectable ground signals applied to flip-flop control U13 which clears trigger flip-flop U12. Input from TTL translator Q26 triggers trigger flip-flop U12 and output fed to emitter follower Q27. Emitter follower Q27 and TTL translator Q26 feed diode gate CR21 and CR25. TRIG START/STOP control adjusts baseline of diode gate CR21 and CR25 output Diode gate CR21 and CR25 output sent to **15** TRIGGER AMPLIFIER function

Start/Stop diode CR27 receives current sink on/off signal from **15** TRIGGER AMPLIFIER function and sends inhibit signal to **16** CAPACITANCE MULTIPLIER function.

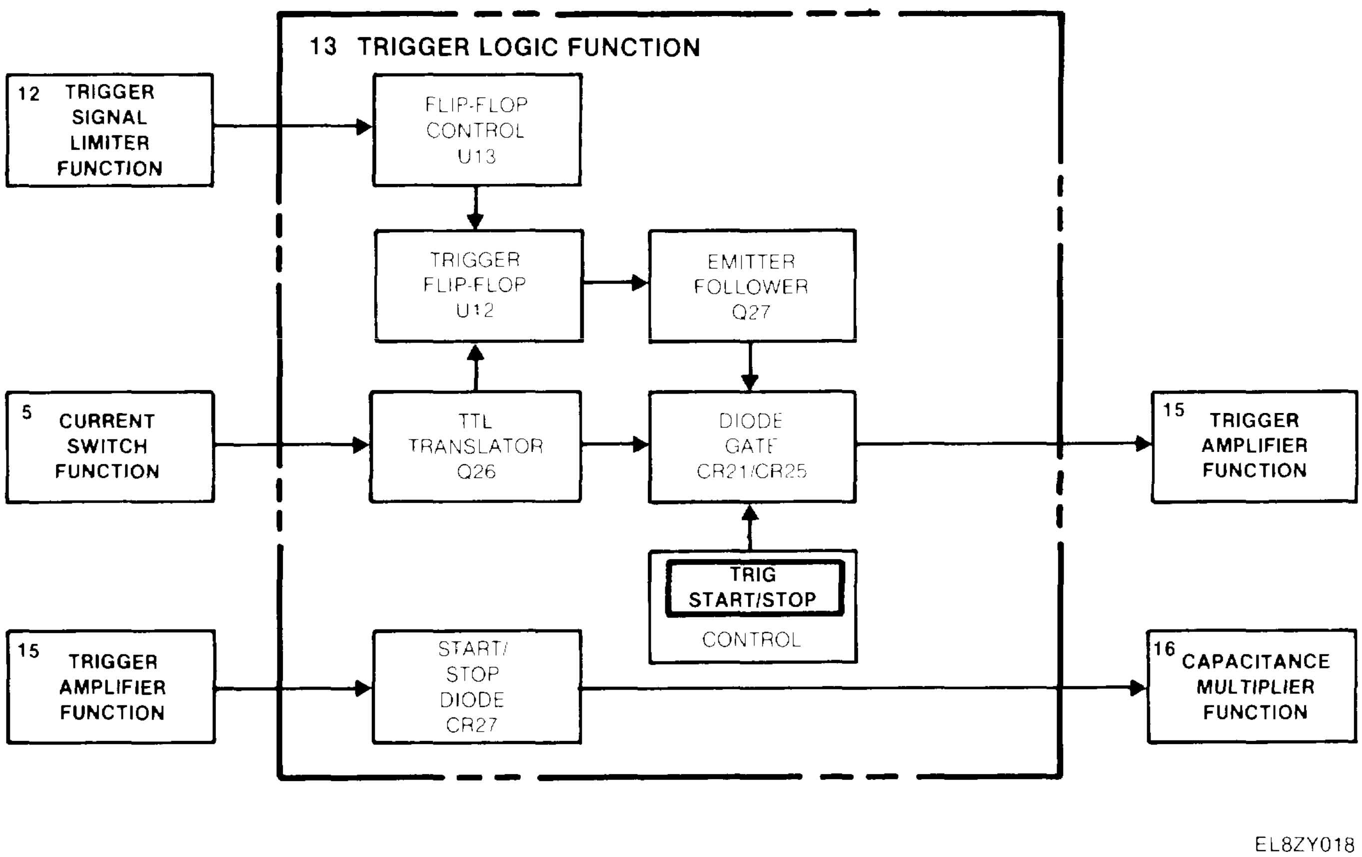


Figure 1-14. Trigger Logic Functional Block Diagram.

14. TRIGGER BASELINE COMPENSATION FUNCTION (Figure 1-15). Receives sample difference voltage from **3** CURRENT SOURCE function Develops input baseline compensation current for **15** TRIGGER AMPLIFIER function.

Sample difference voltage applied to voltage follower U9 and voltage follower U10. Output of voltage follower U9 used to control upper input of voltage follower U10. Voltage follower U10 and current regulator Q7 form voltage-to-current converter. Current from current regulator Q7 enters summing node of **15** TRIGGER AMPLIFIER function to become voltage offset. Offset voltage will vary in proportion to loading of **3** CURRENT SOURCE function.

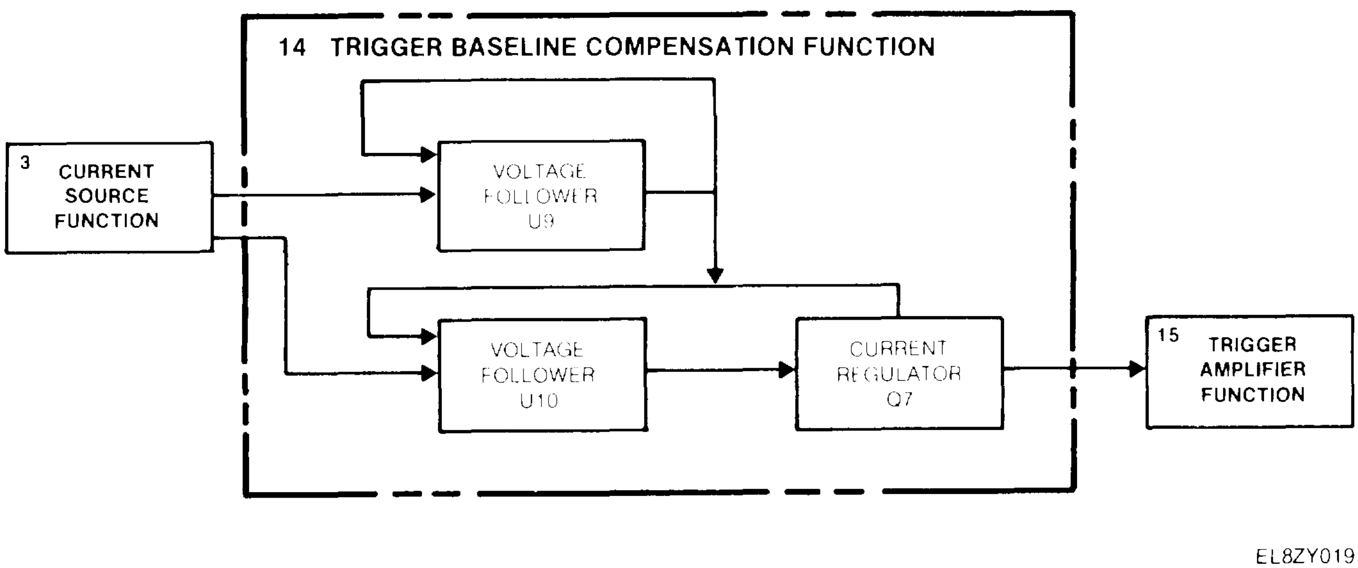


Figure 1-15. Trigger Baseline Compensation Functional Block Diagram.

15. TRIGGER AMPLIFIER FUNCTION (Figure 1-16). Receives baseline compensation current from **14** BASELINE COMPENSATION function and trigger signal from **13** TRIGGER LOGIC function. Outputs control current sink signal to **13** TRIGGER LOGIC function.

Trigger signal from **13** TRIGGER LOGIC function and baseline compensation from **14** BASELINE COMPENSATION function fed to dc amplifier Q28 and Q29. DC amplifier Q28 and Q29 controls dc voltage levels of ac amplifier Q30 and Q31. DC voltage levels in ac amplifier Q30 and Q31 set emitter follower Q32 dc stabilization. Sample of dc stabilization level returned to dc amplifier Q28 and Q29 as feedback compensation

Trigger signal also fed to ac amplifier Q30 and Q31. AC amplifier Q30 and Q31 amplify trigger signal and feeds emitter follower Q32. Emitter follower Q32 provides control current sink signal to **13** TRIGGER LOGIC function.

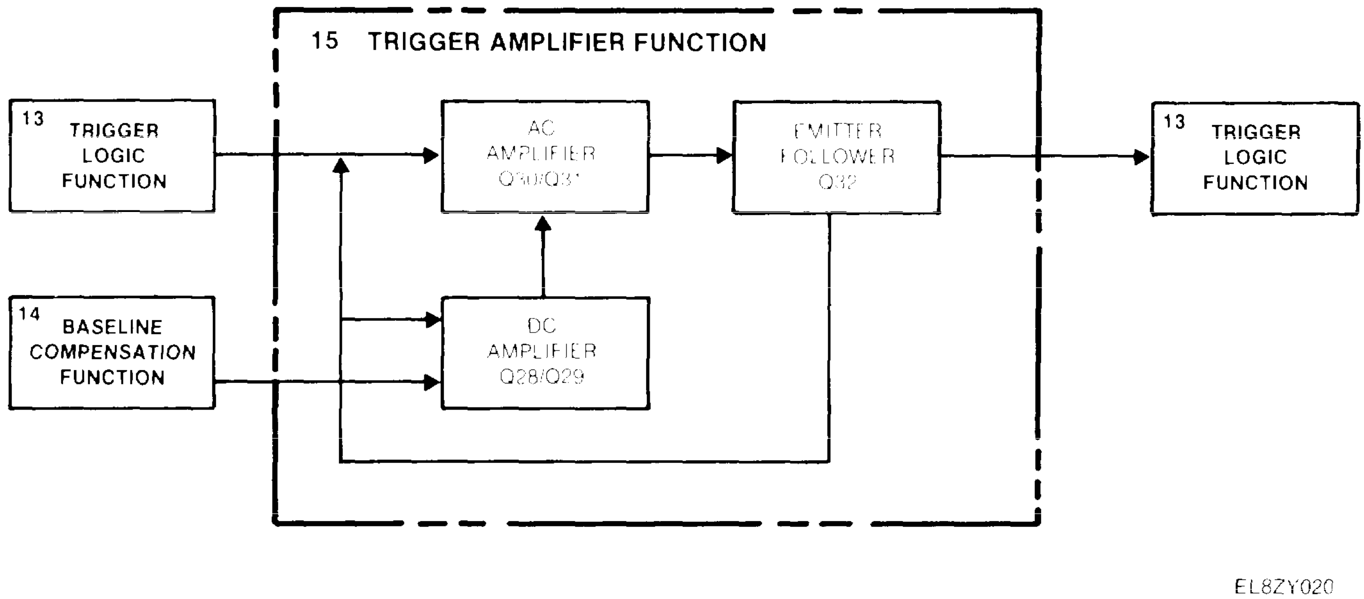


Figure 1-16. Trigger Amplifier Functional Block Diagram.

16. CAPACITANCE MULTIPLIER FUNCTION (Figure 1-17). Receives switched positive and negative charging currents from **5** CURRENT SWITCH function and charging inhibit signal from **13** TRIGGER LOGIC function

Switched positive and negative charging currents fed to timing capacitors Charging inhibit signal from **13** TRIGGER LOGIC FUNCTION controls start/stop operation of charging capacitors. FREQ MULT switch provides direct high frequency range selection for timing capacitors. It also provides indirect low frequency range selection by controlling capacitance multiplier circuit U7 and U8. Capacitance multiplier circuit U7 and U8 feed timing capacitors only on low ranges.

Timing capacitors charging signal fed to **6** TRIANGLE AMPLIFIER function.

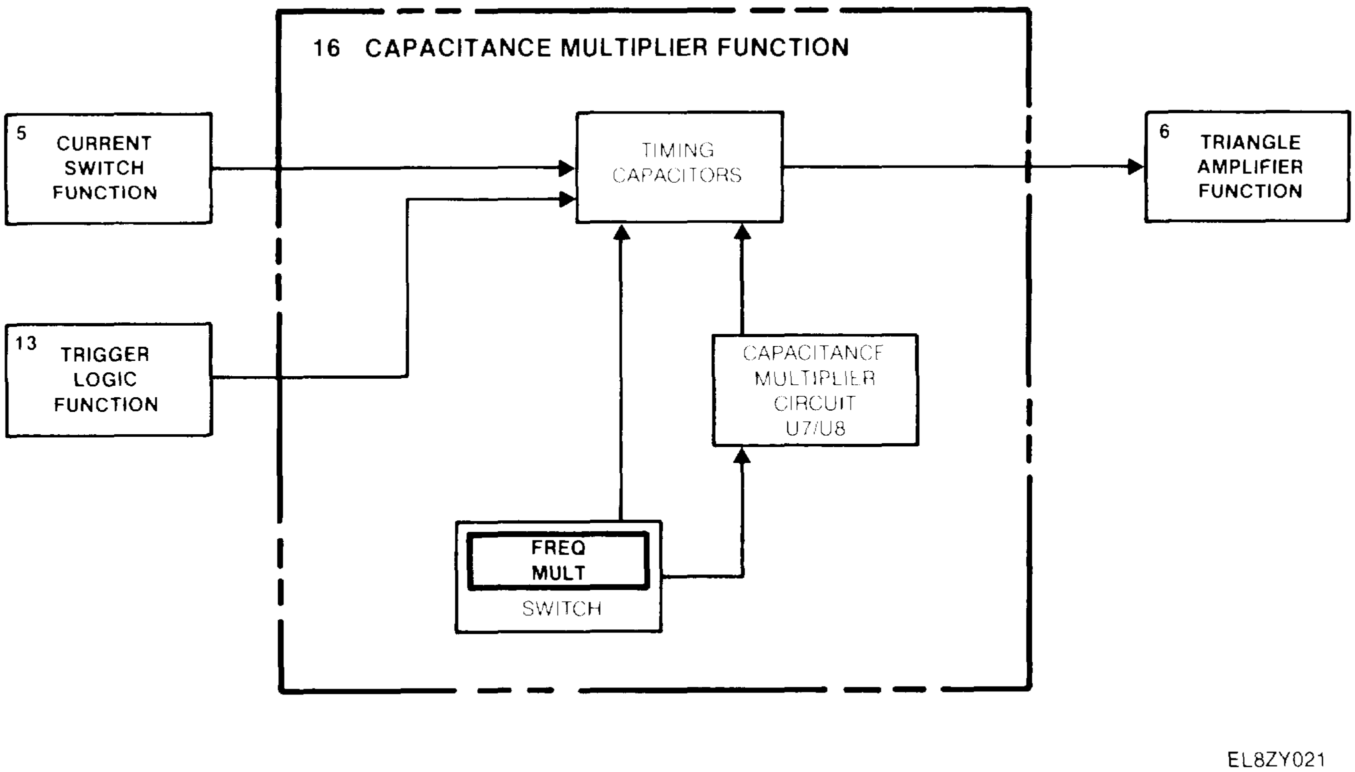


Figure 1-17. Capacitance Multiplier Functional Block Diagram.

17. PREAMPLIFIER FUNCTION (Figure 1-18). Receives low level composite signal from **11** MULTIPLIER function. Outputs amplified and stabilized composite signal to **18** OUTPUT AMPLIFIER function.

Stabilized composite signal fed to low frequency dc amplifier U17 Low frequency dc amplifier U17 controls dc levels in ac amplifier Q40 and Q41. DC levels in ac amplifier Q40 and Q41 set dc baseline level of ac amplifier Q42 and Q43 Any change in baseline level is fed back to low frequency dc amplifier U17 and cancel led.

Stabilized composite signal also fed to ac amplifier Q40 thru Q43 for amplification before being sent to **18** OUTPUT AMPLIFIER function.

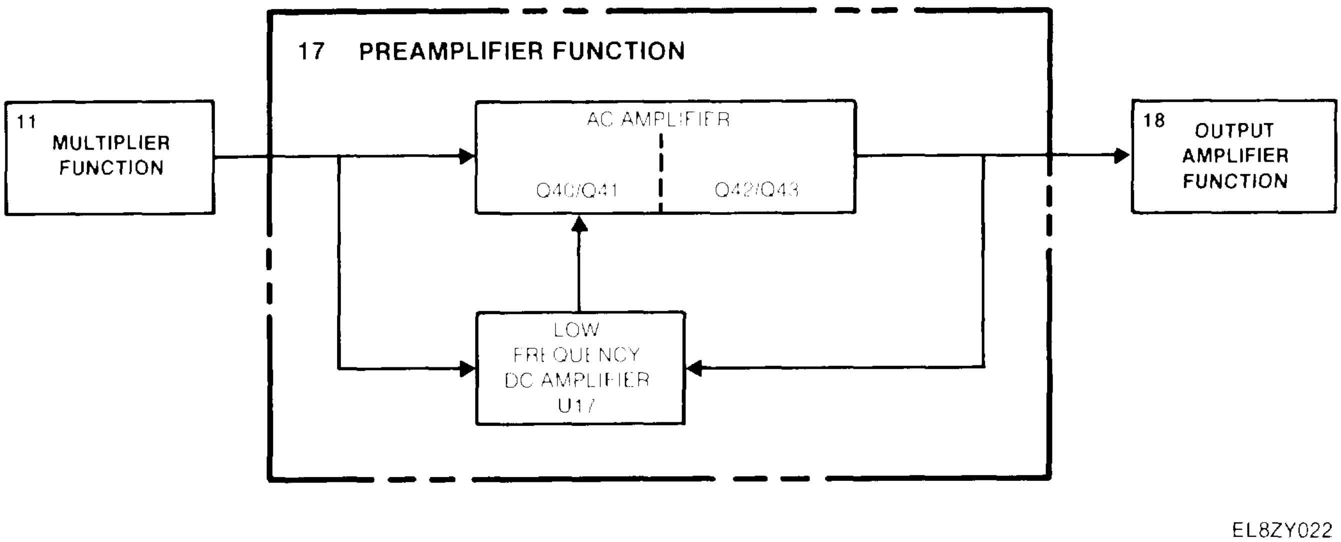


Figure 1-18. Preamplifier Functional Block Diagram.

18. OUTPUT AMPLIFIER FUNCTION (Figure 1-19). Receives amplified composite signal from **17** PREAMPLIFIER function. Supplies high level composite signal to **19** ATTENUATOR function.

Amplified composite signal fed to low frequency dc amplifier U19, Q37 and Q38. Low frequency dc amplifier U19, Q37 and Q38 uses amplified composite signal and feedback from power amplifier group to develop stabilization control for power amplifier Q47 and Q49. Power amplifier Q47 and Q49 dc level controls power amplifier Q51, Q53, Q54 and Q55 output baseline Any change in output baseline is fed back to low frequency dc amplifier U19, Q37 and Q38 for cancellation.

Amplified composite signal also fed to power amplifier Q46, Q47, Q48, Q49, Q51 Q53, Q54 and Q55 for high level amplification. Output of power amplifier Q46, Q47, Q48, Q49, Q51, Q53, Q54 and Q55 applied to **19** ATTENUATOR function.

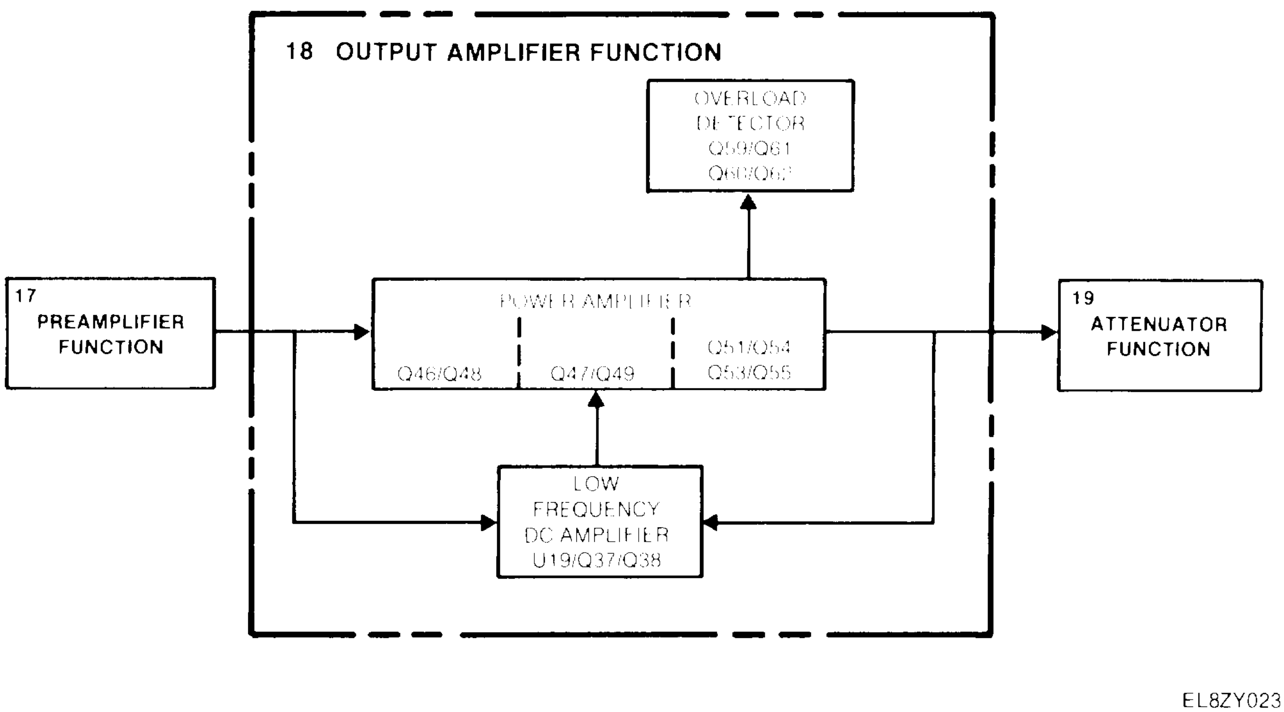


Figure 1-19. Output Amplifier Functional Block Diagram.

19. ATTENUATOR FUNCTION (Figure 1-20). Receives high level amplified signal from **18** OUTPUT AMPLIFIER function. Outputs stepped and variable level signals to FUNCTION OUT front panel connector.

High level amplified signal applied to ATTENUATION switch. Attenuation switch selects which resistors in resistor network are used to attenuate high level amplified signal to desired levels. Output is sent to FUNCTION OUT front panel connector.

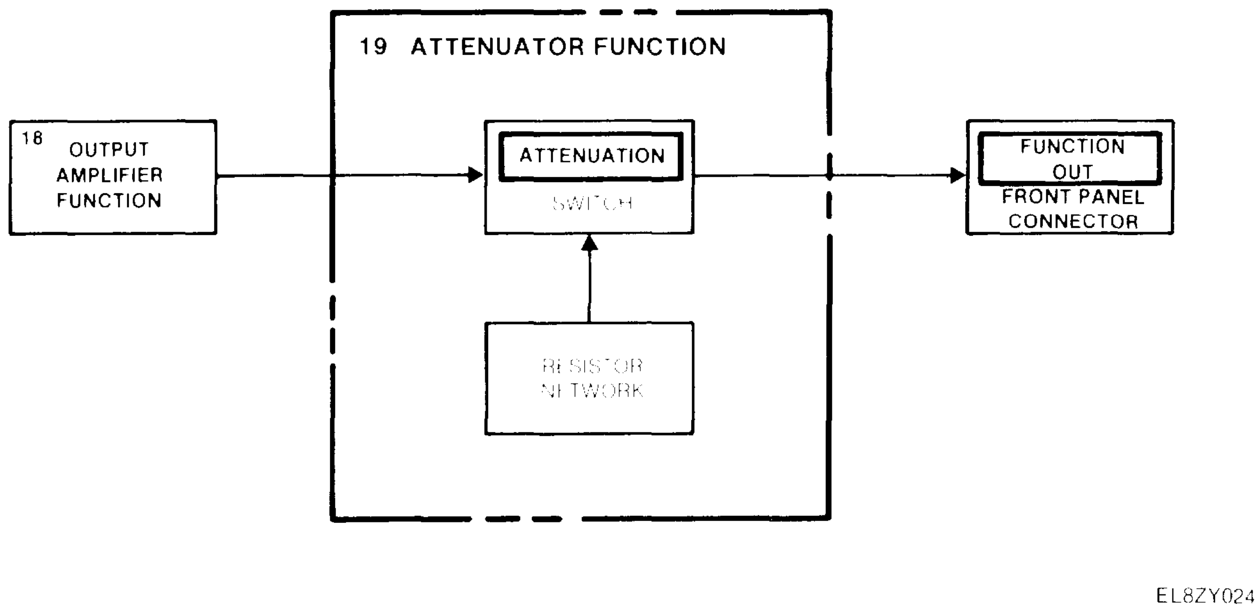


Figure 1-20. Attenuator Functional Block Diagram.

20. MODULATION GENERATOR FUNCTION (Figure 1-21). Receives dc sweep voltage from FM IN front panel connector. Outputs frequency selectable sine, triangle and square wave signals to **23** RAMP GENERATOR function.

Op amp V1A dc input voltages controlled by VARIABLE frequency adjustment. Output of op amp V1A fed to op amp V1B. Output of op amp V1B applied to function generator U2 frequency control input. Function generator U2 produces sine, triangle and square wave output within a selected range with frequency determined by dc level on frequency control input Function generator U2 frequency range controlled by FREQ/PERIOD MULT switch Symmetry adjustments minimize waveform distortion in function generator U2.

Applying dc sweep voltage from FM IN front panel connector to op amp V1A changes op amp V1A dc operating voltages at sweep rate Change is coupled to op amp V1B and to function generator U2. Signal out frequency of function generator U2 will vary at sweep rate. Output is then fed to **23** RAMP GENERATOR function.

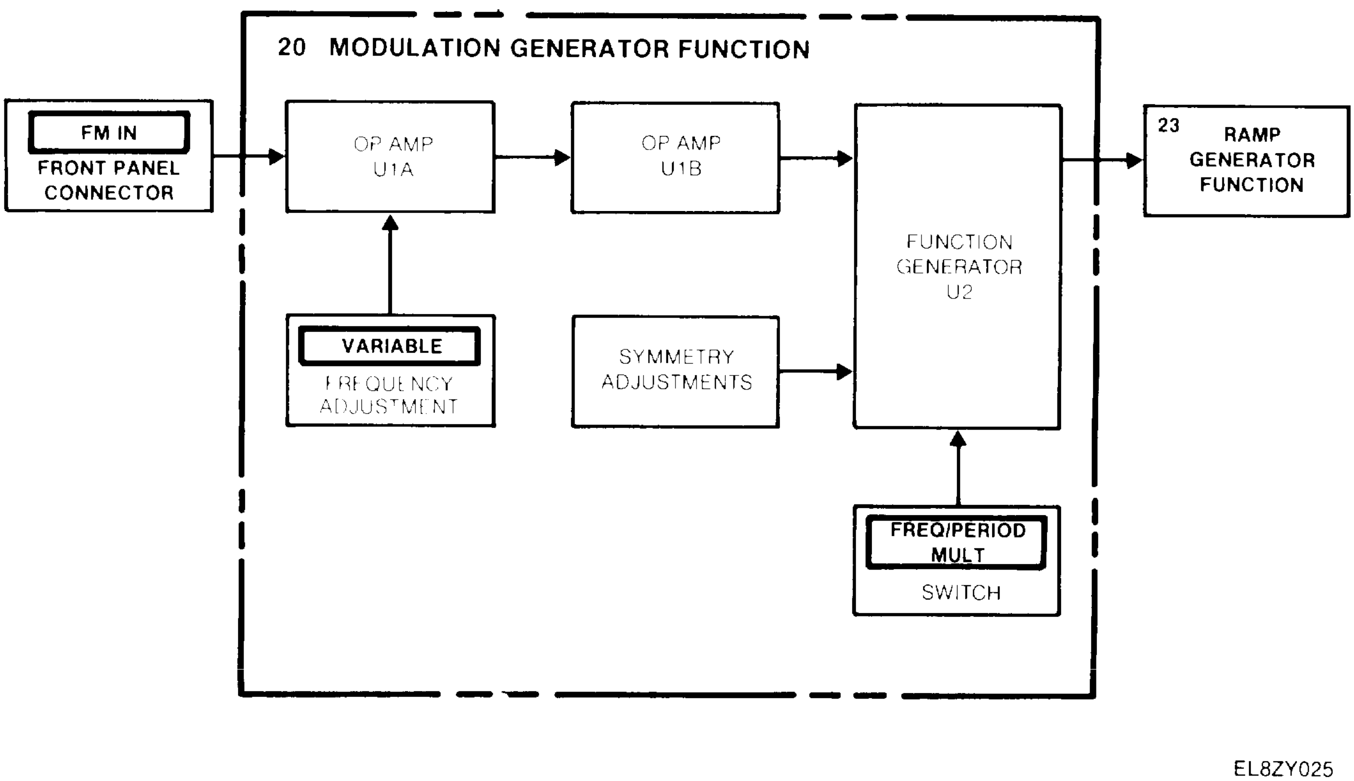


Figure 1-21. Modulation Generator Functional Block Diagram.

21. FUNCTION BUFFER FUNCTION (Figure 1 -22). Receives selected waveform signal from **23** RAMP GENERATOR function. Applies buffered waveform signal to **22** MODULATION CONTROL function and **12** TRIGGER SIGNAL LIMIT function.

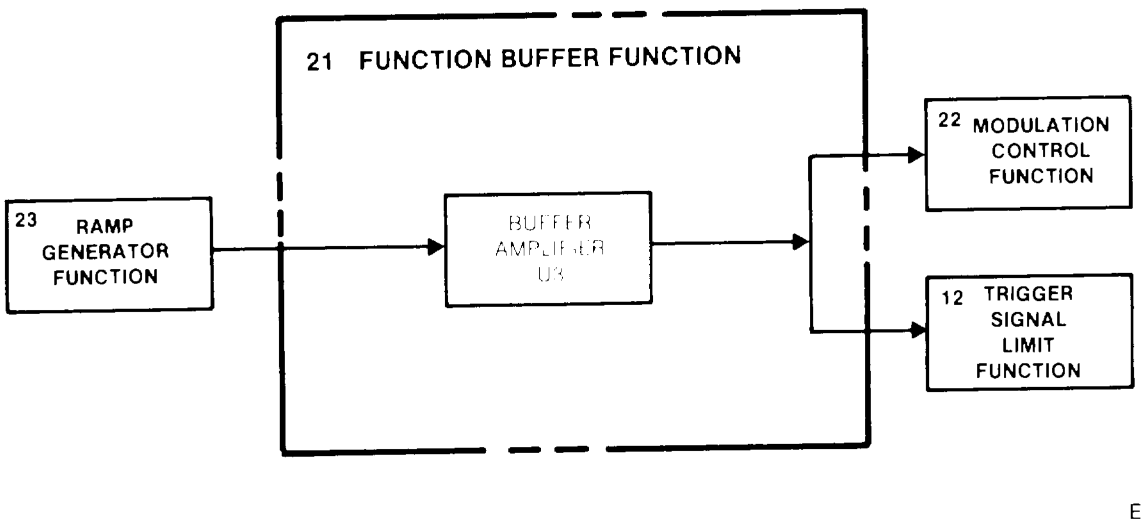


Figure 1-22. Function Buffer Functional Block Diagram.

22. MODULATION CONTROL FUNCTION (Figure 1-23). Receives selected waveform signal from **21** FUNCTION BUFFER function and signal from EXT MOD IN front panel connector, Outputs selected waveform signal to OUT (600 Ω) front panel connector, **11** MULTIPLIER function, or 1 VCG SUMMING AMPLIFIER function

Signal from EXT MOD IN front panel connector fed to AM switch, FM/SWP switch, and PM(ϕ) switch for routing to **11** MULTIPLIER function or **1** VCG SUMMING AMPLIFIER function. Selected waveform signal from **21** FUNCTION BUFFER function fed to MOD AMP adjustment for amplitude control Output of MOD AMP adjustment applied to AM switch, FM/SWP switch, and PM(ϕ) switch for routing to **11** MULTIPLIER Function or **3** VCG SUMMING AMPLIFIERS function.

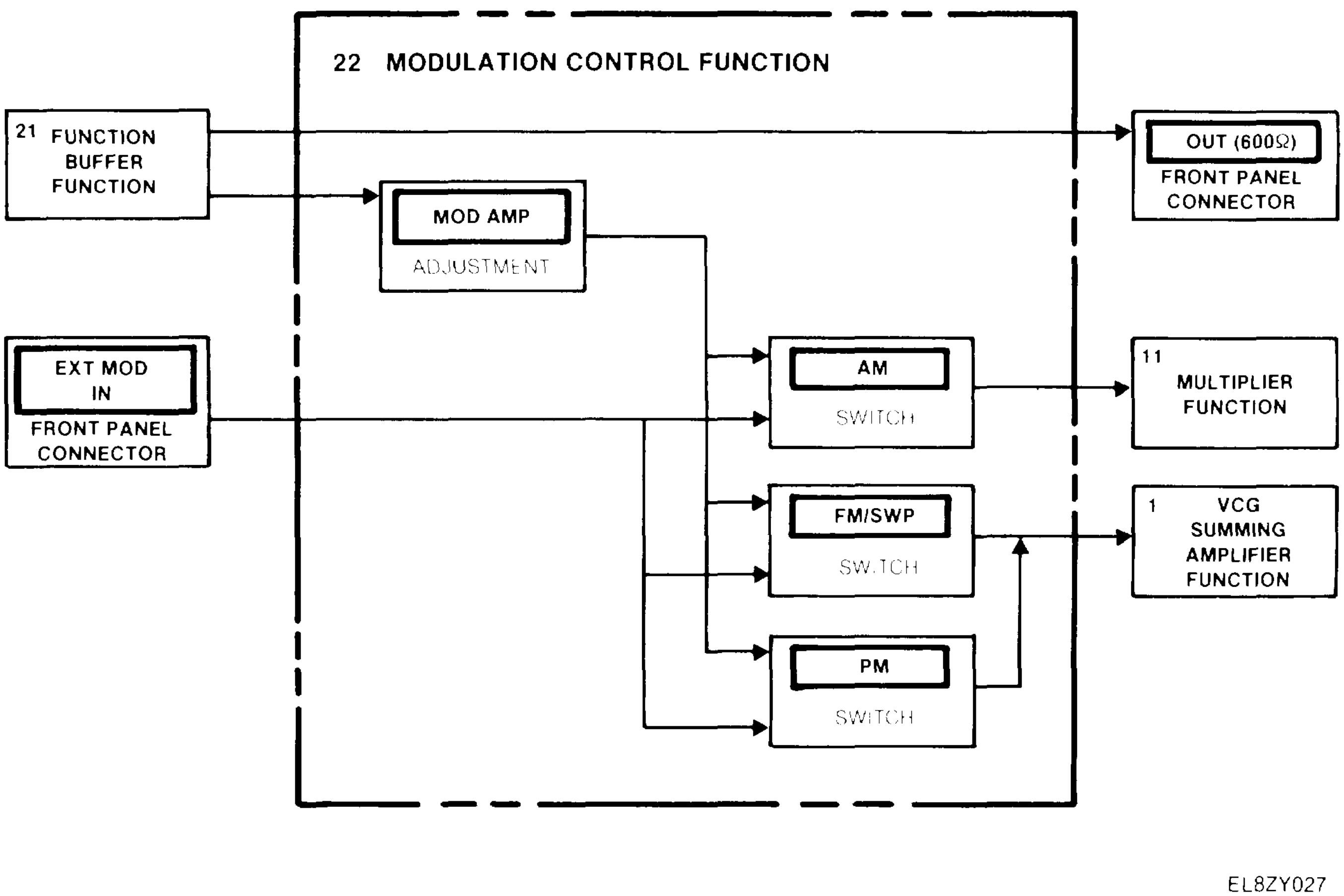


Figure 1-23. Modulation Control Functional Block Diagram.

23. RAMP GENERATOR FUNCTION (Figure 1-24). Receives sine, triangle and square wave signals from **20** MODULATION GENERATOR function. Outputs positive and negative-go[ng ramps to **24** RAMP BUFFER function and buffered sine, triangle, square and ramp signals to **21** FUNCTION BUFFER function

Sine, triangle or square signals are fed from **20** MODULATION GENERATOR function to FUNCTION switch FUNCTION switch sends triangle and square signals to balanced modulator U5 Balanced modulator U5 (controlled by modulator adjustments) mixes both inputs. Balanced modulator U5 outputs (positive and negative-going ramps) are doubled by current mirror Q4, Q5 and Q6 and sent to 24 RAMP BUFFER function **24** RAMP BUFFER function return's buffered ramp signals to FUNCTION switch for selection. All outputs from FUNCTION switch sent to **21** FUNCTION BUFFER function.

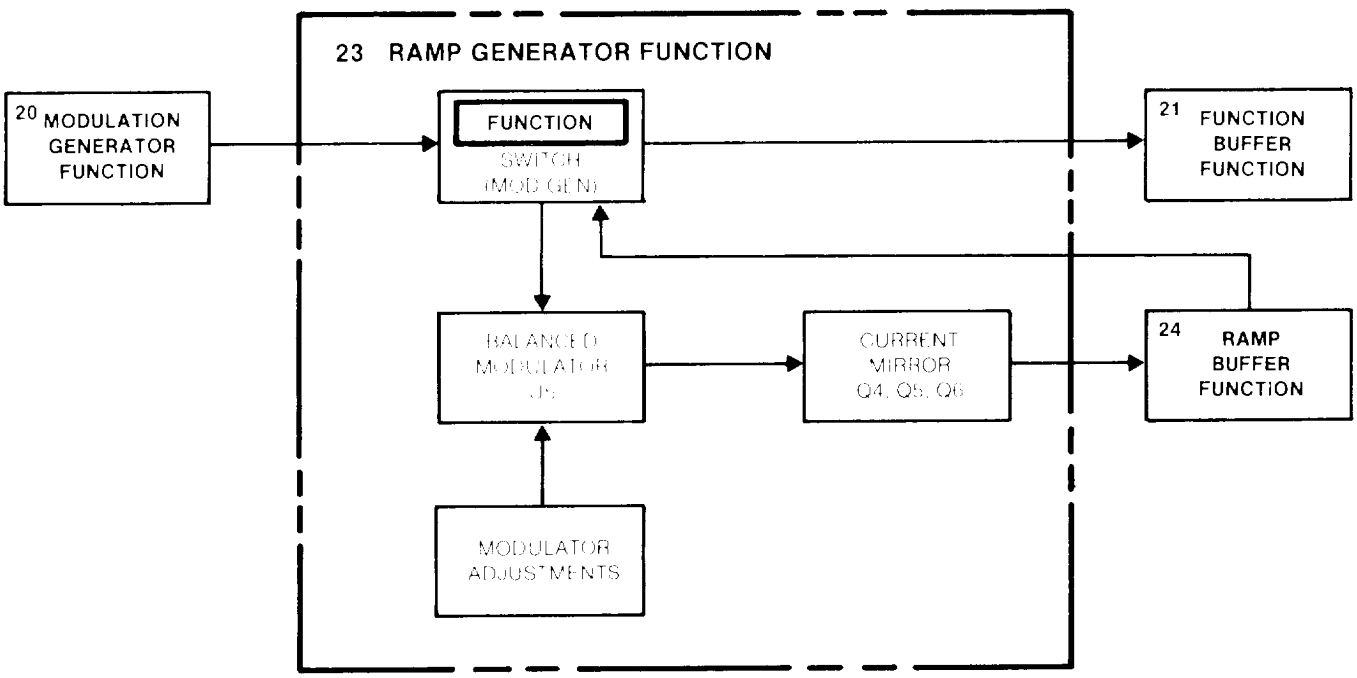


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Figure 1-24. Ramp Generator Functional Block Diagram.

24. RAMP BUFFER FUNCTION (Figure 1-25). Receives positive and negative-going ramp signals from 23 RAMP GENERATOR function. Positive and negative-going ramps are buffered in buffer amplifier U6 and returned back to 23 RAMP GENERATOR function.

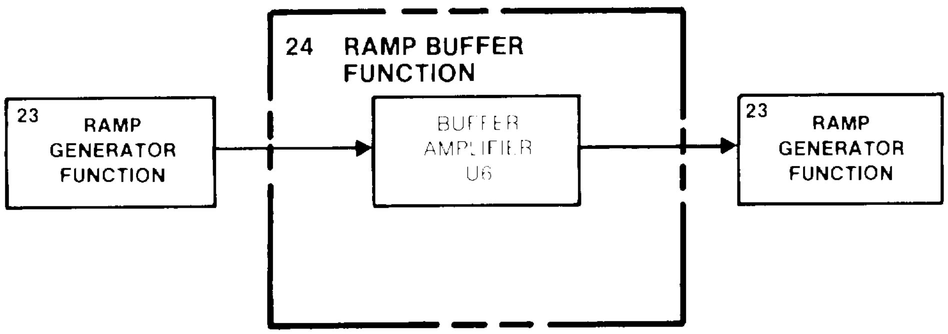


Figure 1-25. Ramp Buffer Functional Block Diagram.

25. ±24 V POWER SUPPLY FUNCTION (Figure 1-26). Receives unregulated ac supply voltage from POWER TRANSFORMER Supplies regulated 24 V positive and negative voltages to all USER FUNCTIONS.

Unregulated ac supply voltage from POWER TRANSFORMER fed to full wave bridge rectifier CR4 thru CR7 and rectified to unregulated dc voltages. Unregulated dc voltages are fed to 24 V positive regulator VR4 and 24 V negative regulator VRI 24 V positive regulator VR4 and 24 V negative regulator VR1 filter and regulate dc voltage for use in all USER FUNCTIONS.

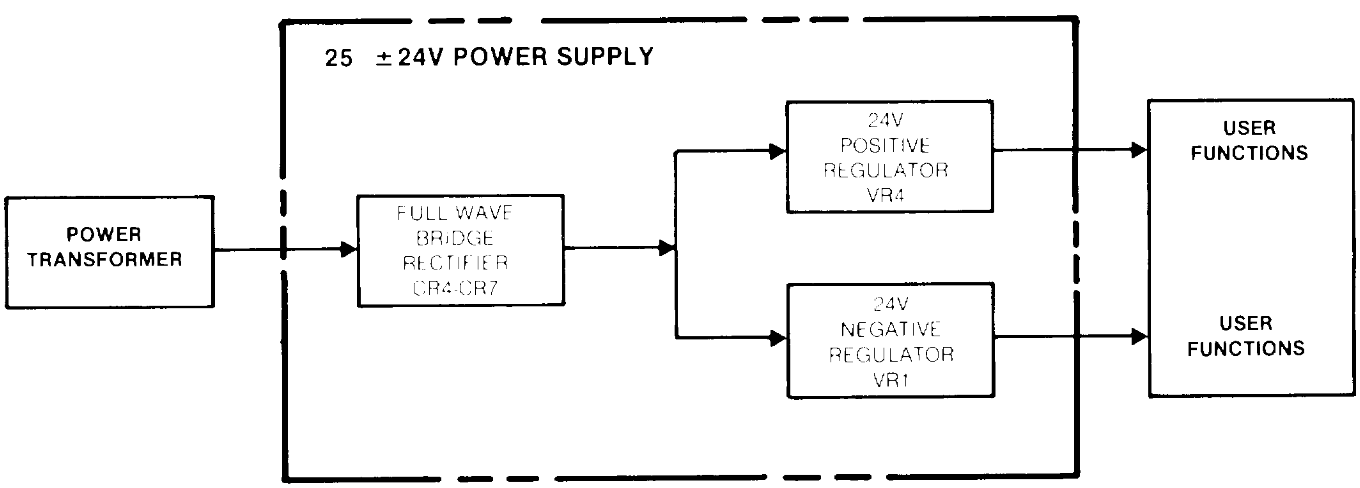


Figure 1-26. ± 24 V Power Supply Functional Block Diagram.

26. ±15 V POWER SUPPLY FUNCTION (Figure 1-27). Receives unregulated ac supply voltage from POWER TRANSFORMER. Supplies regulated 15 V positive and negative voltages to all USER FUNCTIONS. Unregulated ac supply voltage from POWER TRANSFORMER fed to full wave bridge rectifier CR8 thru CR11 and rectified to unregulated dc voltages. Unregulated dc voltages are fed to 15 V positive regulator VR3 and 24 V negative regulator VR2 15 V positive regulator VR3 and 15 V negative regulator VR2 filter and regulate dc voltage. for use in all USER FUNCTIONS. Sample of both positive and negative outputs fed to control amplifier U7A and U7B Control amplifier U7A and U7B provides tighter control of voltage regulation and increased filtering of outputs.

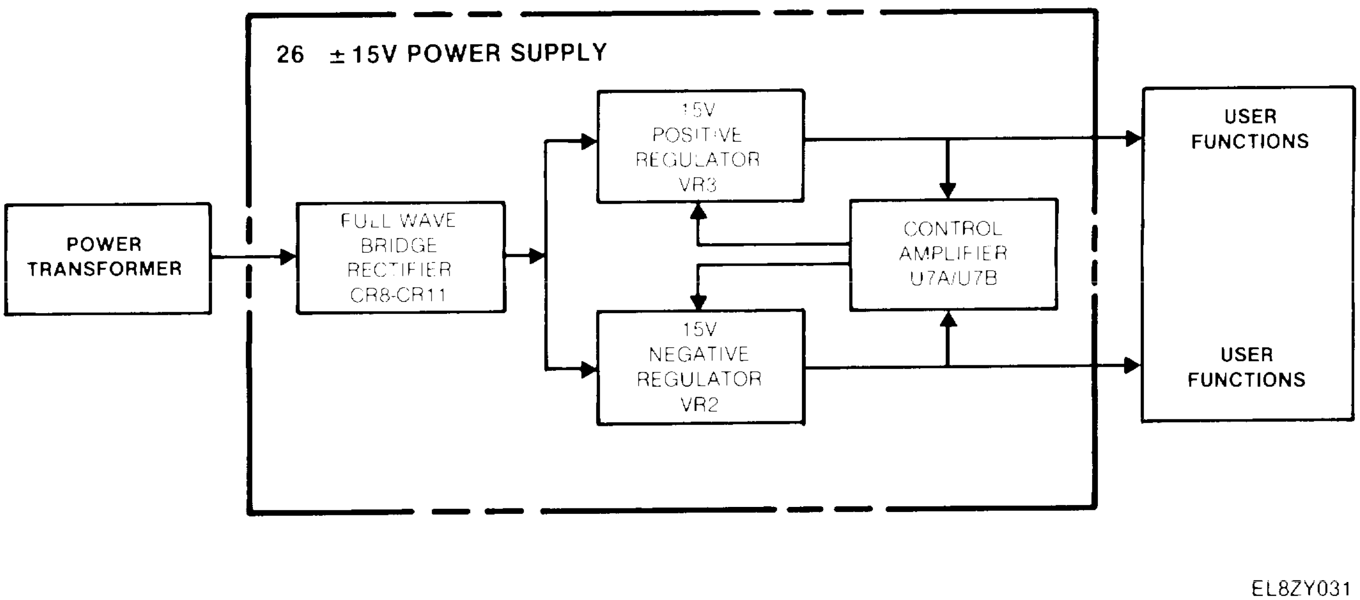


Figure 1-27. ± 15 V Power Supply Functional Block Diagram.

CHAPTER 2

MAINTENANCE INSTRUCTIONS

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

2-1. COMMOM TOOLS AND EQUIPMENT.

Common tools and equipment required for general support maintenance of Signal Generator SG-1171/U are listed in Appendix B of TM 11-6625-3051-12.

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

No special tools, TMDE, or support equipment are required.

2-3. REPAIR PARTS.

Repair parts are listed and Illustrated in the Repair Parts and Special Tools List, TM 11-6625-3051-24P.

Section II. SERVICE UPON RECEIPT

2-4. UNPACKING.

Special design reusable packing material inside this shipping carton provides maximum protection for the Signal Generator SG-1171/U. Avoid damaging carton and packing material during equipment unpacking. Use figure 2-1 and following steps for unpacking Signal Generator SG-1171/U:

a. Cut and remove paper sealing tape on carton top and open carton **(2).**

b. Grasp signal generator **(3)** while restraining shipping carton **(2)** and lift equipment and packing material **(1)** vertically.

c. Place signal generator **(3)** and end cap packing material **(1)** on flat table or surface.

d. Remove end cap packing material **(1)** while firmly supporting signal generator **(3).**

e. Remove protective plastic bag from signal generator **(3).** Place desiccant bags back inside protective plastic bag.

f. Place protective plastic bag and end cap packing material **(1)** inside shipping carton **(2).**

g. Return shipping carton **(2)** to supply system.

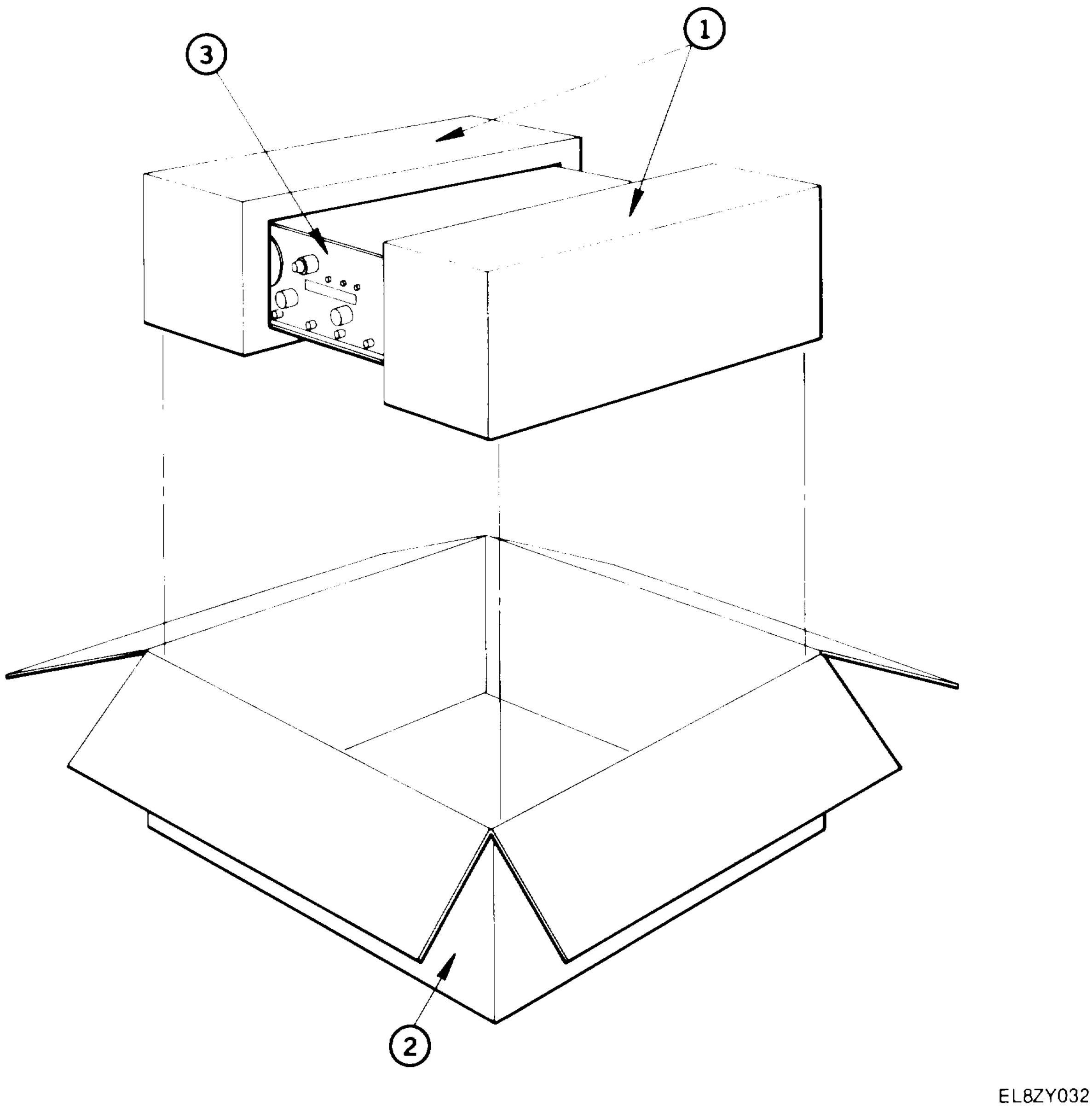


Figure 2-1. Unpacking Equipment

2-5. CHECKING UNPACKED EQUIPMENT.

a. Inspect equipment for damage incurred during shipment. If equipment has been damaged, report damage on Form SF 364, Report of Discrepancy.

b. Check equipment against packing slip to see if shipment is complete. Report all discrepancies in accordance with Instruct Ions of DA Pam 738-750.

c. Check to see whether equipment has been modified.

Section III. TROUBLESHOOTING

SYMPTOM INDEX

2-6. INTRODUCTION.

Troubleshooting at general support maintenance level requires that all troubles be located as quickly as possible. The amount of troubleshooting permitted is based on the Maintenance Allocation Chart (MAC) allowance for your activity. Because of this, the only trouble symptoms contained here are those that could be caused by defects you can repair.

NOTE

Before using this troubleshooting section, check equipment work order and talk to organizational maintenance, if possible, for description of symptoms and steps taken to correct them Check all forms and tags attached to, or accompanying equipment to determine reason for removal from service

2-7. CIRCUIT BOARD INSPECTION.

a. Inspect for loose or damaged parts If circuit board not damaged, tighten loose parts Replace all damaged parts Check that problem still exists and troubleshoot.

b. Inspect for loose or damaged wires. If circuit board not damaged, fix loose or damaged wires. Check that problem still exists and troubleshoot.

2-8. USING THE TROUBLESHOOTING SECTION.

The troubleshooting section has been divided into three main parts These three main parts are explained in the following text and referenced to the troubleshooting table example shown below.

Malfunction

Test or Inspect Ion

Corrective Action

1. NO DIAL LIGHT, ALL OUTPUT WAVEFORMS (FUNCTION OUT (50Ω), SYNC OUT (TTL) AND MODULATION GENERATOR OUT (600Ω) NORMAL.

Do dial light circuit fault isolation test (para 2-25)

• Replace defective part.

a. MALFUNCTION: A symptom that is seen or heard without using test equipment, Find name of malfunction listed in first column.

b. TEST OR INSPECTION: Tests or inspections are procedure steps that isolate damaged part. Perform tests or inspections in order listed.

c. CORRECTIVE ACTION Corrective action tells what needs to be done to correct problem.

2-9. TROUBLESHOOTING TABLE.

Troubleshooting table (table 2-1) lists common malfunctions which may be found during operation Perform tests, inspections and corrective actions in order listed. After performing troubleshooting and repair of signal generator, it will be necessary to perform a complete alignment.

NOTE

After replacing defective component, recheck voltage or resistance readings If problem remains, continue troubleshooting procedures as appropriate.

2-10. TROUBLESHOOTING PROCEDURES.

Each troubleshooting procedure referenced to is to be followed in order until told to do another step or paragraph, or to replace a part. After replacing a part, return to the original malfunction and verify that the problem has been corrected.

NOTE

All voltage and waveform measurements taken on boards A1 and A2 are referenced to chassis ground unless otherwise specified.

For all tests performed while monitoring the FUNCTION OUT (50Ω) connector, the cable must be terminated with 50Ω at the tester. For all tests performed while monitoring the MODULATION GENERATOR OUT (600Ω) connector, the cable must be terminated with 600Ω at the tester.

Table 2-1. Troubleshooting

Malfunction
Test or Inspection
Corrective Act Ion

1. FUSE BLOWS.

Step 1. Check that number visible on voltage selector card matches power source (fig. FO-8)

- Turn voltage selector card to correct position.
- Replace defective fuse with fuse rated for present power source

Step 2. Do power supply input circuit fault isolation test (para 2-24).

- Replace defective part.

2. NO DIAL LIGHT, ALL OUTPUT WAVEFORMS (FUNCTION OUT (50Ω), SYNC OUT (TTL) AND MODULATION GENERATOR OUT (600Ω) NORMAL.

Do dial light circuit fault isolation test (para 2-25).

- Replace defective part.

3. ALL OUTPUT WAVEFORMS (FUNCTION OUT (50Ω), SYNC OUT (TTL) AND MODULATION GENERATOR OUT (600Ω) INCORRECT OR MISSING.

Do power supply fault isolation test (para 2-11).

- Replace defective part.

4. FUNCTION OUT (50Ω) AND SYNC OUT (TTL) INCORRECT OR MISSING, MODULATION GENERATOR OUT (600Ω) NORMAL.

Step 1 Check for normal (15 Vp-p) sine waveform at FUNCTION OUT (50Ω) while rotating FREQ MULT switch from 10M through .01 (fig. FO-6).

- If normal waveform of correct frequency not displayed in all positions, do power supply fault isolation test (para 2-11).
- If normal waveform of correct frequency not displayed in all positions and all supplies normal, do step 2.
- If only position 10M not normal, leave switch in position 10M, then do main board range fault isolation test (para 2-39).
- If only position 1M not normal, leave switch in position 1 M, then do main board range fault isolation test (para 2-39) step 4.
- If only position 100K not normal, leave switch in position 100K, then do main board range fault isolation test (para 2-39) step 6.

Table 2-1. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

- If only position 10K not normal, leave switch in position 10K, then do main board range fault isolation test (para 2-39) step 7.
- If only position 1K not normal, leave switch in position 1K, then do main board range fault isolation test (para 2-39) step 8.
- If only position 100 not normal, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- If only position 10 not normal, leave switch in position 10, then do capacltance multiplier fault Isolation test (para 2-41) step 6.
- If only position 1 not normal, leave switch in position 1, then do capacitance multiplier fault isolation test (para 2-41) step 7.
- If only position .1 not normal, leave switch in position .1, then do capacitance multiplier fault isolation test (para 2-41) step 8.
- If only position .01 not normal, leave switch in position .01, then do capacitance multiplier fault isolation test (para 2-41) step 9.
- If only positions 10M, 1M, 100K and 10K not normal, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- If only positions 1M, 100K and 10K not normal, replace resistor A1R46 (para 2-86).
- If only positions 1M through .01 not normal, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- If only positions 100K and 10K not normal, replace resistor A1R37 (para 2-86)
- If only positions 100 through .01 not normal, replace matched capacitor set containing A1C63, A1C64, and A1C65 (para 2-85).
- If only positions 10 through .01 not normal, do capacitance multiplier fault isolation test (para 2-41).

Step 2. Do trigger logic fault isolation test (para 2-46) step 7. If voltage reading in step 7 normal, return to this point. DO NOT do step 10 of para 2-46.

- Do main generator loop isolation test (para 2-27).
- Replace defective part.

Table 2-1. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

5. FUNCTION OUT (50Ω) INCORRECT OR MISSING, SYNC OUT (TTL) AND MODULATION GENERATOR OUT (600Ω) NORMAL.

Step 1. Check for normal waveforms (15 Vp-p sine, triangle, square, + 7.5V positive pulse, – 7.5V negative pulse), at FUNCTION OUT (50Ω) while rotating FUNCTION switch from sine wave through negative pulse (fig. FO-6).

- If only triangle and sine wave not normal, do FUNCTION OUT (50Ω) signal path isolation test (para 2-26).

- Do FUNCTION OUT (50Ω) signal path isolation test (para 2-26) step 6 if:

  Only square wave and positive pulse not normal.

  Only square wave and negative pulse not normal.

  Only square wave and both pulses not normal

- If only one or two other waveforms not normal, do signal shaper fault isolation test (para 2-49).

Step 2. Check for sine waveform at FUNCTION OUT (50Ω) while rotating ATTENUATION (dB) switch from 0/20 through 60/80 positions (fig. FO-6).

- If output normal in any position, do attenuator fault isolation test (para 2-55).

Step 3. Do FUNCTION OUT (50Ω) signal path isolation test (para 2-26).

- Replace defective Part.

6. SYNC OUT (TTL) INCORRECT OR MISSING, FUNCTION OUT (50Ω) AND MODULATION GENERATOR OUT (600Ω) NORMAL.

Step Do trigger logic fault isolation test (para 2-46) steps 7, 8 and 9 only, If voltage reading in step 7 normal, return to this point.

- Replace defective part.

Step 2. Do sync out fault isolation test (para 2-29).

- Replace defective part.

7. MODULATION GENERATOR OUT (600Ω) INCORRECT OR MISSING, SYNC OUT (TTL) AND FUNCTION OUT (50Ω) NORMAL.

Do modulation generator out (600Ω) fault isolation test (para 2-31).

- Do test specified from result.

Table 2-1. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

8. MODULATION GENERATOR CANNOT BE FM MODULATED FROM MODULATION GENERATOR FM IN CONNECTOR.

Step 1 Check for normal modulation generator operation when MODULATION GENERATOR FM IN disconnected (fig. FO-6).

- If operation normal, replace resistor A2R49 (para 2-86).

Step 2. Do modulation generator out (600Ω) fault isolation test (para 2-31).

- Replace defective part

9. SYMMETRY CONTROL DOES NOT VARY SYMMETRY OF SIGNAL CORRECTLY AT FUNCTION OUT (50Ω)

Do main generator loop isolation test (para 2-27) step 12

- Replace defective part.

10. DC OFFSET CONTROL NOT WORKING PROPERLY.

Do DC offset fault isolation test (para 2-53).

- Replace defective part.

11. OVERLOAD INDICATOR ON CONTINUOUSLY, SYNC OUT (TTL) AND FUNCTION OUT (50Ω) NORMAL.

Do output overload protection fault isolation test (para 2-54).

- Replace defective part

12. GENERATOR CANNOT BE TRIGGERED OR GATED

Step 1. Check waveform at OUT (600Ω) connector (fig. FO-6).

- If waveform displayed not approximately 10 Vp-p, do malfunction 7.

Step 2. Check for INT or EXT TRIGGER or GATED capability (fig, FO-6).

- If only one condition is not normal (such as EXT GATE), replace switch/control assembly A2SW1/A2R1 (para 2-79).

Step 3. Do trigger/gate fault isolation test (para 2-28).

- Replace defective part.

Table 2-1. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

13. GENERATOR CANNOT BE LOCKED TO EXTERNAL SYNC IN SIGNAL

Do SYNC IN fault isolation test (para 2-30)

• Replace defective part.

14. GENERATOR CANNOT BE AM MODULATED.

Step 1. Check waveform at OUT (600Ω) connector (fig. FO-6).

• If waveform displayed not approximately 10 Vp-p, do malfunction 7.

Step 2. Do AM modulation fault isolation test (para 2-32).

• Replace defective part.

15. GENERATOR CANNOT BE FM/SWP MODULATED.

Step 1. Check waveform at OUT (600Ω) connector (fig. FO-6).

ž If waveform displayed not approximately 10 Vp-p, do malfunction 7

Step 2. Do FM/SWP modulation fault isolation test (para 2-33).

• Replace defective part.

16. GENERATOR CANNOT BE PM(ϕ) MODULATED.

Step 1. Check waveform at OUT (600Ω) connector (fig. FO-6).

• If waveform displayed not approximately 10 Vp-p, do malfunction 7

Step 2. Do PM(ϕ) modulation fault isolation test (para 2-34).

Ž Replace defective part.

2-11. POWER SUPPLY FAULT ISOLATION TEST.

DESCRIPTION

This test locates faulty power supply

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE Remove bottom cover (para 2-61) Remove top cover (para 2-62)

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position

2. Check voltage at A1 VR2 lead nearest edge of board (fig. FO-4)
   - Set POWER OFF/ON switch ON
   - If reading between +23V and +25V, do step 4.
3. Check voltage at " + " lead of A2C26 (fig. FO-5).
   - If reading between +23V and +25V, replace ribbon cable A2P5 (para 2-84)
   - Set POWER OFF/ON switch OFF.
   - Do +24V regulator fault isolation test (para 2-12)
4. Check voltage at A1VR3 center lead (fig FO-4).
   - l If reading between –23V and –25V, do step 6.
5. Check voltage at " –" lead of A2C29 (fig, FO-5).
   - If reading between –23V and –25V, replace ribbon cable A2P5 (para 2-84).
   - Set POWER OFF/ON switch OFF.
   - Do –24V regulator fault isolation test (para 2-13).

6. Check voltage at A1E12 (fig, FO-4).

- If reading between +14.4V and +15.6V, do step 8.

7. Check voltage at " + " lead of A2C33 (fig. FO-5).

- If reading between +14.4V and + 15.6V, replace ribbon cable A2P5 (para 2-84).
- Set POWER OFF/ON switch OFF.
- Do +15V regulator fault isolation test (para 2-15).

8. Check voltage at A1E11 (fig. FO-4).

- If reading between –14.4V and –15.6V, supplies normal. Return to troubleshooting table 2-1.

9. Check voltage at “ – “ lead of A2C34 (fig, FO-5).

- If reading between –14.4V and –15.6V, replace ribbon cable A2P5 (para 2-84).
- Set POWER OFF/ON switch OFF.
- Do – 15V regulator fault isolation test (para 2-1 6).

END OF TEST

2-12. +24V REGULATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds a +24V regulator circuit fault

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death

NOTE

PRELIMINARY PROCEDURE: Remove bottom cover (para 2-61). Remove top cover (para 2-62)

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance from A4VR4 mounting screw to A4VR4 metal tab (fig, FO-9).
   - Disconnect power cable.
   - Disconnect A4P4 from A4VR4 after noting its direction.
   - If reading not Infinite, replace microcircuit A4VR4, insulation sleeve and insulator (para 2-73).
3 Check resistance of A2CR12 (fig. FO-5).
   - If reverse resistance measurement of A2CR12 not 10 times greater than forward resistance, reconnect A4P4, then replace A2CR12 (para 2-87).
   - Reconnect A4P4.
4. Check voltage at " + " lead of A2C22 (fig, FO-5).
   - Reconnect power cable.
   - Set POWER OFF/ON switch ON.
   - If reading between +27V and +38V, do step 6.
5 Check forward resistance of A2C22 (fig. FO-5).
   - Set POWER OFF/ON switch OFF.
   - Disconnect A4P4 (fig. FO-9) and A4P7 (fig, FO-5) after noting connector directions.
   - If reading (after 15 seconds) less than 20 kilohms, replace electrolytic capacitor A2C22 (para 2-85).
   - Reconnect A4P4 and A4P7.
   - Do unregulated ±24V fault isolation test (para 2-14).
6 Check voltage at " + " lead of A2C26 (fig. FO-5) with main board disconnected.
   - Set POWER OFF/ON switch OFF.
   - Disconnect A1P2 from A1J2 (fig. FO-4).
   - Connect " – " leads of A2C22 and A2C33 (fig. FO-5).

- Set POWER OFF/ON switch ON.
- If reading between +23V and +25V, do +24V main board overload fault isolation test (para 2-18).

7. Check forward resistance of A2C26 (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- Disconnect A2C22 from A2C33.
- If reading (after 15 seconds) less than 20 kilohms, reconnect A1P2 (fig, FO-4), then replace electrolytic capacitor A2C26 (para 2-85).
- Reconnect A1P2 (fig. FO-4).
- Replace microcircuit A4VR4 (para 2-73).

END OF TEST

2-13. -24V REGULATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds a –24V regulator circuit fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2 Check resistance from A4VR1 mounting screw to A4VR1 metal tab (fig. FO-9).

- Disconnect power cable.
- Disconnect A4P1 from A4VR1 after noting its direction.
- If reading not infinite, replace microcircuit A4VR1, insulation sleeve and insulator (para 2-73).

3 Check resistance of A2CR13 (fig. FO-5).

- If reverse resistance measurement of A2CR13 not 10 times greater than forward resistance, reconnect A4P1, then replace A2CR13 (para 2-87).
- Reconnect A4P1.

4. Check voltage at " – " lead of A2C23 (fig. FO-5).

- Reconnect power cable
- Set POWER OFF/ON switch ON.
- If reading between –27V and –38V, do step 6.

5. Check forward resistance of A2C23 (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- Disconnect A4P1 (fig FO-9) and A4P7 (fig, FO-5) after noting connector directions.
- If reading (after 15 seconds) less than 20 kilohms, replace electrolytic capacitor A2C23 (para 2-85)
- Reconnect A4P1 and A4P7.
- Do unregulated ±24V fault isolation test (para 2-14).

6. Check voltage at " – " lead of A2C29 (fig. FO-5) with main board disconnected.

- Set POWER OFF/ON switch OFF
- Disconnect A1P2 from A1J2 (fig FO-4).
- Connect " –" leads of A2C22 and A2C33 (fig. FO-5).
- Set POWER OFF/ON switch ON.
- If reading between –23V and –25V, do –24V main board overload fault isolation test (para 2-1 9).

7. Check forward resistance of A2C29 (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- Disconnect A2C22 from A2C33.
- Reconnect A1P2 and A1P4.

- Unsolder and lift one lead of A2C29.
- If reading (after 15 seconds) less than 20 kilohms, replace electrolytic capacitor A2C29 (para 2-85).
- Replace microcircuit A4VR1 (para 2-73) and ceramic capacitor A2C30 (para 2-85), then reconnect A2C29.

END OF TEST

2-14. UNREGULATED ±24V FAULT ISOLATION TEST.

DESCRIPTION

This test finds a fault in the unregulated ±24V circuit.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove top cover (para 2-62)

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position

2. Check resistance of A2CR4, A2CR5, A2CR6 and A2CR7 (fig, FO-5).

- Disconnect A4P1, A4P4 and A4P7 (fig. FO-9) after noting connector directions.
- If any reverse resistance measurement not greater than 100 kilohms and 10 times greater than forward resistance, replace the appropriate diode (para 2-87).
- Reconnect A4P1 and A4P4

3. Check ±24V power transformer windings (fig. FO-5).

- Disconnect power cable.
- Disconnect A4P6 and A4P7.
- Remove power receptacle cover inside rear panel (part of para 2-69).
- Measure the following points.

MEASUREMENT POINTS	NORMAL READING
A4P7 pin 1 to pin 3	4.8 to 5.8 ohms
A4P7 pin 2 to pin 3	4.8 to 5.8 ohms
Chassis ground to A4P7 pin 3	open
A4P6 pin 3 to A4P7 pin 3	open
A4P7 pin 3 to A4J1 5-D	open
A4P7 pin 3 to A4J1 5-C	open

- If any measurements not normal, replace power transformer A4T1 (para 2-70), then reconnect A4P6, A4P7.
- Reconnect A4P6 and A4P7, reinstall power receptacle cover (part of para 2-69), then do power supply input circuit fault isolation test (para 2-24).

END OF TEST

2-15, +15V REGULATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds a +15V regulator circuit fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance from A4VR3 mounting screw to A4VR3 metal tab (fig. FO-9).

- Disconnect power cable.
- Disconnect A4P3 from A4VR3.
- If reading not infinite, replace microcircuit A4VR3, insulation sleeve and insulator (para 2-73).

3. Check voltage at " + " lead of A2C24 (fig. FO-5).

- Reconnect A4P3.
- Reconnect power cable.
- Set POWER OFF/ON switch ON.
- If reading between +17.5V and +30V, do step 5.

4. Check forward resistance of A2C24 (fig, FO-5).

- Set POWER OFF/ON switch OFF.
- Disconnect A4P3 (fig. FO-9) and A4P6 (fig, FO-5) after noting connector directions.
- If reading (after 15 seconds) less than 20 kilohms, replace electrolytic capacitor A2C24 (para 2-85).
- Reconnect A4P3 and A4P6.
- Do unregulated ~15V fault isolation test (para 2-17).

5. Check voltage at " + " lead of A2C33 (fig. FO-5) with main board disconnected.

- Set POWER OFF/ON switch OFF.
- Disconnect A1P2 from A1J2 (fig. FO-4).
- Connect " – " leads of A2C22 and A2C33.
- Set POWER OFF/ON switch ON.
- If reading between +14.4V and + 15.6V, do +15V main board overload fault isolation test (para 2-20).

6 Check A2U7 voltages (fig. FO-5).

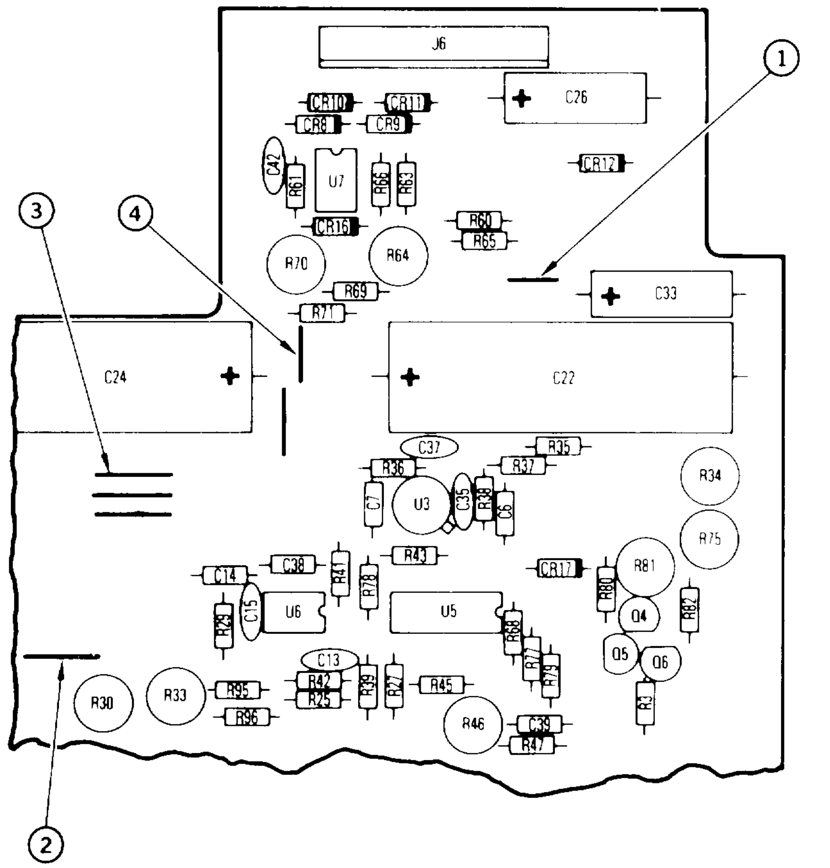
- Set POWER OFF/ON switch OFF.
- Disconnect A2C22 from A2C33
- Reconnect A1P2 (fig. FO-4).
- Set POWER OFF/ON switch ON.
- Record voltage at A2U7 pin 5.
- Record voltage at A2U7 pin 6.
- Record voltage at A2U7 pin 7.
- If voltage recorded at pin 5 is positive with respect to pin 6, and pin 7 is more negative than pin 6, replace linear microcircuit A2U7 (para 2-94).
- If voltage recorded at pin 5 is negative with respect to pin 6, and pin 7 is more positive than pin 6, replace linear microcircuit A2U7 (para 2-94).

7 Check voltage at lifted end of jumper wire (1) on auxiliary board (fig FO-5).

- Set POWER OFF/ON switch OFF.
- Unsolder and lift right lead of jumper wire (1) on auxiliary board.
- Set POWER OFF/ON switch ON.
- If reading between +14.4V and +15.6V, reconnect and solder leads of jumper wire (1), then do + 15V auxiliary board overload fault isolation test (para 2-22).

8 Check voltage at cathode lead of A2CR16 (fig. FO-5).

- If reading between +6.1V and +6.8V, do step 10.
- If reading more than + 6.8V, reconnect and solder leads of jumper wire (1) on auxiliary board, then replace diode A2CR16 (para 2-87).



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9. Check voltage at cathode lead of A2CR16 (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of jumper wire (1) on auxiliary board.
- Unsolder and lift anode lead of A2CR16.
- Set POWER OFF/ON switch ON.
- If reading more than + 6.1V, replace diode A2CR16 (para 2-87).
- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A2CR16.

10. Check for smooth resistance transition of trim pot A2R64 (fig. FO-5).

- Disconnect A4P3 (fig. FO-9) and A1P2 (fig, FO-4).
- Measure and record resistance value between center lead (wiper) and left lead.
- Rotate trim pot A2R64 from fully clockwise to fully counterclockwise.

- Measure resistance value between center lead (wiper) and right lead.
- Rotate trim pot A2R64 from fully clockwise to fully counterclockwise.
- If either resistance transition not smooth, replace trim pot A2R64 (para 2-91), then reconnect A4P3, A1P2 and jumper wire (1) on auxiliary board.
- Return trim pot A2R64 to setting recorded in this step.

11 Check resistance of A2R60, A2R63, A2R65, and A2R66 (fig. FO-5).

- If any reading not within limits, replace resistor (para 2-86), then reconnect A4P3, A1P2 and jumper wire (1) on auxiliary board.

12. Check forward resistance of A2C33 (fig. FO-5).

- Reconnect A4P3 (fig FO-9) and A1P2 (fig FO-4).
- Reconnect and solder leads of jumper wire (1) on auxiliary board.
- Unsolder and lift one lead of A2C33.
- If reading (after 15 seconds) less than 20 kilohms, replace electrolytic capacitor A2C33 (para 2-85).
- Replace microcircuit A4VR3 (para 2-73), then reconnect and solder leads of A2C33.

END OF TEST

2-16. –15V REGULATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds a –15V regulator circuit fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious Injury or death

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance from A4VR2 mounting screw to A4VR2 metal tab (fig FO-9).
   - Disconnect power cable.
   - Disconnect A4P2 from A4VR2.
   - If reading not infinite, replace microcircuit A4VR2, insulation sleeve and insulator (para 2-73).
3. Check voltage at " – " lead of A2C21 (fig. FO-5).
   - Reconnect A4P2.
   - Reconnect power cable.
   - Set POWER OFF/ON switch ON.
   - If reading between –17.5V and –30V, do step 5.
4. Check forward resistance of A2C21 (fig. FO-5).
   - Set POWER OFF/ON switch OFF.
   - Disconnect A4P6 (fig, FO-5) and A4P2 (fig. FO-9) after noting connector directions.
   - If reading (after 15 seconds) less than 20 kilohms, replace electrolytic capacitor A2C21 (para 2-85), then reconnect A4P6 and A4P2.
   - Reconnect A4P6 and A4P2, then do unregulated ±15V fault isolation test (para 2-17).
5. Check voltage at " – " lead of A2C34 (fig. FO-5) with main board disconnected.
   - Set POWER OFF/ON switch OFF.
   - Disconnect A1P2 from A1J2 (fig. FO-4).
   - Connect " – " leads of A2C22 and A2C33.
   - Set POWER OFF/ON switch ON.
   - If reading between –14.4V and –15.6V, do –15V main board overload fault isolation test (para 2-21).

6. Check A2U7 voltages (fig FO-5).

- Set POWER OFF/ON switch OFF.
- Disconnect A2C22 from A2C33.
- Reconnect A1P2 (fig. FO-4).
- Set POWER OFF/ON switch ON.
- Record voltage at A2U7 pin 1.
- Record voltage at A2U7 pin 2.
- Record voltage at A2U7 pin 3.
- If voltage recorded at pin 3 is positive with respect to pin 2, and pin 1 is more negative than pin 2, replace linear microcircuit A2U7 (para 2-94).
- If voltage recorded at pin 3 is negative with respect to pin 2, and pin 1 is more positive than pin 2, replace linear microcircuit A2U7 (para 2-94).

7. Check voltage at lifted end of jumper wire (4) on auxiliary board (fig FO-5).

- Set POWER OFF/ON switch OFF
- Unsolder and lift front end of jumper wire (4) on auxiliary board.
- Disconnect A4P7.
- Remove white wire (pin 9) from connector A4P7 (part of para 2-75).
- Reconnect A4P7.
- Connect white wire to lifted jumper wire (4) on auxiliary board

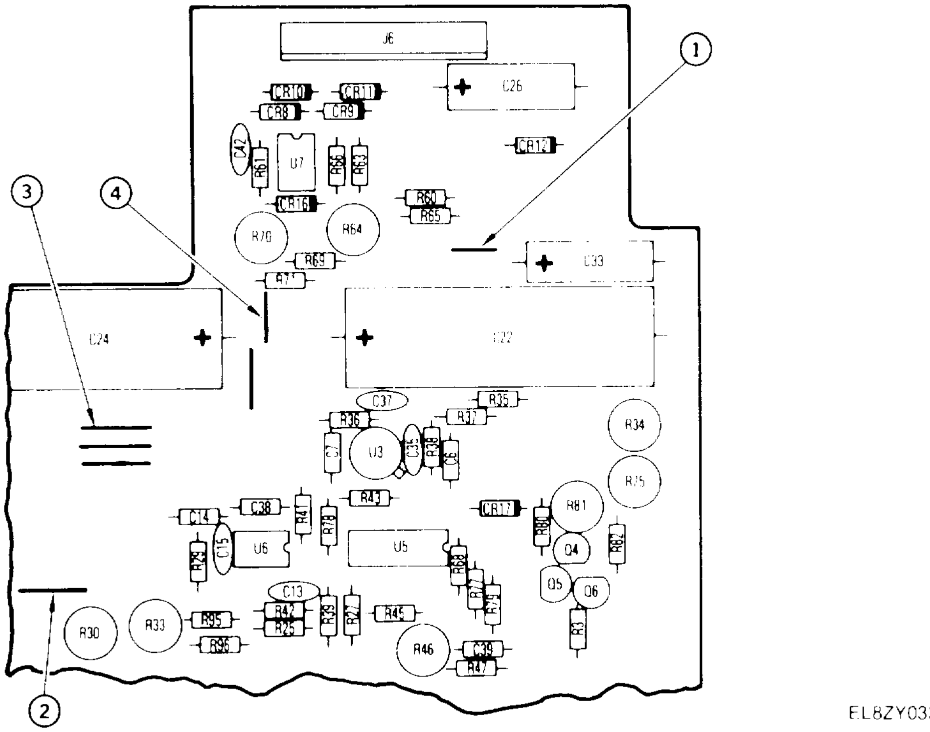
NOTE

Make sure white wire does not touch any surface

- Set POWER OFF/ON switch ON
- If reading between –14.4V and –15.6V, do –15V auxiliary board overload fault isolation test (para 2-23).

8. Check for smooth resistance transition of trim pot A2R70 (fig FO-5).

- Set POWER OFF/ON switch OFF.
- Disconnect A1P2 (fig. FO-4) and A4P2 (fig, FO-9).
- Measure and record resistance value between center lead (wiper) and left lead.
- Rotate trim pot A2R70 from fully clockwise to fully counterclockwise.
- Measure resistance value between center lead (wiper) and right lead.



• Rotate trim pot A2R70 from fully clockwise to fully counterclockwise.

• If either resistance transition not smooth, replace trim pot A2R70 (para 2-91), then reconnect A4P2, A1P2, jumper wire (4) and reinstall white wire in A4P7 (part of para 2-75).

• Return trim pot A2R70 to setting recorded in this step.

9. Check resistance of A2R61, A2R69, A1R71 and A1C42 (fig. FO-5).

• If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88), then reconnect A4P2, A1P2, jumper wire (4), and white wire in A4P7 (part of para 2-75).

10. Check forward resistance of A2C34 (fig. FO-5)

• Disconnect white wire from jumper wire (4) on auxiliary board.

• . Disconnect A4P7.

• Note direction of connector pin (white wire) and insert into A4P7 pin 9 (part of para 2-75).

• Reconnect A4P2, A1P2 and A4P7.

• Reconnect and solder leads of jumper wire (4) on auxiliary board.

• If reading (after 15 seconds) less than 20 kilohms, replace electrolytic capacitor A2C34 (para 2-85).

• Replace microcircuit A4VR2 (para 2-73).

END OF TEST

2-17. UNREGULATED ±15V FAULT ISOLATION TEST.

DESCRIPTION

This test finds a fault In the unregulated ±15V circuit.

INITIAL SETUP

WARNING

With covers removed several dangerous voltage points may be exposed. Contact wIth these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE.:

Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A2CR8 A2CR9, A2CR10, and A2CR11 (fig FO-5).

   - Disconnect A4P2 and A4P3 (fig FO-9) after noting connector directions.
   - If any reverse resistance measurement not greater than 100 kilohms and 10 times greater than forward resistance, replace the appropriate diode (para 2-87).
   - Reconnect A4P2 and A4P3 (fig. FO-9).

3. Check resistance of ± 15V power transformer windings (fig. FO-5 and FO-9).

   - Disconnect power cable.
   - Disconnect A4P6.
   - Remove power receptacle cover Inside rear panel (part of para 2-69).
   - Measure the following points.

MEASUREMENT POINTS	NORMAL READING
A4P6 pin 1 to pin 3	1.8 to 2.4 ohms
A4P6 pin 2 to pin 3	1.8 to 2.4 ohms
Chassis ground to A4P6 pin 3	Infinite
A4P6 pin 3 to A4J1 5-D	Infinite
A4P6 pin 3 to A4J15-C	Infinite

- If any measurements not normal, replace power transformer A4T1 (para 2-70) then reconnect A4P6.
- Reconnect A4P6, reinstall power receptacle cover (part of para 2-69), then do power supply input circuit fault Isolation test (para 2-24).

END OF TEST

2-18. +24V MAIN BOARD OVERLOAD FAULT ISOLATION TEST.

DESCRIPTION

This test finds a main board fault overloading the +24V power supply

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious Injury or death

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig, FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q38, A1Q46, A1Q47, A1Q51 and A1Q54 (fig. FO-4).

- Disconnect A2C22 from A2C33 (fig. FO-5).
- Reconnect A1P2.
- If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistors:

IF THIS TRANSISTOR MEASURES BAD:	REPLACE:
A1Q37	A1Q37 and A1Q38 (para 2-92)
A1Q38	A1Q37 and A1Q38 (para 2-92)
A1Q46	A1Q46 and A1Q48 (para 2-92)
A1Q47	A1Q47 and A1Q49 (para 2-83)
A1Q51	A1Q51 and A1Q53 (para 2-92)
A1Q54	A1Q54 and A1Q55 (para 2-83)

3. Check voltage at rear lead of A1R41 (fig. FO-4).

- Unsolder and lift front lead of A1R41.
- Set POWER OFF/ON switch ON.
- If reading less than +23V, reconnect and solder leads of A1R41, then replace electrolytic capacitor A1C108 and ceramic capacitors A1C100 and A1C144 (para 2-85).
- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R41.
- Replace ceramic capacitor AIC17, electrolytic capacitor A1C18 (para 2-85) and linear microcircuits A1U5, A1U9 and A1U10 (para 2-94).

END OF TEST

2-19. –24V MAIN BOARD OVERLOAD FAULT ISOLATION TEST.

DESCRIPTION

This test finds a main board fault overloading the –24V power supply.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q48, A1Q49, A1Q53 and A1Q55 (fig. FO-4).

- Disconnect A2C22 from A2C33 (fig. FO-5).
- Reconnect A1P2.
- If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistor:

IF THIS TRANSISTOR MEASURES BAD:	REPLACE:
A1Q48	A1Q46 and A1Q48 (para 2-92)
A1Q49	A1Q47 and A1Q49 (para 2-83)
A1Q53	A1Q51 and A1Q53 (para 2-92)
A1Q55	A1Q54 and A1Q55 (para 2-83)

3. Check voltage at rear lead of A1R43 (fig FO-4).

- Unsolder and lift front lead of A1R43.
- Set POWER OFF/ON switch ON.
- If reading not between –23V and –25V, reconnect and solder leads of A1R43, then replace electrolytic capacitor A1C110, and ceramic capacitors A1C101 and A1C145 (para 2-85).
- Reconnect and solder leads of A1R43.
- Replace electrolytic capacitor A1C19 (para 2-85) and linear rmicrocircuit A1U6 (para 2-94).

END OF TEST

2-20. +15V MAIN BOARD OVERLOAD FAULT ISOLATION TEST.

DESCRIPTION

This test finds a main board fault overloading the +15V power supply

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage poinfs may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
FUNCTION	Sine wave

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1C11, A1Q24, A1Q27, A1Q28, A1Q43 and A1Q44 (fig. FO-4).

- Disconnect A2C22 from A2C33 (fig, FO-5).
- Reconnect A1P2.
- If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistor (para 2-92).

3. Check voltage at A1E4 (fig, FO-4) while rotating FREQ MULT switch (fig, FO-6).

- Set POWER OFF/ON switch ON.
- Rotate FREQ MULT switch from 10K to 10M positions.
- If reading lower than +14.4V in all positions, do step 4.
- Leave switch in position where reading is less than +14.4V.
- Set POWER OFF/ON switch OFF.

IF FREQ MULT SWITCH SET TO:	REPLACE RESISTOR
10K or 100K	A1R37 (para 2-86)
1M	A1R374 (para 2-86)
10M	A1R39 and A1R325 (para 2-86)

4. Check voltage at A1E4 (fig, FO-4).

- Record voltage at right lead of A1R344.
- Center trim pot A1R226 (in MULTIPLIER circuit).
- If reading between + 14.4V and + 15.6V, replace resistor A1R344 (para 2-86).
- Return trim pot A1R226 to setting recorded in this step.

5. Check voltage at A1E4 (fig, FO-4).

- Set FUNCTION switch to DC.
- If reading lower than + 14.4V, do step 7.

6. Check resistance of A1R1 85, A1R1 86, and A1R188 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Replace appropriate resistor (para 2-86).

7. Check voltage at A1E4 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and lift one lead of A1R66.
- Set POWER OFF/ON switch ON.
- If reading between +14.4V and +15.6V, do step 14.

8. Check voltage at A1E4 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R66.
- Unsolder and lift one lead of A1R139.
- Set POWER OFF/ON switch ON
- If reading between +14.4V and +15.6V, do step 19.

9. Check voltage at A1E4 (fig FO-4).

  Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R139.
- Unsolder and lift one lead of A1R339.
- Set POWER OFF/ON switch ON.
- If reading less than +14.4V, do step 10.
- Set POWER OFF/ON switch OFF.
- Replace microcircuit A4VR1 (para 2-73) and electrolytic capacitor AIC134 (para 2-85), then reconnect and solder leads of A1R339.

10. Check voltage at A1E4 (fig, FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R339.
- Unsolder and lift one lead of A1R293.
- Set POWER OFF/ON switch ON.
- If reading between +14.4V and +15.6V, replace ceramic capacitor A1C96 (para 2-85) and linear microcircuit A1U18 (para 2-94), then reconnect and solder leads of A1R293.

11. Check resistance of A1R88 and A1R145 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R293.
- If any reading not within limits, replace resistor (para 2-86).

12. Check for lowest +15V reading on main board (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If any reading not stable, set POWER OFF/ON switch OFF, wait 10 seconds, set POWER OFF/ON switch ON, wait 2 seconds, note reading.

IF LOWEST READING IS AT:	REFER TO:
A1R113 rear lead	Step 24
Al RI 70 right lead	Step 20
A1R244 rear lead	Step 13
A1U3 pin 7	Step 22
A1U19 pin 7	Step 25

13. Determine lowest +15V voltage reading of the following locations (fig. FO-4).

IF LOWEST READING IS AT:	REFER TO:
A1R244 rear lead	Step 27
A1R258 right lead	Step 26

14. Check voltages at anode and cathode of A1CR3 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R66.
- Set POWER OFF/ON switch ON.
- If difference in readings between 5.9V and 6.5V, do step 16.
- If difference in readings greater than 6.5V, replace diode A1CR3 (para 2-87).

15. Check voltages at cathode of A1CR3 and A1TP3 (fig, FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and lift anode lead of A1CR3.

- Set POWER OFF/ON switch ON.
- If difference in readings more than 6.5V, replace diode A1CR3 (para 2-87).
- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1CR3.

16. Check voltage at cathode and anode leads of A1CR4 (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If difference in readings between 5.9V and 6.5V, do step 18.
- If difference in readings greater than 6.5V, replace diode A1CR4 (para 2-87).

17. Check voltage at cathode lead of A1CR4 and A1Q11 collector (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and lift anode lead of A1CR4.
- Set POWER OFF/ON switch ON.
- If difference in readings more than 6.5V, replace diode A1CR4 (para 2-87).
- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1CR4.

18. Check resistance of A1R67, A1R68, A1C30 and A1C35 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Replace appropriate resistor (para 2-86) or ceramic capacitor (para 2-85).

19. Check resistance of A1R135, A1R140 and A1C69 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of AlR139.
- Replace appropriate resistor (para 2-86) or ceramic capacitor (para 2-85).

20. Check voltage at A1E4 (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and remove A1U7 and A1U8.
- Set POWER OFF/ON switch ON.
- If reading between + 14.4V and + 15.6V, replace linear microcircuits A1U7 and A1U8 (para 2-85).

- Set POWER OFF/ON switch OFF.

- Reinstall linear microcircuits A1U7 and A1U8.

21. Check resistance of A1R160, A1R161, A1R163, A1R164, A1R167, A1R170, A1R174, A1C24, A1C27, A1C136 and A1C137 (fig. FO-4).

- Replace appropriate resistor (para 2-86) or ceramic capacitor (para 2-85).

22. Check voltage at A1E4 (fig. FO-4).

- Set POWER OFF/ON switch OFF.

- Disconnect A3P15 from A1J1.

- Set POWER OFF/ON switch ON.

- If reading between + 14.4V and + 15.6V, replace ceramic capacitor A1C1 (para 2-85).

- Set POWER OFF/ON switch OFF.

- Reconnect A3P15.

23 Check resistance of A1R28 (fig, FO-4).

- If reading not within limits, replace resistor (para 2-86).

- Replace linear microcircuits A1U1, A1U2, A1U3, and A1U4 (para 2-94) then reconnect and solder leads of A1R28.

24. Check resistance of A1R112, A1R113, A1R114, A1C52, A1C53 and A1C54 (fig, FO-4).

- Set POWER OFF/ON switch OFF.

- Replace appropriate resistor (para 2-86) or ceramic capacitor A1C54 (para 2-85).

25. Check resistance of A1R370 and A1C46 (fig, FO-4).

- Set POWER OFF/ON switch OFF.

- If any reading not within limits, replace resistor (para 2-86) or ceramic capacitor A1C54 (para 2-85).

- Replace linear microcircuit A1U19 (para 2-94).

26. Check resistance of A1R91, A1R92, A1R93, A1R212, A1R219, A1R220, A1R254, A1R258, and A1R266 (fig. FO-4).

- Set POWER OFF/ON switch OFF.

- If any reading not within limits, replace resistor (para 2-86).

- Replace electrolytic capacitor AIC140 (para 2-85).

27. Check resistance of A1R244, A1C89 and A1C143 (fig. FO-4).

    Set POWER OFF/ON switch OFF.

    If any reading not within limits, replace resistor (para 2-86) or ceramic capacitor (para 2-85).

    Replace linear microcircuit A1U17 (para 2-96).

END OF TEST

2-21. -15V MAIN BOARD OVERLOAD FAULT ISOLATION TEST.

DESCRIPTION

This test finds a main board fault overloading the –15V power supply.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
FUNCTION	Sine wave

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q13, A1Q16, A1Q22, A1Q23, A1Q25, A1Q26, A1Q32 and A1C142 (fig. FO-4).

- Disconnect A2C22 from A2C33 (fig. FO-5).
- Reconnect A1P2
- If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistor (para 2-92 or 2-93).

3. Check voltage at A1E11 (fig FO-4).

- Set POWER OFF/ON switch ON.
- Note voltage at right lead of A1R344.
- Center trim pot A11R226 (in MULTIPLIER circuit).
- If reading between – 14.4V and – 15.6V, replace resistor A1R344 (para 2-86).
- Return trim pot A1R226 to setting recorded in this step.

4 Check voltage at A1E11 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and lift one lead of A1R79.
- Set POWER OFF/ON switch ON.
- If reading between – 14.4V and – 15.6V, do step 8.

5. Check voltage at A1E11 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R79.
- Unsolder and lift one lead of A1R142.
- Set POWER OFF/ON switch ON.
- If reading between – 14.4V and – 15.6V, do step 11.

6. Check resistance of A1R196, A1R197, and A1R323 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R142.
- If any reading not within limits, replace resistor (para 2-86).

7. Check for most positive – 15V reading of the following locations (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If any reading not stable, set POWER OFF/ON switch OFF, wait 10 seconds, set POWER OFF/ON switch ON, wait 2 seconds, note reading.

IF MOST POSITIVE READING IS AT:	REFER TO:
A1U1 pin 4	Step 12
AU15 pin 7	Step 13
AIR121 (front lead)	Step 16
A1R172 (left lead)	Step 17

8. Check voltage at A1CR5 anode and cathode leads (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R79.
- Set POWER OFF/ON switch ON.
- If difference in readings between 5.9V and 6.5V, do step 10.
- If difference in readings greater than 6.5V, replace diode A1CR5 (para 2-87).

9. Check voltage at cathode of A1CR5 and right lead of A1R77 (fig, FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and Iift anode lead of A1CR5.
- Set POWER OFF/ON switch ON.
- If difference in readings more than 6.5V, replace diode A1CR5 (para 2-87).
- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1CR5.

10. Check resistance of A1R78, A1C36, A1C37 and A1C38 (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Replace appropriate resistor (para 2-86), ceramic capacitor A1C38 (para 2-85) or disc capacitor A1C36 (para 2-88).

11. Check resistance of A1R136, A1R141 and A1C70 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R142.
- Replace appropriate resistor (para 2-86) or ceramic capacitor (para 2-85).

12. Check resistance of A1R35 and A1C22 (fig, FO-4).

- Set POWER OFF/ON switch OFF.
- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88).
- Replace linear microcircuits A1U1, A1U2, A1U3 and A1U4 (para 2-94).

13. Check voltage at A1E11 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Remove A1U15 from socket.
- Set POWER OFF/ON switch ON.
- If reading between – 14.4V and – 15.6V, replace linear microcircuit A1U15 (para 2-94).

14. Check voltage at A1E11 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reinstall original A1U15.
- Unsolder and lift one lead of A1R390.
- Set POWER OFF/ON switch ON.
- If reading more positive than – 14.4V, do step 15.
- Set POWER OFF/ON switch OFF.
- Replace ceramic capacitor A1C139 (para 2-85) and linear microcircuit A1U18 (para 2-94), then reconnect and solder leads of A1R390.

15. Check resistance of A1R243, A1R248, A1C45, A1C85, A1C91, A1C93 and A1C142 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1R390.
- If any reading not within limits, replace resistor (para 2-86) or ceramic capacitor (para 2-85).
- Replace linear microcircuits A1U17 (para 2-96) and A1U19 (para 2-94).

16. Check resistance of A1R89, A1R100, A1R103, A1R110, A1R121, A1R28, A1R130, A1R180, A1C47, A1C58 and A1C59 (fig, FO-4).

- Set POWER OFF/ON switch OFF.
- If any reading not within limits, replace resistor (para 2-86) or ceramic capacitor (para 2-85).
- Replace electrolytic capacitors A1C73 and A1C167 (para 2-85).

17. Check resistance of A1R144, A1R 154, A1R 62, A1R164, A1R172, A1C25, A1C28, A1C75, and A1C81 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If any reading not within limits, replace resistor (para 2-86) or ceramic capacitor (para 2-85).
- Replace linear microcircuits A1U7 and A1U8 (2-94).

END OF TEST

2-22. +15V AUXILIARY BOARD OVERLOAD FAULT ISOLATION TEST.

DESCRIPTION

This test finds an auxiliary board fault overloading the +15V power supply.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig, FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A2C13 (fig, FO-5).

- If reverse resistance measurement not 10 times greater than forward resistance, replace transistor A2Q3 (para 2-92)

3. Check voltage at " + " lead of A2C33 (fig. FO-5).

- Unsolder and lift one lead of jumper wire (3) on auxiliary board.
- Set POWER OFF/ON switch ON.
- If reading less than + 14.4V do step 4.
- Set POWER OFF/ON switch OFF.
- Replace ceramic capacitor A2C6 (para 2-85), electrolytic capacitor A2C33 (para 2-85) and linear micro-circuit A2U3 (para 2-96), then reconnect and solder leads of jumper wire (3) on auxiliary board

4. Check resistance of A2C15, A2C17 and A2C19 (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of jumper wire (3) on auxillary board.
- If any reading not within limits, replace ceramic capacitor (para 2-85).
- Replace linear microcircuits A2U1 and A2U6 (para 2-94).

END OF TEST

2-23. –15V AUXILIARY BOARD OVERLOAD FAULT ISOLATION TEST.

DESCRIPTION

This test finds an auxiliary board fault overloading the –15V power supply

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

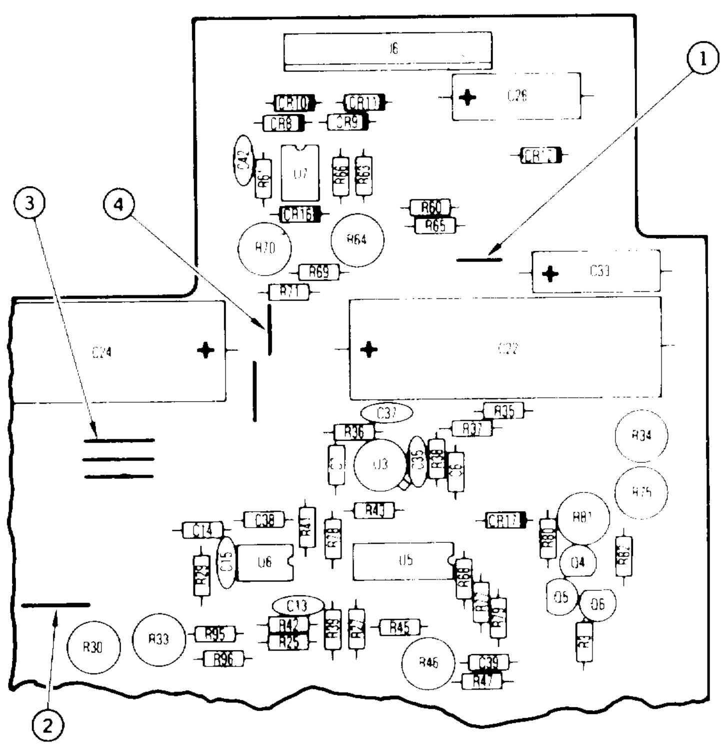
1. Set signal generator POWER OFF/ON switch to OFF (fig FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Note voltage at A2U2 pins 1 and 12 (fig FO-5).

- Disconnect white wire from jumper (4) on auxiliary board.
- Disconnect A4P7.
- Note direction of connector pin (white wire) and insert into A4P7 pin 9 (part of para 2-75).
- Reconnect A4P7.
- Reconnect and solder leads of jumper (4) on auxiliary board.
- Set POWER OFF/ON switch ON.
- Note voltage at A2U2 pin 1.
- Note voltage at A2U2 pin 12.
- Center trim pots A2R11 and A2R12.



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3. Check voltage at " – " lead of A2C34 (fig, FO-5).

- If reading between – 14.4V and – 15.6V, replace digital microcircuit A2U2 (para 2-94).
- Return trim pot A2R11 to setting recorded at A2U2 pin 1.
- Return trim pot A2R12 to setting recorded at A2U2 pin 12.

4. Check resistance of A2R22, A2R59, A2C7, A2C14, A2C18 and A2C34 (fig, FO-5).

- Set POWER OFF/ON switch OFF.
- If any reading not within limits, replace resistor (para 2-86), electrolytic capacitor or ceramic capacitor (para 2-85).
- Replace linear microcircuits A2U1, A2U2, A2U3 and A2U6 (para 2-94).

END **OF TEST**

2-24. POWER SUPPLY INPUT CIRCUIT FAULT ISOLATION TEST.

DESCRIPTION

This test finds a power supply input circuit fault.

INITIAL SETUP

WARNING

Power cable must be removed to prevent dangerous voltages in generator.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of fuse A4F1 (fig 2-2).

• If reading more than 2.0 ohms, replace fuse A4F1 (TM 11-6625-3051-12

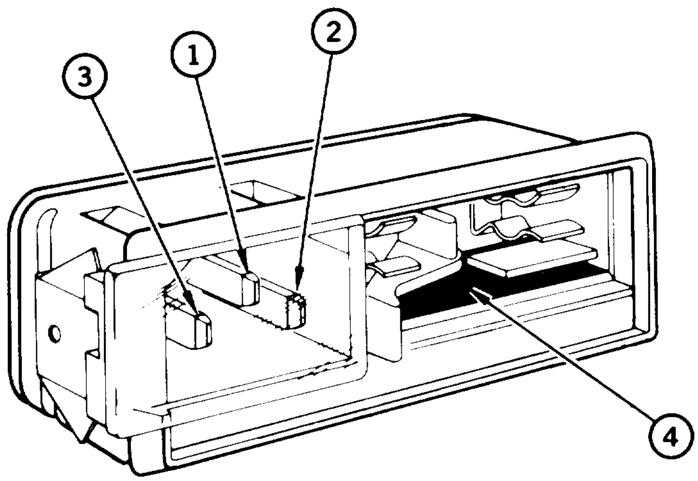

Figure 2-2. Power Receptacle Terminal Connections.

3. Check resistance between terminals of A4J15 (fig. 2-2).

• If any reading not infinite, replace power receptacle A4J15 (para 2-69).

MEASUREMENT POINTS

Ground (1) to Hot (2)

Hot (2) to Neutral (3)

Ground (1) to Neutral (3)

4. Check resistance between hot (2) and neutral (3) terminals of A4J15 (fig. 2-2).

WARNING

Ensure that power cable remains disconnected

• Set POWER OFF/ON switch ON.

IF READING IS:	REFER TO:
Between 12 and 22 ohms	Step 5
Less than 12 ohms	Step 6
Greater than 22 ohms	Step 7

5. Check resistance between point A4J15-D and ground terminal (fig 2-3⏚).

- Remove voltage selector card (fig. 2-2.4)
- Remove power receptacle cover inside rear panel (part of para 2-69).
- If reading infinite, replace power receptacle A4J15 (para 2-69).
- Replace power transformer A4T1 (para 2-70).

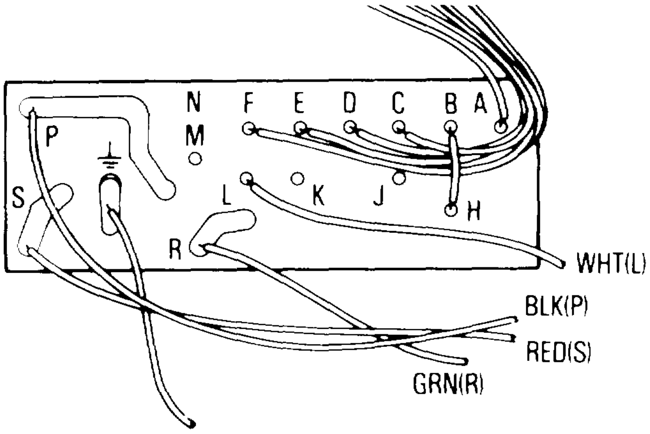

Figure 2-3. Power Receptacle Wiring Connections

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6. Check insulation and wire for damage (fig FO-9).

- Remove power receptacle cover inside rear panel (part of para 2-69).
- If wiring damaged, repair as necessary, then reinstall power receptacle cover.
- Replace power transformer A4T1 (para 2-70).

7. Check and clean voltage selector card (fig. 2-2,4)

- Remove voltage selector card.
- . Inspect plated surfaces of voltage selector card for cleanness and breaks.
- If voltage selector card damaged, replace power receptacle A4J15 (para 2-69).

- Clean voltage selector card with trichlorotriflouroethene and soft cloth.

WARNING

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

- Leave voltage selector card out of receptacle

8. Check resistance between points A4J15-C and A4J15-E (fig 2-3).

- Remove power receptacle cover inside rear panel (part of para 2-69).
- If reading not between 23 ohms and 33 ohms, replace power transformer A4T1 (para 2-70), then reinstall voltage selector card.

9. Check resistance between points A4J15-D and A4J15-F (fig 2-3).

- If reading not between 33 ohms and 43 ohms, replace power transformer A4T1 (para 2-70), then reinstall voltage selector card.
- Reinstall voltage selector card with “120” visible.

10 Check resistance between power receptacle points (fig 2-3).

- Measure the followlng points.

A4J15-H to A4J15-J
A4J15-D to A4J15-H
A4J15-K to A4J15-L

- If any reading not less than 0.1 ohms, replace power receptacle A4J15 (para 2-69.

11 Check resistance between points A4J15-R and A4J15-S (fig 2-3).

- If less than 0.1 ohms, replace power receptacle A4J15 (para 2-69).
- Replace power switch A4SW1 (para 2-67).

END OF TEST

2-25. DIAL LIGHT CIRCUIT FAULT ISOLATION TEST.

DESCRIPTION

This test finds a dial light circuit fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check voltage at A2CR8 anode (fig. FO-5).

   Set POWER OFF/ON switch ON.

   If reading not more negative than – 17.5V, do unregulated ±15V fault isolation test (para 2-17).

3. Check voltage at front lead of A2R2 (fig, FO-5).

   If reading more positive than – 14V, replace switch/control assembly A2SW2/A2R2 (para 2-86).

   Replace light bulb assembly A3DS1 (para 2-100).

END OF TEST

2-26. FUNCTION OUT (50 Ω) SIGNAL PATH ISOLATION TEST.

DESCRIPTION

This test finds a fault causing FUNCTION OUT to be incorrect or missing

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig, FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2.0
FREQ MULT (Hz)	1K
SYMMETRY	OFF
DC OFFSET	OFF
FUNCTION	Triangle
ATTENUATION	0
Mode	CONT
All small knobs (except TRIG START/STOP)	Clockwise
TRIG START/STOP	0°CAL
MODULATION Switches	OFF

NOTE

Signal generator controls not listed may be left in any position.

2. Set oscilloscope (scope) controls as follows: Vertical controls:

CONTROL	SETTING
VERT MODE	CH 1
VOLTS/DIV	.5
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls:

CONTROL	SETTING
TIME/DIV	1 ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

WARNING

Power supply voltage or output amplifier signal always present on output amplifier heat sinks.

3. Check for normal waveforms in output path of generator (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If 1 Vp-p triangle not displayed at A1U15 pin 9, do step 4.
- If 4 Vp-p triangle not displayed at center lead of A1R5, do step 5.
- If 30 Vp-p waveform displayed at A1TP8, do attenuator fault isolation test (para 2-55).
- Do output amplifier fault isolation test (para 2-52).

4. Check waveform at A1TP4 (fig, FO-4).

- If 25 Vp-p triangle displayed, do signal shaper fault isolation test (para 2-49).
- Do triangle buffer fault isolation test (para 2-45).

5. Check voltage at pin 2 of A1U15 socket and center lead of A1R5 (fig, FO-4).

- Set POWER OFF/ON switch OFF.
- Remove A1Q50 and A1U15.
- Set POWER OFF/ON switch ON
- If voltage at both points between + 0.1V and – 0.1V, replace A1Q50 and reinstall A1U15, then do multiplier fault isolation test (para 2-50).
- Set POWER OFF/ON switch OFF.
- Replace A1Q50 and reinstall AlU15.
- Do preamplifier fault isolation test (para 2-51).

6 Check waveform at A1Q57 collector (fig FO-4).

- Set FUNCTION switch to square
- If 2.5 Vp-p square wave displayed, do signal shaper fault isolation test (para 2-49).

7. Check resistance of A1Q57 and A1Q58 (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Rotate FUNCTION switch to DC.
- If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistor (para 2-92).

8 Check resistance of A1R150, A1R151, A1R202, A1R235 and A1R242 (fig. FO-4).

- Replace appropriate resistor (para 2-86).

END OF TEST

2-27. MAIN GENERATOR LOOP ISOLATION TEST.

DESCRIPTION

This test finds a fault in the main generator loop

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2.0
FREQ MULT (Hz)	1K
SYMMETRY	OFF
FUNCTION	Triangle
Mode	CONT
All small knobs (except TRIG START/STOP)	Clockwise
TRIG START/STOP	0°CAL
MODULATION Switches	OFF

NOTE

Signal generator controls not listed may be left in any position.

2. Set oscilloscope (scope) controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH 1
VOLTS/DIV	.5
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls:

CONTROL	SETTING
TIME/DIV	.1 ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

WARNING

Power supply voltage or output amplifier signal always present on output amplifier heat sinks.

3. Check resistance of A1Q16 and A1C158 (fig FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistor (para 2-92).

4. Check voltage at A1CR27 cathode (fig. FO-4).

- Set POWER OFF/ON switch ON.

- If reading positive, do step 6.

5. Check waveform at A1TP3 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and lift one lead of A1CR27.
- Set POWER OFF/ON switch ON.
- If 2.5 Vp-p triangle displayed, reconnect A1CR27, then do trigger/gate fault isolation test (para 2-28).
- Set POWER OFF/ON switch OFF.
- Reconnect A1CR27.
- Set POWER OFF/ON switch ON.

6. Check voltages at the following points (fig. FO-4).

TEST POINT	IF READING IS:	REFER TO:
A1U5 pin 6	Not +9.5V to + 12.5V	Step 11
A1U6 pin 6	Not – 10.5V to – 12.5V	Step 11
A1FB1 and A1TP3	Greater than 200 millivolts between points	Step 10
A1Q14 collector	Not + 2V to + 4.0V	Step 8
A1Q15 collector	Not – 2V to – 4.0V	Hysteresis switch fault isolation test (para 2-43).
A1C25 emitter	More negative than – 1.5V	Current switch fault isolation test (para 2-44)

7. Check voltages at anode and cathode of AICR13 (fig. FO-4).

- If anode of A1CR13 0.7V more positive than cathode of A1CR13, do step 13.
- Do current switch fault isolation test (para 2-44).

8. Check voltage at A1Q14 collector (fig. FO-4).

- If reading between – 1.5V and – 3V, do step 9.
- Set POWER OFF/ON switch OFF.
- Unsolder and lift cathode of AICR17 and anode of AICR18.
- Set POWER OFF/ON switch ON.
- If reading between + 2.5V and +4.5V, reconnect A1CR17 and A1CR18, then do current switch fault isolation test (para 2-44).
- Set POWER OFF/ON switch OFF.
- Reconnect AICR17 and A1CR18, then do hysteresis switch fault isolation test (para 2-43).

9. Check voltage at A1Q15 collector (fig. FO-4).

- If reading between + 2V and + 4V, do current switch fault isolation test (para 2-44).
- Do hysteresis switch fault isolation test (para 2-43).

10. Check waveform at A1TP3 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Unsolder and lift one lead of A1R80.
- Set POWER OFF/ON switch ON.
- If 25 Vp-p triangle displayed, reconnect A1R80, then do triangle buffer fault isolation test (para 2-45).
- Set POWER OFF/ON switch OFF.
- Reconnect A1R80, then do triangle amplifier fault isolation test (para 2-42).

11. Check voltage at A1CR1 anode lead (fig. FO-4).

- If reading not read between – 4V and – 6V, do VCG summing fault isolation test (para 2-35).

12. Check voltages at the following points (fig. FO-4).

- Note voltage at right lead of A1R3.
- Set POWER OFF/ON switch OFF.
- Connect A1CR46 cathode lead to ground.
- Turn A1R14 fully clockwise.
- Set POWER OFF/ON switch ON
- If any reading not as shown, disconnect A1CR46 cathode lead from ground, return trim pot A1R14 to setting recorded above, then do appropriate test.

TEST POINT	IF READING IS:	REFER TO:
A1U2 pin 6	Not – 2V to – 5V	VCG amplifiers fault isolation test (para 2-36)
A1U3 pin 6	Not –3.5V to –6.5V	VCG amplifiers fault isolation test (para 2-36)
A1U4 pin 6	Not –9.5V to – 12.5V	VCG amplifiers fault isolation test (para 2-36)
A1U5 pin 6	Not + 5V to + 8V	Current source fault isolation test (para 2-37)
A1U6 pin 6	Not –9.5V to – 12.5V	Current sink fault isolation test (para 2-38)

- Turn A1R14 fully counterclockwise for the following tests

A1U2 pin 6	Not –12V to –15V	VCG amplifiers fault isolation test (para 2-36)
A1U3 pin 6	Not 0 Vdc to + 0.5V	VCG amplifiers fault isolation test (para 2-36)
A1U4 pin 6	Not +12V to +15V	VCG amplifiers fault isolation test (para 2-36)
A1U5 pin 6	Not + 21V to + 24V	Current source fault isolation test (para 2-37)
A1U6 pin 6	More positive than – 23V	Current sink fault isolation test (para 2-38)

- Return trim pot A1R14 to setting recorded in this step.
- Set POWER OFF/ON switch OFF
- Disconnect A1CR46 cathode lead from ground

13. Check resistance of A1R1 33 (fig. FO-4).

- Set POWER OFF/ON switch OFF
- If reading not within limits, replace resistor (para 2-86).

14. Check voltage at A1U5 pin 6 (fig. FO-4).

- Unsolder and lift right lead of A1R133.
- Connect a 100 ohm resistor between lifted lead of AlR133 and ground.
- Set frequency dial at 2.0
- Set POWER OFF/ON switch ON.
- If reading not between + 10.5V and + 13.5V, remove 100 ohm resistor, reconnect A1R133, then do current source fault isolation test (para 2-37).

15. Check voltage at A1Q3 collector (fig. FO-4).

- If reading not between + 0.10V and + 0.15V, remove 100 ohm resistor, reconnect A1R133, then do current source fault isolation test (para 2-37).

16. Check voltage at A1U5 pin 6 (fig. FO-4).

- Rotate frequency dial to 02.
- If reading not between + 16.5V and + 19.5V, remove 100 ohm resistor, reconnect A1R1 33, then do current source fault isolation test (para 2-37).

17. Check voltage at A1Q3 collector (fig. FO-4).

- If reading not between 0 Vdc and + 0.01V, remove 100 ohm resistor, reconnect A1R1 33, then do current source fault isolation test (para 2-37).

18. Check resistance of A1R134 (fig, FO-4).

Set POWER OFF/ON switch OFF.

Remove 100 ohm resistor.

Reconnect A1R33.

If A1R134 reading not between 32.87 ohms and 33.53 ohms, replace resistor (para 2-86).

Do current sink fault isolation test (para 2-38).

END OF TEST

2-28. TRIGGER/GATE FAULT ISOLATION TEST.

DESCRIPTION

This test finds a fault preventing trigger and gate modes from working properly.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2.0
FREQ MULT (Hz)	10k
SYMMETRY	OFF
FUNCTION	Triangle
Mode	INT GATE
All small knobs (except TRIG START/STOP)	CW
TRIG START/STOP	0°CAL
MODULATION GENERATOR:	
FUNCTION	Sine
FREQ/PERIOD MULT (Hz/s)	10/100m to 1 K/1m
MODULATION Switches	OFF

NOTE

Signal generator controls not listed may be left in any position

2. Set oscilloscope (scope) controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH 1
VOLTS/DIV	2
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls:

CONTROL	SETTING
TIME/DIV	.2 ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3. Check resistance of A1CR27 (fig, FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace diode set A1CR2 and A1CR27 (para 2-87).

4. Check waveform at cathode lead of A2CR3 (fig, FO-5).

- Connect a coaxial cable from EXT TRIG IN connector to OUT (600 Ω) connector (fig. FO-6).

- Set POWER OFF/ON switch ON.

- Adjust TRIGGER LEVEL vernier for symmetrical square wave.
- If symmetrical square wave of approximately 4.2 Vp-p + 1.7V offset not displayed, do trigger signal limiter fault isolation test (para 2-60).

5. Check for correct results at right side of AIR173 (fig FO-4).

- If any reading not as shown, do appropriate step.

MODE SETTING:	APPROXIMATE RESULT:	REFER TO:
INT GATE	Unsymmetrical square wave 2.2 Vp-p + 0.3V offset	Step 7
INT TRIG	Positive pulse 2.2 Vp-p + 0.3V offset	Step 8
CONT	+1.4V	Step 9
EXT TRIG	Positive pulse 2.2 Vp-p + 0.3V offset	Step 8
EXT GATE	Unsymmetrical square wave 2.2 Vp-p + 0.3V offset	Step 7

6. Check resistance of A1R156 and A1R157 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Replace appropriate resistor (para 2-86).

7. Check waveform at A1CR21 cathode lead (fig FO-4).

- If nonsymmetrical – 0.3V square wave displayed, do trigger amplifier fault Isolation test (para 2-47).
- Do step 10.

8. Check waveform at A1CR21 cathode lead (fig. FO-4).

- If – 0.3V pulse displayed, do trigger amplifier fault isolation test (para 2-47).
- Do step 10

9. Check voltage at A1CR21 cathode lead (fig. FO-4).

- If reading between – 0.2V and – 0.4V, do trigger amplifier fault Isolation test (para 2-47).

10. Check resistance of A1R158 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If reading not within Iimits, replace resistor (para 2-86).

11. Check voltage at A1CR21 cathode lead (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If reading not approximately – 1.6V, do trigger logic fault isolation test (para 2-46).

12. Check resistance of A1R155 (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Reconnect A1R158.
- If reading not wlthin limits, replace resistor (para 2-86).

13. Check voltage at right side of A1R173 (fig FO-4).

- Connect rear lead of A1R155 to ground.
- Set POWER OFF/ON switch ON.
- If reading not between + 1.5V and + 2.5V, reconnect A1R155 then do trigger amplifier fault isolation test (para 2-47).
- Set POWER OFF/ON switch OFF.
- Reconnect A1R155
- Do trigger baseline compensation fault isolation test (para 2-48).

END OF TEST

2-29. SYNC OUT FAULT ISOLATION TEST.

DESCRIPTION

This test finds a fault in the sync out circuit.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q16 and A1Q23 (fig. FO-4).

Set POWER OFF/ON switch OFF.

If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistor (para 2-92).

3. Check resistance of A1R106, A1R108, A1R109, A1R110, and A1R338 (fig. FO-4).

Replace appropriate resistor (para 2-86).

END OF TEST

2-30. SYNC IN FAULT ISOLATION TEST.

DESCRIPTION

This test finds a fault in the sync in circuit.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position

2. Check resistance of A1CR52 (fig. FO-4).

- If resistance measurement in either direction not normal forward resistance, replace A1CR52 and A1CR53 (para 2-87).

3. Check resistance of A1R98, A1R391, A1R392, A1C48, A1C171, and A1C172 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88).
- Replace linear microcircuit A1U14 (para 2-96).

END OF TEST

2-31. MODULATION GENERATOR OUT (600 Ω) FAULT ISOLATION TEST.

DESCRIPTION

This test finds a fault causing MODULATION GENERATOR OUT (600 Ω) to be incorrect or missing

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
MODULATION GENERATOR	
FUNCTION	SINE
FREQ/PERIOD MULT (Hz/s)	10/100m to 1K/1m
MODULATION Switches	OFF
All small knobs (except TRIG START/STOP	Clockwise

NOTE

Signal generator controls not listed may be left in any position.

2. Set oscilloscope (scope) controls as follows:

Vertical controls

CONTROL	SETTING
VERT MODE	CH 1
VOLTS/DIV	2
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls

CONTROL	SETTING
TIME/DIV	1ms
(VAR)	Fully clockwlse
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3. Check waveforms at A2U2 pins 2, 3 and 9 (fig. FO-5).

- Set FREQ/PERIOD MULT switch to any position which produces an incorrect output at OUT (600 Ω) Connector

PIN	WAVEFORM	MINIMUM P-P AMPLITUDE	MINIMUM OFFSET
2	Sine wave	1V	– 2V
3	Triangle	2V	– 2V
9	Square	2V	– 3V

- If any waveform does not meet or exceed minimum requirements, do modulation generator fault isolation test (para 2-56).

4 Check waveform at A2E3 (fig FO-5)

- Rotate MODULATION GENERATOR FUNCTION switch through all positions.

FUNCTION	NORMAL P-P AMPLITUDE	NORMAL DC OFFSET
Sine wave	3V	– 8V
Triangle	3V	– 8V
Square	3V	– 8V
Positive Ramp	1.5V	– 8V
Negative Ramp	1.5V	- 8V
SWP SET	0V	– 6V

- If any result not approximately normal, do ramp generator fault isolation test (para 2-57)
- Do function buffer fault isolation test (para 2-58).

END OF TEST

2-32. AM MODULATION FAULT ISOLATION TEST.

DESCRIPTION

This test finds an AM modulation fault

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death

NOTE

PRELIMINARY PROCEDURE.
Remove bottom cover (para 2-61)
Remove top cover (para 2-62)

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
TRIG START/STOP	0°CAL
All small knobs (except TRIG START/STOP	Clockwise
MODULATION GENERATOR:	
FUNCTION	Sine
MOD AMPLITUDE	MAX
FREQ/PERIOD MULT (Hz/s)	10/100m to 1K/1m
MODULATION Switches:	
AM	INT
FM/SWP	OFF
PM (ϕ)	OFF

NOTE

Signal generator controls not listed may be left in any position

2. Set oscilloscope (scope) controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH1
VOLTS/DIV	2V
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls:

CONTROL	SETTING
TIME/DIV	.2ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3. Check voltage at right lead of A1R348 (fig, FO-4)

- Set POWER OFF/ON switch ON
- If reading not between – 6.5V and – 8.5V, do step 7

4. Check waveform at A1TP6 (fig. FO-4)

- If waveform displayed is approximately 5 Vp-p, do multiplier fault isolation test (para 2-50).

5. Check resistance between A2SW2 right side center lead (fig, FO-5), and A1TP6 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If reading not less than 01 ohms, replace ribbon cable A2P5 (para 2-84).

6. Check resistance of A1R348 (fig. FO-4).

- Set AM MODULATION switch OFF.
- If reading not within limits, replace resistor (para 2-86).
- Do modulation control fault isolation test (para 2-59).

7. Check resistance between right lead of A1R348 (fig. FO-4) and A2SW2 left center lead (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- If reading not less than 0,1 ohms, replace ribbon cable A2P5 (para 2-84).

8 Check resistance of A2R87 (fig. FO-5).

- Set AM MODULATION switch OFF.
- If reading not within limits, replace resistor (para 2-86).
- Replace toggle switch A2SW2 (para 2-91).

END OF TEST

2-33. FM/SWP MODULATION FAULT ISOLATION TEST.

DESCRIPTION

This test finds an FM/SWP modulation fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61)
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator controls (fig FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
All small knobs (except TRIG START/STOP	Clockwise
TRIG START/STOP	0°CAL
MODULATION GENERATOR:	
FUNCTION	Sine
FREQ/PERIOD MULT (Hz/s)	10/100m to 1K/1m
MODULATION Switches	
AM	OFF
FM/SWP	INT
PM (ϕ)	OFF

NOTE

Signal generator controls not listed may be left in any position.

2. Set oscilloscope (scope) controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH1
VOLTS/DIV	2
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls.

CONTROL	SETTING
TIME/DIV	.2ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3 Check waveform at rear lead of A1R15 (fig. FO-4)

- Set POWER OFF/ON switch ON
- If waveform displayed is approximately 10 Vp-p, replace resistor A1R15 (para 2-86)

4. Check resistance between rear lead of A1R15 (fig. FO-4) and jumper wire between A2SW3 and A2SW4 (fig FO-5).

- Set POWER OFF/ON switch OFF
- If reading not less than 0.1 ohms, replace ribbon cable A2P5 (para 2-84).
- Do modulation control fault isolation test (para 2-59)

END OF TEST

2-34. PM (φ) MODULATION FAULT ISOLATION TEST.

DESCRIPTION

This test finds a PM (φ) modulation fault

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
All small knobs (except TRIG START/STOP	Clockwise
TRIG START/STOP	0°CAL
MODULATION GENERATOR:	
FUNCTION	Sine
FREQ/PERIOD MULT (Hz/s)	10/100m to 1K/1m
MODULATION Switches:	
AM	OFF
FM/SWP	OFF
PM (ϕ)	INT

NOTE

Signal generator controls not listed may be left in any position.

2 Set oscilloscope (scope) controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH1
VOLTS/DIV	2
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls:

CONTROL	SETTING
TIME/DIV	.2ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3 Check waveform at right lead of A1R16 (fig. FO-4)

- Set POWER OFF/ON switch ON
- If waveform displayed is approximately 10 Vp-p, do differentiator fault isolation test (para 2-40)

4. Check resistance between right lead of A1R16 (fig. FO-4) and jumper wire between A2J11 and A2J12 (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- If reading not less than 0.1 ohms, replace ribbon cable A2P5 (para 2-84).
- Do modulation control fault isolation test (para 2-59).

END OF TEST

2-35. VCG SUMMING FAULT ISOLATION TEST.

DESCRIPTION

This test finds a VCG summing fault

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1CR1 and A1CR46 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate diode (para 2-87).

3. Check voltage at rear lead of A1R7 while rotating A1R8 (fig. FO-4).

- Set POWER OFF/ON switch ON.
- Record voltage at rear lead of A1R7.

- Rotate A1R8 from fully counterclockwise to fully clockwise.
- If reading does not swing from more positive than + 14.4V to more negative than 14.4, replace trim pot A1R8 (para 2-91).
- Return trim pot A1R8 to setting recorded in this step.

4. Check voltage at right lead of A1R13 while rotating A1R14 (fig. FO-4).
   - Record voltage at right lead of A1R13.
   - Rotate A1R14 from fully counterclockwise to fully clockwise.
   - If reading does not swing from more positive than + 14.4V to more negative than - 14.4, replace trim pot A1R14 (para 2-91).
   - Return trim pot A1R14 to setting recorded in this step,

5. Check voltage at rear lead of A1R207 (fig. FO-4).
   - Set VERNIER fully counterclockwise.
   - If reading not more negative than – 14.4V, replace switch/control assembly A1SW1/A1R1 (para 2-86).

6. Check resistance between the following A1P15 pins (fig. FO-4).
   - Set POWER OFF/ON switch OFF.
   - Disconnect A1P15.
   - If any reading not within limits given, replace Dial Pot A3R1 (para 2-68).

DIAL SETTING:	POINTS TESTED:	NORMAL RESULT:
2.0	Pins 1 and 2	4.5 kilohms to 5.5 kilohms
	Pins 1 and 3	4,5 kilohms to 5.5 kilohms
	Pins 2 and 3	4 ohms or less
.02	Pins 1 and 2	4 ohms or less
	Pins 2 and 3	4.5 kilohms to 5.5 kilohms

7. Check for smooth resistance transition of trim pot A1R10 (fig. FO-4).
   - Measure and record resistance value between center lead (wiper) and left lead.
   - Rotate trim pot A1R10 from fully clockwise to fully counterclockwise.
   - Measure resistance value between center lead (wiper) and right lead.
   - Rotate trim pot A1R10 from fully clockwise to fully counterclockwise.

- If either resistance transition not smooth, replace trim pot A1R10 (para 2-86)
- Return trim pot A1R10 to setting recorded in this step

8. Check resistance of A1R6, A1R7, A1R9, A1R11, A1R12, A1R13, A1R32, A1R207, A1R146, A1C1, A1C2, and A1C8 (fig FO-4).

- Disconnect A1P15.
- If reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85), or disc capacitor (para 2-88), then reconnect A1P15.
- Reconnect A1P15, then replace linear microcircuit A1U1 (para 2-94)

END OF TEST

2-36. VCG AMPLIFIERS FAULT ISOLATION TEST.

DESCRIPTION

This test finds a VCG amplifier fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	20
FREQ MULT (Hz)	1K
SYMMETRY	OFF
Mode	CONT
All small knobs (except TRIG START/STOP)	Clockwise
TRIG START/STOP	0°CAL
MODULATION Switches	OFF

NOTE

Signal generator controls not listed may be left in any position

2. Check resistance of A1Q1 and A1Q2 (fig. FO-4).

   - If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate transistor (para 2-92).

3. Check resistance between A1E21 and A1E22 (fig. FO-4).

   - If reading not less than 0.1 ohm, replace switch/control assembly A1SW2/A1R2 (para 2-97).

4. Check resistance of A1R29, A1R30, A1R33 and A1R34 (fig. FO-4).

   - If reading not withi limits, replace resistor (para 2-86).

5. Check voltage at A1U2 pin 2 (fig. FO-4).

   - Unsolder and lift left lead of A1R29 and right lead of A1R34.
   - Connect 10 kilohm resistor between left lead of A1R29 and A1E11.
   - Set POWER OFF/ON switch ON
   - If reading not between – 0.2V and + 0.2V, do step 8.

6. Check voltage at A1U4 pin 2 (fig. FO-4).

   - Set POWER OFF/ON switch OFF.
   - Disconnect 10 kilohm resistor.
   - Connect 10 kilohm resistor between right lead of A1C116 and A1E4.
   - Set POWER OFF/ON switch ON.
   - If reading not between – 4.0V and – 60V, do step 10.

- Set POWER OFF/ON switch OFF.
- Disconnect 10 kilohm resistor, then reconnect A1R29 and A1R34.

7. Check resistance of A1R19, A1R20, A1R26 and A1C120 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 89).
- Replace linear microcircuit A1U3 (para 2-94).

8 Check voltage at left lead of A1R24 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Disconnect 10 kilohm resistor.
- Reconnect A1R29 and A1R34.
- Set POWER OFF/ON switch ON.
- Record voltage at left lead of A1R24.
- Rotate A1R23 from fully counterclockwise to fully clockwise.
- If reading does not swing from more positive than + 14.4V to more negative than – 14.4V, replace trim pot A1R23 (para 2-91)
- Return trim pot A1R23 to setting recorded in this step

9 Check resistance of A1R22, A1R24, A1R25, A1R28 and A1C115 fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If reading not within limits, replace resistor (para 2-86) or disc capacitor A1C115 (para 2-88).
- Replace linear microcircuit A1U2 (para 2-94).

10. Check for smooth resistance transition of trim pot A1R36 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Disconnect 10 kilohm resistor.
- Reconnect A1R29 and A1R34.
- Measure and record resistance value between center lead (wiper) and left lead.
- Rotate trim pot A1R36 from fully clockwise to fully counterclockwise.
- Measure resistance value between center lead (wiper) and right lead.
- Rotate trim pot A1R10 from fully clockwise to fully counterclockwise.

- If either resistance transition not smooth, replace trim pot A1R36 (para 2-86).
- Return trim pot A1R36 to setting recorded in this step.

11. Check resistance of A1R21, A1R27, A1R35 and A1C116 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88).
- Replace linear microcircuit A1U4 (para 2-94).

END OF TEST

2-37. CURRENT SOURCE FAULT ISOLATION TEST.

DESCRIPTION

This test finds a current source fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1 Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q3, A1Q4 and A1CR2 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the matched diode set (A1CR2 and A1CR27, para 2-87) or appropriate transistor (para 2-92).

3. Check resistance of A1R38, A1R40, A1R41, A1R42, A1R133, A1R326, A1R327, A1R333, A1C20 and A1C21 (fig FO-4).

- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88).
- Replace linear microcircuit A1U5 (para 2-94).

END OF TEST

2-38. CURRENT SINK FAULT ISOLATION TEST.

DESCRIPTION

This test finds a current sink fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q5 and A1Q6 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate transistor (para 2-92).

3. Check resistance of A1R43, A1R44, A1R45, A1R48, A1R134, A1R328, A1R330, A1R345, A1C22 and A1C23 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86) or disc capacitor A1C23 (para 2-88).
- Replace linear microcircuit A1U6 (para 2-94).

END OF TEST

2-39. MAIN BOARD RANGE FAULT ISOLATION TEST.

DESCRIPTION

This test finds a frequency range fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to 10M (fig. FO-6).

- Set POWER OFF/ON switch OFF.
- If reading between A1E3 and front lead of A1R329 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- If reading between A1E4 and right lead of A1R325 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

3. Check resistance of A1R39, A1R47, A1R81, A1R82, A1R83, A1R84, A1R85, A1R86, A1R325, and A1R329 (fig. FO-4).

   - Set POWER OFF/ON switch OFF.
   - Set FREQ MULT switch to 1K.
   - If any reading not within limits, replace resistor (para 2-86).
   - Replace silver mica capacitors A1C40, A1C41, A1C42, A1C43 and A1C67 (para 2-88), and trim capacitor A1C68 (para 2-99).

4. Check resistance of A1SW1 with FREQI MULT (Hz) switch set to 1M (fig, FO-4).

   - Set POWER OFF/ON switch OFF.
   - If reading between A1E3 and front lead of A1R46 more than 0.1 ohms, replace switch/control assembly A1SW1/AR1 (para 2-76).
   - If reading between A1E4 and front lead of A1R374 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
   - If reading between A1E5 and front lead of A1C133 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

5. Check resistance of A1R374 (fig. FO-4).

   - If reading not within limits, replace resistor (para 2-86).
   - Replace silver mica capacitor A1C133 (para 2-88) and trim capacitor A1C125 (para 2-99).

6. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to 100K (fig. FO-6).

   - Set POWER OFF/ON switch OFF.
   - If reading between A1E3 and front lead of A1R46 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
   - If reading between A1E4 and front lead of A1R37 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
   - If reading between A1E5 and front lead of A1C62 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
   - Replace silver mica capacitors A1C61, and A1C126 (para 2-88), and trim capacitor A1C62 (para 2-99).

7. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to 10K (fig. FO-6).

   - Set POWER OFF/ON switch OFF.
   - If reading between A1E3 and front lead of A1R46 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

- If reading between A1E4 and front lead of A1R37 more than 0.1 ohms, replace switch/control assembly ASW/A1R1 (para 2-76).

- If reading between A1E5 and right lead of A1C63 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

- Replace matched capacitor set containing A1C63, A1C64, and A1C65 (para 2-85).

8. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to 1 K (fig FO-6).

   - Set POWER OFF/ON switch OFF.

   - If reading between A1E5 and left lead of A1C64 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

   - Replace matched capacitor set containing A1C63, A1C64, and A1C65 (para 2-85).

END OF TEST

2-40. DIFFERENTIATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds a differentiator fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2.0
FREQ MULT	100
SYMMETRY	OFF
ATTENUATION	0
FUNCTION	Triangle
Mode	CONT
TRIG START/STOP	0°CAL
Other small knobs	Clockwise
MODULATION GENERATOR:	
FUNCTION	Triangle
FREQ/PERIOD MULT (Hz/s)	1/10 to 10/100m
MODULATION Switches:	
AM OFF	
FM/SWP	OFF
PM (ϕ)	INT

NOTE

Signal generator controls not listed may be left in any position.

2. Set oscilloscope controls as follows

Vertical controls

CONTROL	SETTING
VERT MODE	CH1
VOLTS/DIV	5
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls

CONTROL	SETTING
TIME/DIV	1 ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3 Check for normal (jittery or wavy) phase modulated waveform at FUNCTION OUT (50Ω) connector (fig. FO-6).

- Set POWER OFF/ON switch ON.
- Note phase modulated waveform.

- Set FREQ MULT (Hz) switch to 1K.
- Set FREQ/PERIOD MULT (Hz/s) switch to 10/100m to 1 K/1m.
- Set TIME/DIV scope setting to .1ms.
- Note phase modulated waveform.
- If only position 100 not normal, do step 13.
- If only position 1K not normal, do step 14.
- If both positions 100 and 1K not normal, do step 12.

4. Check 10K range phase modulated waveform at FUNCTION OUT (50Ω) connector (fig. FO-6).
   - Set FREQ MULT (Hz) switch to 10K.
   - Set TIME/DIV scope setting to 10.µs.
   - If waveform normal (unstable double image), do step 6.

5 Check resistance between A1E6 and right lead of A1C5 (fig. FO-4).
   - Set POWER OFF/ON switch OFF.
   - If resistance not less than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
   - Replace mica capacitor A1C5 (para 2-88).

6. Check 100K range phase modulated waveform at FUNCTION OUT (50Ω) connector (fig. FO-6).
   - Set FREQ MULT (Hz) switch to 100K.
   - Set TIME/DIV scope setting to 1µs.
   - Set FREQ/PERIOD MULT (Hz/s) switch to right-hand position (1K/1m to 100K/10µ).
   - If waveform normal (similar to FM/SWP), do step 8.

7. Check resistance between A1E6 and right lead of A1C4 (fig. FO-4).
   - Set POWER OFF/ON switch OFF.
   - If resistance not less than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
   - Replace mica capacitor A1C4 (para 2-88).

8. Check 1M range phase modulated waveform at FUNCTION OUT (50Ω) connector (fig. FO-6).
   - Set FREQ MULT (Hz) switch to 1M.
   - Set TIME/DIV scope setting to .1µs.
   - If waveform normal (similar to FM/SWP but with a narrower sweep), do step 10.

9. Check resistance between A1E6 and A1SW1-F fourth lead from right (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If resistance not less than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace silver mica capacitor A1C3 (para 2-88).

10. Check 10M range phase modulated waveform at FUNCTION OUT (50Ω) connector (fig. FO-6).

- Set FREQ MULT (Hz) switch to 10M.
- Depress X10 MAG(IN) scope setting.
- If waveform normal (similar to FM/SWP but with a much narrower sweep), do step 12.

11 Check resistance between A1E6 and A1SW1-F fifth lead from right (fig FO-4).

- Set POWER OFF/ON switch OFF.
- If resistance not less than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace disc capacitor A1C131 (para 2-88).

12. Check resistance of A1R16, A1R17, and A1R18 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Set PM (ϕ) switch OFF.
- Set FREQ MULT (Hz) switch to 10.
- If any reading not within limits, replace resistor (para 2-86).
- Replace switch/control assembly A1SW1/A1R1 (para 2-76).

13. Check resistance between A1E20 and A1E6 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Set FREQ MULT (Hz) to 100.
- If reading not less than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace mica capacitor A1C7 (para 2-82).

14. Check resistance between right lead of A1C6 and A1E6 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Set FREQ MULT (Hz) to 1K.

- If reading not less than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace mica capacitor A1C6 (para 2-88).

END OF TEST

2-41. CAPACITANCE MULTIPLIER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a capacitance multiplier fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
FREQ MULT (Hz)	1
SYMMETRY	OFF
Mode	CONT
All small knobs (except TRIG START/STOP	Clockwise
TRIG START/STOP	0°CAL
MODULATION Switches	OFF

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to 1 (fig. FO-6).

- If reading between A1E1 and front lead of A1R60 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

- If reading between A1E2 and right lead of A1C65 greater than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

3. Check voltage at A1U8 pins 1 and 5 (fig. FO-4).

- Set POWER OFF/ON switch ON.

- Record voltage at A1U8 pin 1.

- Rotate A1R56 fully clockwise.

- If reading at A1U8 pin 5 not greater than +14.4V and reading at A1U8 pin 1 not between 100 mV and 300 mV less than reading at pin 5, replace trim pot A1R56 (para 2-91).

- Rotate A1R56 fully counterclockwise.

- If reading at A1U8 pin 1 not greater than +14.4V and reading at A1U8 pin 5 not between 100 mV and 300 mV less than reading at pin 1, replace trim pot A1R56 (para 2-91).

- Return trim pot A1R56 to setting recorded in this step.

4. Check for smooth resistance transition of trim pot A1R51 (fig. FO-4).

- Set POWER OFF/ON switch OFF.

- Measure and record resistance value between center lead (wiper) and left lead.

- Rotate trim pot A1R51 from fully clockwise to fully counterclockwise.

- Measure resistance value between center lead (wiper) and right lead.

- Rotate trim pot A1R51 from fully clockwise to fully counterclockwise.

- If either resistance transition not smooth, replace trim pot A1R51 (para 2-91).

- Return trim pot A1R51 to setting recorded in this step.

5. Check resistance of A1R49, A1R50, A1R52, A1R53, A1R54, A1R55, A1R57, A1R62, A1R63 and A1C29 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88).

- Replace linear microcircuits A1U7 and A1U8 (para 2-94), and epoxy mica capacitor A1C26 (para 2-82).

6. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to 10 (fig. FO-6).

- Set POWER OFF/ON switch OFF.

- If reading between A1E1 and rear lead of A1R58 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).

- If reading between A1E2 and A1E5 greater than 0.2 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace matched resistor set A1R58, A1R59, and A1R60 (para 2-86).

7. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to 1 (fig. FO-6).

- Set POWER OFF/ON switch OFF.
- If reading between A1E1 and front lead of A1R60 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- If reading between A1E2 and A1E5 greater than 0.2 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace matched resistor set A1R58, A1R59, and A1R60 (para 2-86).

8. Check resistance of A1SW1 (fig. FO-4) with FREQ MULT (Hz) switch set to .1 (fig. FO-6).

- Set POWER OFF/ON switch OFF.
- If reading between A1E1 and rear lead of A1R60 more than 0.1 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- If reading between A1E2 ad A1E5 greater than 02 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace matched resistor set A1R58, A1R59, and A1R60 (para 2-86).

9. Check resistance of A1SW1 (fig FO-4) with FREQ MULT (Hz) switch set to .01 (fig. FO-6).

- Set POWER OFF/ON switch OFF.
- If reading between A1E2 and A1E5 greater than 0.2 ohms, replace switch/control assembly A1SW1/A1R1 (para 2-76).
- Replace resistor A1R61 (para 2-86).

END OF TEST

2-42. TRIANGLE AMPLIFIER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a triangle amplifier fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows.

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2.0
FREQ MULT (Hz)	1K
Mode	CONT

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1CJ8 and A1Q9 (matched pair), A1Q10, A1Q11 and A1Q13 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If reverse resistance measurement not 10 times greater than forward resistance for any junction, replace the appropriate transistors (para 2-92).

3. Check voltage at anode and cathode leads of A1CR3 (fig. FO-4).

- If cathode reading between 5.9V and 6.5V more positive than anode reading, do step 5.
- If cathode reading more than 6.5V higher than anode reading, replace diode A1CR3 (para 2-87).

4. Check voltage at cathode lead of A1CR3 and emitter lead of A1Q10 (fig. FO-4).
   - Set POWER OFF/ON switch OFF.
   - Unsolder and lift anode lead of A1CR3.
   - Set POWER OFF/ON switch ON.
   - If A1CR3 cathode reading more than 5.9V higher than A1Q10 emitter reading, replace diode A1CR3 (para 2-87).
   - Set POWER OFF/ON switch OFF.
   - Reconnect and solder leads of A1CR3.
5. Check voltage at anode and cathode leads of A1CR4 (fig. FO-4).
   - If cathode reading between 5.9V and 6.5V more positive than anode reading, do step 7.
   - If cathode reading more than 6.5V higher than anode reading, replace diode A1CR4 (para 2-87).
6. Check voltage at cathode lead of A1CR4 and collector lead of A1Q11 (fig. FO-4).
   - Set POWER OFF/ON switch OFF.
   - Unsolder and lift anode lead of A1CR4.
   - Set POWER OFF/ON switch ON.
   - If A1CR4 cathode reading more than 5.9V higher than A1Q11 collector reading, replace diode A1CR4 (para 2-87).
   - Set POWER OFF/ON switch OFF.
   - Reconnect and solder leads of A1CR4.
7. Check voltage at anode and cathode leads of A1CR5 (fig. FO-4).
   - If cathode reading between 5.9V and 6.5V more positive than anode reading, do step 9.
   - If cathode reading greater than 6.5V more positive than anode reading, replace diode A1CR5 (para 2-87).
8. Check voltage at cathode lead of A1CR5 and right lead of A1R77 (fig. FO-4).
   - Set POWER OFF/ON switch OFF.
   - Unsolder and lift anode lead of A1CR5.
   - Set POWER OFF/ON switch ON.
   - If A1CR5 cathode reading at least 5.9V more positive than right lead of A1R77, replace diode A1CR5 (para 2-87).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1CR5.

9 Check resistance of A1R66, A1R67, A1R68, A1R69, A1R70, A1R71, A1R72, A1R73, A1R74, A1R75, A1R76, A1R77, A1R78, A1R79, A1C30. A1C31, A1C32, A1C33, A1C34, A1C35, A1C36, A1C37 and A1C38 (fig FO-4).

- Replace appropriate resistor (para 2-86), ceramic capacitor (para 2-85) or disc capacitor (para 2-88).

END OF TEST

2-43. HYSTERESIS SWITCH FAULT ISOLATION TEST.

DESCRIPTION

This test finds a hysteresis switch fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position

2. Check resistance of A1Q14, A1Q15, A1CR6 and A1CR7 (matched pair), A1CR8 and A1CR9 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance for any junction (except A1CR8 and A1CR9 which should read normal forward resistance in either direction), replace the appropriate diode (para 2-87) or transistor (para 2-92).

3. Check for smooth resistance transition of trim pot A1R87 (fig. FO-4).

- Measure and record resistance value between front lead of A1R88 and A1E4.
- Rotate A1R87 from fully clockwise to fully counterclockwise.
- If resistance transition not smooth, replace trim pot A1R87 (para 2-91).
- Return trim pot A1R87 to setting recorded in this step.

4. Check for smooth resistance transition of trim pot A1R90 (fig. FO-4).

- Measure and record resistance value between front lead of A1R89 and A1E11.
- Rotate A1R90 from fully clockwise to fully counterclockwise.
- If resistance transition not smooth, replace trim pot A1R90 (para 2-91).
- Return trim pot A1R90 to setting recorded in this step.

5 Check resistance of A1R88, A1R89, A1R91, A1R92, A1R93, A1R95, A1R96, A1R97, A1R98, A1R99, A1R100, A1R101, A1R102, A1R103, A1R104, A1R105, A1R179, A1R180, A1C47, A1C48 and A1C118 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85) or disc capacitor (para 2-88).
- Replace linear microcircuit A1U14 (para 2-96).

END OF TEST

2-44. CURRENT SWITCH FAULT ISOLATION TEST.

DESCRIPTION

This test finds a current switch fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1 Set signal generator POWER OFF/ON switch to OFF (fig, FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q24, A1Q25, A1CR13, A1CR14, A1CR15, A1CR16, A1CR17 and A1CR18 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate diode (para 2-87) or transistor (para 2-92).

3. Check resistance of A1R133, A1R134, A1R135, A1R136, A1R137, A1R138, A1R139, A1R140, A1R141, A1R142, A1C69, A1C70 and A1C71 (fig FO-4).

- Replace appropriate resistor (para 2-86) or ceramic capacitor (para 2-85)

END OF TEST

2-45. TRIANGLE BUFFER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a triangle buffer fault

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2 0
FREQ MULT (Hz)	1K
Mode	CONT

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q17, A1Q18, A1Q119, A1Q20, A1Q21 and A1Q22 (fig. FO-4).

l If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate transistor.

IF THIS SEMICONDUCTOR MEASURES BAD:	REPLACE:
A1Q17	Matched pair A1Q17 and A1Q18 (para 2-92)
A1Q18	Matched pair A1Q17 and A1Q18 (para 2-92)
A1Q19	A1Q19 (para 2-92)
A1Q20	A1Q20 (para 2-92)
A1Q21	A1Q21 (para 2-92)
A1Q22	A1Q22 (para 2-93)

3. Check voltage at anode and cathode leads of A1CR12 (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If cathode reading between 5.9V and 6.5V more positive than anode reading, do step 5.
- If cathode reading more than 6.5V higher than anode reading, replace diode A1CR12 (para 2-87).

4. Check voltage at anode lead of A1CR12 and emitter lead of A1Q21 (fig. FO-4).

- Set POWER OFF/ON switch OFF
- Unsolder and lift cathode lead of A1CR12.
- Set POWER OFF/ON switch ON.
- If A1Q10 emitter reading more than 5.9V higher than A1CR12 anode reading, replace diode A1CR12 (para 2-87).

- Set POWER OFF/ON switch OFF.
- Reconnect and solder leads of A1CR12.

5 Check resistance of A1R80, A1R111, A1R112, A1R113, A1R114, A1R115, A1R116, A1R117, A1R118, A1R119, A1R120, A1R121, A1R122, A1R123, A1R124, A1R125, A1R126, A1R127, A1R128, A1R129, A1R130, A1R131, A1R132, A1C51, A1C52, A1C54, A1C55, A1C56, A1C57 and A1C59 (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Replace appropriate resistor (para 2-86), ceramic capacitor (para 2-85) or disc capacitor (para 2-88)

END OF TEST

2-46. TRIGGER LOGIC FAULT ISOLATION TEST.

DESCRIPTION

This test finds a trigger logic fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Mode	INT TRIG
All small knobs (except TRIG START/STOP)	Clockwise
TRIG START/STOP	0°CAL
FREQ/PERIOD MULT (Hz/s)	10/1K
MODULATION Switches	OFF

NOTE

Signal generator controls not listed may be left in any position.

2. Set oscilloscope controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH 1
VOLTS/DIV	1
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls:

CONTROL	SETTING
TIME/DIV	.1ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3. Check resistance of A1Q16, A1Q26, A1Q27, A1Q58, A1CR19, A1CR20, A1CR21, A1CR22, A1CR23, A1CR24, A1CR25, A1CR26 and A1CR27 (matched to A1CR2) (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate diode (para 2-87) or transistor (para 2-92).

4. Check voltage at rear of A1R147 (fig. FO-4) while rotating TRIG START/STOP vernier from fully counter-clockwise to fully clockwise (fig. FO-6).

- Set POWER OFF/ON switch ON.

- If reading does not vary from more positive than + 14.4V to more negative than – 14.4V, replace switch/control assembly A1SW4/A1R4 (para 2-77).

5. Check A2P5 ribbon cable (fig. FO-4 and FO-5).

- Set POWER OFF/ON switch OFF.

- If any of the following resistance readings not less than 0.1 ohms, replace ribbon cable A2P5 (para 2-84).

MEASUREMENT POINTS

A1U13 pin 1 to A2SW1A (third lead from right)

A1U13 pin 2 to A2CR3 cathode

A1U13 pin 5 to A2SW1A (right hand lead)

6. Check resistance of A1R176 and A1R177 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86).

7. Check voltage at front lead of A1R177 (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If reading between + 4.25V and + 5.75V, do step 10.

8. Check resistance of A1Q16, A1Q23, A1Q57 and A1Q58 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate transistor (para 2-92).

9. Check resistance of A1R339, A1C50, A1C134, A1C135, A1C169 and A1C170 (fig, FO-4).

- If any reading not within limits, replace resistor (para 2-86) ceramic or electrolytic capacitor (para 2-85)
- Replace microcircuits A1VR1 (para 2-74), A1U12 and A1U13 (para 2-94).

10. Check voltage at A1U13 pin 1 (fig FO-4).

- Set MODE switch to CONT.
- If reading ill- high, do trigger signal limiter fault isolation test (para 2-60).

11. Check voltage at A1U12 pin 13 (fig. FO-4).

- If reading not TTL low, replace microcircuit A1U13 (para 2-94) and disc capacitor A1C74 (para 2-88).

12. Check voltage at A1U12 pin 3 (fig. FO-4).

- If reading not TTL low, replace microcircuit A1U12 (para 2-94).

13. Check voltage at A1U13 pin 1 (fig. FO-4).

- Set MODE switch to INT TRIG.
- If reading not TTL high, do trigger signal limiter fault isolation test (para 2-60).

14. Check voltage at A1U13 pin 2 (fig. FO-4).

- Set TRIGGER LEVEL vernier to approximately center of rotation.
- If unable to get TTL square wave, do trigger signal limiter fault isolation test (para 2-60).

15. Check voltage at A1U13 pin 5 (fig. FO-4).

- If reading not TTL high, do trigger signal limiter fault isolation test (para 2-60).

16. Check waveform at A1U12 pin 13 (fig. FO-4).

- If reading not TTL high with a narrow negative going spike, replace microcircuit A1U13 (para 2-94) and disc capacitor A1C74 (para 2-88).

17. Check waveform at A1U12 pin 3 (fig FO-4).

- If reading TTL high with a narrow negative going pulse, do step 19.

18. Check resistance of A1R178 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If reading not within limits, replace resistor (para 2-86).
- Replace microcircuit A1U12 (para 2-94).

19. Check voltage at A1U13 pin 1 (fig. FO-4).

- Set MODE switch to INT GATE.
- If reading not TTL high, do trigger signal limiter fault isolation test (para 2-60)

20. Check voltage at A1U13 pin 2 (fig. FO-4).

- If reading not TTL square, do trigger signal limiter fault isolation test (para 2-60).

21. Check voltage at A1U13 pin 5 (fig FO-4).

- If reading not TTL low, do trigger signal limiter fault isolation test (para 2-60)

22. Check waveform at A1U12 pin 13 (fig. FO-4).

- If reading not TTL low with a positive going pulse, replace microcircuit A1U13 (para 2-94) and disc capacitor A1C74 (para 2-88).

23. Check waveform at A1U12 pin 3 (fig FO-4).

- If reading TTL low with a positive going pulse, do step 25.

24. Check resistance of A1R178 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If reading not within limits, replace resistor (para 2-86).
- Replace microcircuit A1U12 (para 2-94).

25. Check resistance of A1R143, A1R144, A1R145, A1R147, A1R148, A1R149, A1R152, A1R153, A1R154, A1R158, A1R162, A1R322, A1R340, A1C72 and A1C136 (fig FO-4).

- Set POWER OFF/ON switch OFF.
- Rotaie TRIGGER START/STOP vernier fully counterclockwise.
- Replace appropriate resistor (para 2-86) or ceramic capacitor (para 2-85).

END OF TEST

2-47. TRIGGER AMPLIFIER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a trigger amplifier fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1 Set signal generator POWER OFF/ON switch to OFF (fig FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2 Check resistance of A1Q28, A1Q29, A1Q30, A1Q31 and A1Q32 (fig FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate transistor (para 2-92).

3. Check voltage at right lead of A1R160 (fig FO-4).

- Set POWER OFF/ON switch ON.
- Record voltage at right lead of A1R160.
- Rotate A1R159 from fully clockwise to fully counterclockwise.
- If reading does not swing from more negative than – 14.4V to more positive than + 14.4V, replace trim pot A1R159 (para 2-91).
- Return trim pot A1R159 to setting recorded in this step

4. Check resistance of A1R155, A1R156, A1R157, A1R160, A1R161 , A1R163, A1R164, A1R165, A1R166, A1R167, A1R168, A1R169, A1R170, A1R171, A1R172, A1R173, A1R174, A1R175, A1R264, A1C76, A1C77, A1C78, A1C79, A1C80 and A1C81 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Replace appropriate resistor (para 2-86), disc capacitor (para 2-88) or ceramic capacitor (para 2-85).

END OF TEST

2-48. TRIGGER BASELINE COMPENSATION FAULT ISOLATION TEST.

DESCRIPTION

This test finds a trigger baseline compensation fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig FO-6).

NOTE

Signal generator controls not listed may be left in any position

2. Check resistance of A1Q7 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace FET A1Q7 (para 2-92).

3. Check resistance of A1R64, A1R65 and A1R155 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86).

- Replace linear microcircuits A1U9 and A1U10 (para 2-94).

END OF TEST

2-49. SIGNAL SHAPER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a signal shaper fault

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig FO-6) as follows

CONTROL	SETTING
POWER OFF/ON	OFF
FUNCTION	DC

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1CR28 A1CR29, A1CR30, A1CR31 A1CR32, A1CR33, A1CR34, and A1CR35 (fig. FO-4).

   - If any reverse resistance measurement not 10 times greater than forward resistance, replace all diodes (para 2-87).

3. Check resistance of switch A1SW4 (fig. FO-4).

   - If reading not less than 0.1 ohms for any measurement below, replace switch/control assembly A1SW4/A1R4 (para 2-77).

FUNCTION SWITCH SETTING	MEASUREMENT POINTS
DC	A1E9 to A1TP9
DC	A1E10 to A1TP9
DC	A1E13 to A1TP9
Sine wave	A1E9 to A1TP4
Sine wave	A1E10 to A1TP9
Sine wave	A1E11 to A1R196 front lead
Sine wave	A1E12 to A1R185 front lead
Sine wave	A1E13 to A1TP9
Triangle	A1E9 to A1TP4
Triangle	A1E10 to A1TP9
Triangle	A1E13 to A1R245 rear lead
Square wave	A1E9 to A1Q57 Collector
Square wave	A1E11 to A1R196 front lead
Square wave	A1E12 to A1R185 front lead
Square wave	A1E13 to A1TP9
Positive pulse	A1E9 to A1Q57 Collector
Positve pulse	A1E12 to A1R185 front lead
Positive pulse	A1E13 to A1TP9

FUNCTION SWITCH SETTING (Cont)	MEASUREMENT POINTS (Cont)
Negative pulse	A1E9 to A1Q57 Collector
Negative pulse	A1E11 to A1R196 front lead
Negative pulse	A1E13 to A1TP9

4 Check resistance of A1R182, A1R183. A1R184, A1R185, A1R186, A1R187, A1R188, A1R189, A1R190 A1R191, A1R192, A1R193, A1R194, A1R195, A1R196, A1R197, A1R199, A1R200, A1R245, A1R247 and A1R323 (fig. FO-4).

- Set FUNCTION switch to DC.
- Replace appropriate resistor (para 2-86) or thermistor (para 2-89).

END OF TEST

2-50. MULTIPLIER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a multiplier fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2.0
TRIG START/STOP	0°CAL
Other small knobs	Clockwise
FREQ MULT	100
SYMMETRY	OFF
FUNCTION	Triangle
Mode	CONT
MODULATION GENERATOR:	
FUNCTION	Sine Wave
FREQ/PERIOD MULT (Hz/s)	10/100m to 1K/1m
MODULATION Switches:	
AM	INT
FM/SWP	OFF
PM(ϕ)	OFF

NOTE

Signal generator controls not listed may be left in any position.

2. Set oscilloscope controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH 1
VOLTS/DIV	1
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls'

CONTROL	SETTING
TIME/DIV	1 ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3 Check resistance of A1Q44, A1Q50 and A1Q52 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace A1Q44 or A1Q50 (para 2-92), or A1Q52 (para 2-93).

4. Check A2P5 ribbon cable (fig. FO-4 and FO-5).

- If any of the following resistance readings not less than 0.1 ohms, replace ribbon cable A2P5 (para 2-84).

MEASUREMENT POINTS

A1TP6 to A2SW2 (right side center lead)

A1R348 right lead to A2SW2 (left side center lead)

5. Check waveform at A1TP6 (fig. FO-4).

- Set POWER OFF/ON switch ON.
- If sine wave of approximately 5 Vp-p not displayed, do modulation control fault isolation test (para 2-59).

6. Check waveform at A1R348 right lead (fig. FO-4).

- If sine wave of approximately 1.25 Vp-p with – 7.5V offset not displayed, do modulation control fault isolation test (para 2-59).

7. Check waveform at A1R222 left lead (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Remove A1U15 from socket.
- Set POWER OFF/ON switch ON.
- If sine wave of approximately 2.5 Vp-p with – 1.1V offset not displayed, do step 14.

8. Check voltage at A1CR10 cathode (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Connect A1CR10 anode to A1TP9.
- Set POWER OFF/ON switch ON.
- If reading not between 3.1V and 3.5V, disconnect A1CR10 anode from A1TP9, reinstall A1U15 and replace diode A1CR10 (para 2-87).

9. Check voltage at A1CR37 cathode (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Disconnect A1CR10 anode from A1TP9.

- Connect A1CR37 anode to A1TP9.
- Set POWER OFF/ON switch ON.
- If reading not between 3.1V and 3.5V, disconnect A1CR37 anode from A1TP9, reinstall A1U15 and replace diode A1CR37 (para 2-87).

10. Check voltage at right lead of A1R212 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Disconnect A1CR37 anode from A1TP9.
- Set POWER OFF/ON switch ON.
- Record voltage at right lead of A1R212.
- Rotate A1R210 from fully clockwise to fully counterclockwise.
- If reading does not swing from greater than + 14.4V to more negative than – 14.4V, reinstall A1U15 and replace trim pot A1R210 (para 2-91).
- Return trim pot A1R210 to setting recorded in this step.

11. Check voltage at right lead of A1R344 (fig. FO-4).

- Record voltage at right lead of A1R344.
- Rotate A1R226 from fully clockwise to fully counterclockwise.
- If reading does not swing from greater than + 14.4V to more negative than – 14.4V, reinstall A1U15 and replace trim pot A1R226 (para 2-91).
- Return trim pot A1R226 to setting recorded in this step.

12. Check for smooth resistance transition of trim pot A1R324 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- Measure and record resistance between right lead of A1R215 and A1TP9.
- Rotate A1R324 from fully clockwise to fully counterclockwise.
- If resistance transition not smooth, reinstall A1U15, then replace trim pot A1R324 (para 2-91).
- Return trim pot A1R324 to setting recorded in this step.

13. Check resistance of A1R201, A1R211, A1R212, A1R215, A1R216, A1R217, A1R219, A1R220, A1R221, A1R224, A1R254, A1R258, A1R259, A1R260, A1R266, A1R344, A1R349, A1C88, A1C138, A1C141 and A1C146 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85) or disc capacitor (para 2-88), then reinstall A1U15.
- Replace linear microcircuit A1U15 (para 2-94).

14. Check waveform at right lead of A1R259 (fig, FO-4).

- Set POWER OFF/ON switch OFF
- Record resistance between right lead of A1R259 and A1TP9.
- Rotate A1R343 fully counterclockwise.
- Set POWER OFF/ON switch ON.
- If amplitude of waveform (or DC level if no waveform present) at right lead of A1R259 less than that at A1U18 pin 6, reinstall A1U15 and replace trim pot A1R343 (para 2-91).
- If amplitude (or DC level) does not decrease to less than 0.1V as A1R343 is rotated to fully clockwise position, reinstall A1U15 and replace trim pot A1R343 (para 2-91).
- Set POWER OFF/ON switch OFF.
- Return trim pot A1R343 to setting recorded in this step.

15. Check resistance of A1R206, A1R222, A1R261, A1R270, A1R293, AlR315, A1R348, A1R390, A1C96, A1C112, A1C139 and A1C147 (fig. FO-4).

- Disconnect A1P2 from A1J2 (fig. FO-4).
- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2435) or disc capacitor (para 2-88), then reinstall A1U15.
- Replace linear microcircuit A1U18 (para 2-94).

END OF TEST

2-51. PREAMPLIFIER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a preamplifier fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
Frequency Dial	2.0
TRIG START/STOP	0°CAL
Other small knobs	Clockwise
FREQ MULT	1k
Mode	CONT
MODULATION Switches	OFF

NOTE

Signal generator controls not listed may be left in any position,

2. Check resistance of A1Q40, A1Q41 , A1Q42, A1Q43, A1CR38 and A1CR44 (fig. FO-4).

   - If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate diode (para 2-87) or transistor (para 2-92).

3. Check voltage at anode and cathode leads of A1CR39 (fig. FO-4).

   - Set POWER OFF/ON switch ON.

   - If cathode reading more than 6.5V higher than anode reading, replace diode A1CR39 (para 2-87).

4. Check voltage at anode and cathode leads of A1CR49 (fig. FO-4).

   - If cathode reading more than 6.5V higher than anode reading, replace diode A1CR49 (para 2-87).

5. Check voltage at cathode lead of A1CR39 and anode lead of A1CR49 (fig. FO-4).

   - If cathode lead of A1CR39 between 11.8V and 13V more positive than anode lead of A1CR49 do step 6.
   - Set POWER OFF/ON switch OFF.
   - Unsolder and lift cathode lead of A1CR49.
   - Set POWER OFF/ON switch ON.
   - If A1CR39 cathode reading more than 11.8V higher than A1CR49 anode reading, replace diodes A1CR39 and A1CR49 (para 2-87).
   - Set POWER OFF/ON switch OFF.
   - Reconnect and solder leads of A1CR49.

6. Check for smooth resistance transition of trim pot A1R218 (fig. FO-4).

   - Set POWER OFF/ON switch OFF.
   - Measure and record resistance between A1E4 and rear of A1R250.
   - Rotate A1R218 from fully clockwise to fully counterclockwise.
   - If resistance transition not smooth, replace trim pot A1R218 (para 2-91).
   - Return trim pot A1R218 to setting recorded in this step.

7. Check for smooth resistance transition of vernier A1R5 (fig. FO-4).

   - Measure resistance value between center lead (wiper) and left lead.
   - Rotate vernier A1R5 from fully clockwise to fully counterclockwise.
   - Measure resistance value between center lead (wiper) and right lead.
   - Rotate vernier A1R5 from fully clockwise to fully counterclockwise.
   - If either resistance transition not smooth, replace switch/control assembly A1SW5/A1R5 (para 2-78).

8. Check resistance of A1R236, A1R237, A1R238, A1R239, A1R240, A1R241, A1R243, A1R244, A1R246, A1R248, A1R249, A1R250, A1R251, A1R252, A1R254, A1R258, A1R266, A1R290, A1R342, A1R346, A1C89, A1C91, A1C92, A1C93, A1C94, A1C95, A1C142 and A1C143 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86) or ceramic capacitor (para 2-85).
- Replace linear microcircuit A1U17 (para 2-96).

END OF TEST

2-52. OUTPUT AMPLIFIER FAULT ISOLATION TEST.

DESCRIPTION

This test finds an output amplifier fault

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

I Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER	OFF
DC OFFSET	OFF
FUNCTION	DC
ATTENUATION	0

NOTE

Signal generator controls not listed may be left in any position.

WARNING

Power Supply voltage or output amplifier signal always present on output amplifier heat sinks.

2. Check resistance of A1Q46, A1Q47, A1Q48, A1Q49, A1C151, A1Q53, A1Q54, A1Q55, A
A1CR42 and A1CR43 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate diode or transistor.

IF THIS DIODE OR TRANSISTOR MEASURES BAD:	REPLACE:
A1Q46	A1Q46 and A1Q48 (para 2-92)
A1Q47	A1Q47 and A1Q49 (para 2-83)
A1Q48	A1Q46 and A1Q48 (para 2-92)
A1Q49	A1Q47 and A1Q49 (para 2-83)
A1Q51	A1Q51 and A1Q53 (para 2-92)
A1Q53	A1Q51 and A1Q53 (para 2-92)
A1Q54	A1Q54 and A1Q55 (para 2-83)
A1Q55	A1Q54 and A1Q55 (para 2-83)
A1CR40	A1CR40 (para 2-87)
A1CR41	A1CR41 (para 2-87)
A1CR42	A1CR42 (para 2-87)
A1CR43	A1CR43 (para 2-87)

3. Check voltage at rear lead of A1R225 (fig FO-4).

- Set POWER OFF/ON switch ON.
- Record voltage at rear lead of A1R225.
- Rotate trim pot A1R347 from fully counterclockwise to fully clockwise.
- If voltage does not swing from more positive than + 14.4V to more negative than – 14.4V, replace trim pot A1R347 (para 2-91).
- Return trim pot A1R347 to setting recorded in this step.

4. Check voltage at right of A1C108 (fig. FO-4).

- If reading not more positive than + 20.5V, do step 8.

5. Check voltage at right lead of A1C110 (fig. FO-4).

- If reading more positive than – 20.5V, do step 9.

6. Check for smooth resistance transition of vernier A1R5 (fig. FO-4).

- Measure resistance value between center lead (wiper) and left lead
- Rotate vernier A1R5 from fully clockwise to fully counterclockwise
- Measure resistance value between center lead (wiper) and right lead
- Rotate vernier A1R5 from fully clockwise to fully counterclockwise.
- If either resistance transition not smooth, replace switch/control assembly A1SW5/A1R5 (para 2-78).

7. Check resistance of A1R225, A1R253, A1R262, A1R263, A1R265, A1R267, A1R268, A1R271, A1R272, A1R273, A1R274, A1R275, A1R276, A1R277, A1R278, A1R279, A1R280, A1R282, A1R287, A1R288, A1R289, A1R291, A1R292, A1R294, A1R346, A1C100, A1C101, A1C102, A1C103, A1C104, A1C105, A1C113 and A1C166 (fig. FO-4).

- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85), electrolytic capacitor (para 2-85) or disc capacitor (para 2-88).
- Do DC offset fault isolation test (para 2-53).

8. Check resistance of A1R297, A1R298, A1C108 and A1C144 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85) or electrolytic capacitor (para 2-85).
- Replace regulator microcircuit A1VR2 (para 2-74).

9. Check resistance of A1R295, A1R296, A1C110 and A1C145 (fig. FO-4).

- Set POWER OFF/ON switch OFF.
- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85) or electrolytic capacitor (para 2-85).
- Replace regulator microcircuit A1VR3 (para 2-74).

END OF TEST

2-53. DC OFFSET FAULT ISOLATION TEST.

DESCRIPTION

This test finds a DC offset fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q37 and A1Q38 (fig. FO-4).

   - If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate transistor (para 2-92).

3. Check voltage at left lead of A1C97 (fig. FO-4).

   - Set POWER OFF/ON switch ON.
   - Rotate DC OFFSET vernier from fully counterclockwise to fully clockwise.
   - If reading does not swing from more positive than + 14.4V to more negative than – 14.4V, replace switch/control assembly A1SW3/A1R3 (para 2-98).

4. Check resistance of A1R256, A1R269, A1R366, A1R367, A1R369, A1R370, A1R371, A1C97, A1C164, A1C165 and A1C168 (fig. FO-4).

   - Set POWER OFF/ON switch OFF.
   - Set DC OFFSET switch OFF.

- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85) or disc capacitor (para 2-88).
- Replace linear microcircuit A1U19 (para 2-94).

END OF TEST

2-54. OUTPUT OVERLOAD PROTECTION FAULT ISOLATION TEST.

DESCRIPTION

This test finds an output overload protection fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed, Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
DC OFFSET	OFF
FUNCTION	DC
ATTENUATION	0
All small knobs (except TRIG START/STOP)	Clockwise
TRIG START/STOP	0°CAL

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A1Q59, A1Q60, A1061, A1C162, A1CR45, A1CR47, A1CR48, A1CR50 and A1CR51 (fig. FO-4).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate diode (para 2-87) or transistor (para 2-92).

3. Check resistance of A1R203, A1R204, A1R335, A1R336, A1R350 and A1R351 (fig. FO-4).

- Replace appropriate resistor (para 2-86).

END OF TEST

2-55. ATTENUATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds an attenuator fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
ATTENUATION (dB)	0

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance between FUNCTION OUT center connector (fig. FO-6) and left lead of A1R311 (fig. FO-4).

- If reading not less than 0.05 ohms, replace A1J4 coaxial wire assembly.

3. Check resistance between FUNCTION OUT ground connector (fig. FO-6) and ground conductor of A1J4 coaxial (fig, FO-4).

- Lift gray coaxial A1J4 from board.
- If reading not less than 0.05 ohms, replace A1J4 coaxial wire assembly,

4. Check resistance between FUNCTION OUT ground (fig. FO-6) and center connector (fig. FO-4).

- If reading not infinite, replace A1J4 coaxial assembly.

5. Check resistance of the following points (fig. FO-4).

- Reconnect A1J4 by carefully inserting center conductor in spring socket and pushing assembly into A1J4.
- If any of the following readings are not less than 0.1 ohms, replace switch/control assembly A1SW5/A1R5 (para 2-78).

ATTENUATION (dB)	MEASUREMENT POINTS
0/20	A1E14 to A1E17
0/20	A1E17 to A1TP8
20/40	A1E14 to A1TP9
20/40	A1E15 to A1E17
20/40	A1E17 to A1TP8
40/60	A1E14 to A1TP9
40/60	A1E15 to A1TP9
40/60	A1E17 to A1TP8
60/80	A1E14 to A1TP9
60/80	A1E15 to A1TP9
60/80	A1E17 to A1TP9

6. Check resistance of A1R299, A1R300, A1R301, A1R302, A1R303, A1R304, A1R305, A1R306, A1R311, A1R312, A1R313, A1R314 and A1R316 (fig, FO-4).

- Replace appropriate resistor (para 2-86).

END OF TEST

2-56. MODULATION GENERATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds a modulation generator fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE
Remove top cover (para 2-62)

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
All small knobs (except TRIG START/STOP	Clockwise
TRIG START/STOP	0°CAL
MODULATION GENERATOR:	
FUNCTION	(Square)
MODULATION SWITCHES	OFF
FREQ/PERIOD MULT (Hz/s)	.1/10 to 10/100m

NOTE

Signal generator controls not listed may be left in any position

2. Set oscilloscope controls as follows:

Vertical controls:

CONTROL	SETTING
VERT MODE	CH 1
VOLTS/DIV	2
(VAR)	Fully clockwise
COUPLING	DC

Horizontal controls:

CONTROL	SETTING
TIME/DIV	.2ms
(VAR)	Fully clockwise
TRIG MODE	AUTO
COUPLING	AC
SOURCE	NORM
X10 MAG	Extended

3. Check resistance of the following points (fig. FO-5).

- If any reading not less than 0.1 ohms, replace switch/control assembly A2SW6/A2R6 (para 2-81).

FREQ/PERIOD MULT	MEASUREMENT POINTS
.1/10 to 10/100m	A2E1 to A2C1 " – " lead
10/100m to 1 K/1m	A2E1 to A2C2 rear lead
1 K/1 m to 100 K/10µ	A2E1 to A2C3 left lead
1 K/1m to 100 K/10µ	A2E2 to jumper wire at right of A2R3

4. Check voltage at A2E2 (fig. FO-5).

- Set FREQ/PERIOD MULT switch to 1 K/1m to 100K/10µ.
- Set POWER OFF/ON switch ON.
- Record voltage on A2E2.
- Rotate trim pot A2R75 from fully clockwise to fully counterclockwise,
- If reading does not swing from more negative than – 14.4V to more positive than + 14.4V, replace trim pot A2R75 (para 2-91).
- Return trim pot A2R75 to setting recorded in this step.

5. Check waveforms at OUT (600Ω) connector (fig. FO-7).

- Rotate FREQ/PERIOD switch from fully counterclockwise to fully clockwise.
- If square wave of correct frequency not displayed only on position .1/10 to 10/100m, replace electrolytic capacitor A2C1 (para 2-85).
- If square wave of correct frequency not displayed only on position 10/100m to 1K/1m, replace mica capacitor A2C2 (para 2-88).
- If square wave of correct frequency not displayed only on position 1 K/1m to 100 K/10u, replace silver mica capacitors A2C3 and A2C4 (para 2-88).

6. Check voltage at A2U2 pin 1 (fig FO-5).

   - Record voltage at A2U2 pin 1.

   - Rotate trim pot A2R11 from fully clockwise to fully counterclockwise.

   - If reading does not swing from more negative than – 14.4V to less than 0.05 Vdc, replace trim pot A2R11 (para 2-91).

   - Return trim pot A2R11 to setting recorded in this step.

7. Check voltage at A2U2 pin 12 (fig. FO-5).

   - Record voltage at A2U2 pin 12.

   - Rotate trim pot A2R12 from fully clockwise to fully counter clockwise.

   - If reading does not swing from more positive than – 0.05 Vdc to more negative than – 14.4V, replace trim pot A2R12 (para 2-91).

   - Return trim pot A2R12 to setting recorded in this step.

8. Check voltage at left lead of A2R16 (fig FO-5).

   - Record voltage at left lead of A2R16.

   - Rotate trim pot A2R17 from fully clockwise to fully counterclockwise.

   - If reading does not swing from more negative than – 14.4V to more positive than + 14.4V, replace trim pot A2R17 (para 2-91).

   - Return trim pot A2R17 to setting recorded in this step.

9. Check voltage at rear lead of A2R92 (fig. FO-5.

   - Record voltage at rear lead of A2R92.

   - Rotate trim pot A2R93 from fully clockwise to fully counterclockwise.

   - If reading does not swing from more negative than – 14.4V to more positive than + 14.4V, replace trim pot A2R93 (para 2-91).

   - Return trim pot A2R93 to setting recorded in this step.

10. Check voltage at center lead of vernier A2R6 (fig. FO-5).

    - Rotate vernier A2R6 from fully clockwise (MAX) to fully counterclockwise.

    - If reading does not swing from more positive than + 14.4V to less than 0.05 Vdc, replace switch/control assembly A2SW6/A2R6 (para 2-81).

11. Check for smooth resistance transition of trim pot A2R14 (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- Measure and record resistance value between center lead (wiper) and left lead.
- Rotate trim pot A2R14 from fully clockwise to fully counterclockwise.
- Measure resistance value between center lead (wiper) and right lead.
- Rotate trim pot A2R14 from fully clockwise to fully counterclockwise.
- If either resistance transition not smooth, replace trim pot A2R14 (para 2-91).
- Return trim pot A2R14 to setting recorded in this step.

12. Check for smooth resistance transition of trim pot A2R48 (fig. FO-5).

- Measure and record resistance value between center lead (wiper) and left lead.
- Rotate trim pot A2R48 from fully clockwise to fully counterclockwise.
- Measure resistance value between center lead (wiper) and right lead.
- Rotate trim pot A2R48 from fully clockwise to fully counterclockwise.
- If either resistance transition not smooth, replace trim pot A2R48 (para 2-91).
- Return trim pot A2R48 to setting recorded in this step.

13. Check resistance of A2R3, A2R7, A2R8, A2R9, A2R10, A2R13, A2R15, A2R16, A2R74, A2R83, A2R92 and A2C5 (fig. FO-5).

- Set FREQ/PERIOD MULT switch to 10/100m to 1K/1m.
- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88).
- Replace linear microcircuit A2U1 (para 2-94), and digital microcircuit A2U2 (para 2-94).

END OF TEST

2-57. RAMP GENERATOR FAULT ISOLATION TEST.

DESCRIPTION

This test finds a ramp generator fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator controls (fig. FO-6) as follows:

CONTROL	SETTING
POWER OFF/ON	OFF
MODULATION GENERATOR:	
FUNCTION	Positive-going sawtooth
MODULATION SWITCHES	OFF
FREQ/PERIOD MULT (Hz/s)	1K/1m to 100K/10µ

NOTE

Signal generator controls not listed may be left in any position.

2 Check resistance of A2Q4, A2Q5 and A2Q6 (fig. FO-5).

- If reverse resistance measurement not 10 times greater than forward resistance, replace the appropriate transistor (para 2-92).

3. Check voltage at A2CR17 cathode (fig. FO-5).

- Connect A2CR17 anode to A2C24 “ – “ lead.
- Set POWER OFF/ON switch ON.
- If reading not between 5.9V and 6.5V, disconnect A2CR17 anode from A2C24 “ – “ lead and replace diode A2CR17 (para 2-87).

4. Check resistance of the following points (fig. FO-5).

- Set POWER OFF/ON switch OFF.
- Disconnect A2CR17 anode from A2C24 " – " lead.
- If any of the following readings not less than 0.1 ohms, replace switch/control assembly A2SW5/A2R5 (para 2-80).

MODULATION FUNCTION	MEASUREMENT POINTS
Sine	A2E3 to A2R73 right lead
Sine	A2E4 to A2E5
Triangle	A2E3 to A2R25 left lead
Triangle	A2E4 to A2E5
Square	A2E3 to A2R26 left lead
Square	A2E4 to A2E5
Negative Ramp	A2E3 to A2U6 pin 6
Negative Ramp	A2E4 to A2SW5A right lead
Negative Ramp	A2E5 to A2R26 right lead
Positive Ramp	A2E3 to A2U6 pin 6
Positive Ramp	A2E4 to A2R26 right lead
Positive Ramp	A2E5 to A2SW5A right lead
SWP SET	A2E3 to A2R95 right lead
SWP SET	A2E4 to A2E5

5. Check for smooth resistance transition of trim pot A2R30 (fig. FO-5).

- Set FUNCTION switch to positive going ramp.
- Measure and record resistance value between center lead (wiper) and left lead.
- Rotate trim pot A2R30 from fully clockwise to fully counterclockwise.
- Measure resistance value between center lead (wiper) and right lead.
- Rotate trim pot A2R30 from fully clockwise to fully counterclockwise.
- If either resistance transition not smooth, replace trim pot A2R30 (para 2-91).
- Return trim pot A2R30 to setting recorded in this step.

6. Check for smooth resistance transition of trim pot A2R33 (fig FO-5).
   - Measure and record resistance value between A2R94 left lead and A2R32 front lead.
   - Rotate trim pot A2R33 from fully clockwise to fully counterclockwise.
   - If resistance transition not smooth, replace trim pot A2R33 (para 2-91).
   - Return trim pot A2R33 to setting recorded in this step.
7. Check for smooth resistance transition of trim pot A2R46 (fig. FO-5).
   - Measure and record resistance value between center lead (wiper) and left lead.
   - Rotate trim pot A2R46 from fully clockwise to fully counterclockwise.
   - Measure resistance value between center lead (wiper) and right lead.
   - Rotate trim pot A2R46 from fully clockwise to fully counterclockwise.
   - If either resistance transition not smooth, replace trim pot A2R46 (para 2-91).
   - Return trim pot A2R46 to setting recorded in this step.
8. Check for smooth resistance transition of trim pot A2R76 (fig. FO-5).
   - Measure and record resistance value between center lead (wiper) and left lead.
   - Rotate trim pot A2R76 from fully clockwise to fully counterclockwise.
   - Measure resistance value between center lead (wiper) and right lead.
   - Rotate trim pot A2R76 from fully clockwise to fully counterclockwise.
   - If either resistance transition not smooth, replace trim pot A2R76 (para 2-91).
   - Return trim pot A2R76 to setting recorded in this step.
9. Check for smooth resistance transition of trim pot A2R81 (fig. FO-5).
   - Measure and record resistance value between center lead (wiper) and left lead.
   - Rotate trim pot A2R81 from fully clockwise to fully counterclockwise.
   - Measure resistance value between center lead (wiper) and right lead.
   - Rotate trim pot A2R81 from fully clockwise to fully counterclockwise.
   - If either resistance transition not smooth, replace trim pot A2R81 (para 2-91).
   - Return trim pot A2R81 to setting recorded in this step.

10. Check resistance of A2R18, A2R19, A2R21, A2R22, A2R23, A2R24, A2R25, A2R26, A2R27, A2R28, A2R29, A2R31 , A2R32, A2R39, A2R41 , A2R42, A2R43, A2R45, A2R47, A2R68, A2R73, A2R77, A2R78, A2R79, A2R80, A2R82, A2R94, A2R95, A2R96, A2C13, A2C38 and A2C39 (fig. FO-5).

- If any reading not within limits, replace resistor (para 2-86), ceramic capacitor (para 2-85) or disc capacitor (para 2-88).
- Replace linear microcircuits A2U5 and A2U6 (para 2-94).

END OF TEST

2-58. FUNCTION BUFFER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a function buffer fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check voltage at right lead of A2R35 (fig. FO-5).

- Set POWER OFF/ON switch ON.
- Record voltage at right lead of A2R35.
- Rotate trim pot A2R34 from fully clockwise to fully counterclockwise.

- If reading does not swing from more positive than – 0.05V to more negative than – 14.4V, replace trim pot A2R34 (para 2-91).
- Return trim pot A2R34 to setting recorded in this step.

3. Check resistance of A2R35, A2R36, A2R37, A2R38, A2R67, A2C35 and A2C37 (fig FO-5).

- Set POWER OFF/ON switch OFF.
- If any reading not within limits, replace resistor (para 2-86) or disc capacitor (para 2-88).
- Replace linear microcircuit A2U3 (para 2-96).

END OF TEST

2-59. MODULATION CONTROL FAULT ISOLATION TEST.

DESCRIPTION

This test finds a modulation control switching fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of modulation toggle switches (fig. FO-5).

- If any resistance reading not less than 0.05 ohms, replace toggle switch listed in right column (para 2-91).

AM/FM/PM SWITCHES:	MEASUREMENT POINTS:	REPLACE:
INT	A2SW2 left center lead to A2R87 front lead	A2SW2
INT	A2SW2 right center lead to A2R88 rear lead	A2SW2
INT	A2SW3 left center lead to A2R88 front lead	A2SW3
INT	A2SW3 left center lead to jumper wire between A2SW3 and A2SW4	A2SW3
INT	A2R5 center lead to jumper wire between A2J11 and A2J12	A2SW4
OFF	A2SW3 front right lead to jumper wire between A2SW2 and A2SW3	A2SW3
OFF	A2SW3 left center lead to jumper wire between A2SW3 and A2SW4	A2SW3
EXT	A2SW2 left center lead to A2R87 rear lead	A2SW2
EXT	A2SW2 right center lead to A2SW4 rear lead	A2SW2
EXT	A2SW3 left center lead to jumper wire between A2SW2 and A2SW3	A2SW3
EXT	A2SW4 rear lead to jumper wire between A2SW3 and A2SW4	A2SW3
EXT	A2SW4 rear lead to jumper wire between A2J11 and A2J12	A2SW4

3. Check resistance of A2P5 (figs FO-4 and FO-5).

- If any resistance reading not less than 0.1 ohms, replace ribbon cable A2P5 (para 2-84).

MEASUREMENT POINTS:

From Auxiliary Board (A2)	To Main Board (A1)
Jumper wire between A2J11 A2J12	A1R16 right lead
A2SW2 left center lead	A1R348 right lead
A2SW2 right center lead	A1TP6
Jumper wire between A2SW3 and A2SW4	A1R15 rear lead

4. Check resistance of A2R87 and A2R88 (fig. FO-5).

- Set MODULATION toggle switches AM, FM/SWP, and PM(ϕ) to OFF.
- If any reading not within limits, replace resistor (para 2-86).
- Replace switch/control assembly A2SW5/A2R5 (para 2-80).

END OF TEST

2-60. TRIGGER SIGNAL LIMITER FAULT ISOLATION TEST.

DESCRIPTION

This test finds a trigger signal limiter fault.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

NOTE

PRELIMINARY PROCEDURE:
Remove bottom cover (para 2-61).
Remove top cover (para 2-62).

NOTE

After replacing failed part, do functional check to verify original symptom has been corrected.

1. Set signal generator POWER OFF/ON switch to OFF (fig. FO-6).

NOTE

Signal generator controls not listed may be left in any position.

2. Check resistance of A2Q1, A2Q2, A2Q3, A2CR1, A2CR2 and A2CR3 (fig FO-5).

- If reverse resistance measurement not 10 times greater than forward resistance for any junction (except A2CR1 and A2CR2 which should read normal forward resistance in either direction), replace the appropriate diode (para 2-87) or transistor (para 2-92).

3. Check voltage at rear lead of A2R50 (fig. FO-5).

- Set POWER OFF/ON switch ON.
- Rotate TRIG LEVEL vernier from fully counterclockwise to fully clockwise.
- If reading does not vary from more positive than + 14.4V to more negative than – 14.4V, replace switch/control assembly A2SW1/A2R1 (para 2-79).

4. Check resistance of A2SW1 (fig. FO-4 and FO-5).

- If any resistance reading not less than 0.1 ohms for the following points, replace switch/control assembly A2SW1/A2R1 (para 2-79).

MODE	MEASUREMENT POINTS:
INT GATE	A1U13 pin 5 to “-” lead of A2C24.
INT GATE	A2E7 to A2R67 rear lead
INT TRIG	A2E7 to A2R67 rear lead
CONT	A1U13 pin 1 to “-” lead of A2C24.
EXT TRIG	A2E7 to EXT TRIG IN center conductor
EXT GATE	A2E7 to EXT TRIG IN center conductor
EXT GATE	A1U13 pin 5 to “-” lead of A2C24.

5. Check resistance of A2R50, A2R51, A2R52, A2R53, A2R54, A2R55, A2R56, A2R57, A2R58, A2R59, A2C16, A2C19 and A2C20 (fig. FO-5).

- Replace appropriate resistor (para 2-86), ceramic capacitor (para 2-85), or disc capacitor (para 2-88).

END OF TEST

Section IV. MAINTENANCE PROCEDURES

2-61. REMOVE BOTTOM COVER

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE. Remove power from unit by disconnecting power cable at rear of instrument.

REMOVE

1. Place signal generator upside down.
2. **Remove four screws (1).**
3. Lift bottom cover (2) straight up.

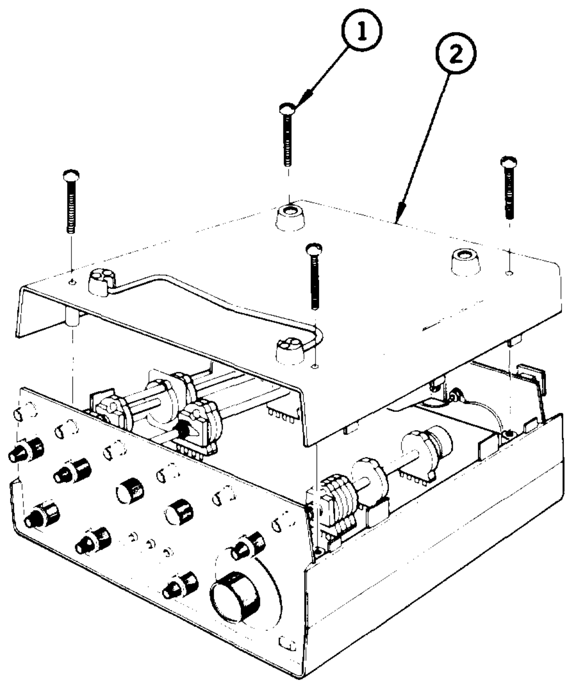
INSTALL

1. Place signal generator upside down.
2. Lower bottom cover (2) straight down.

NOTE

Check that bottom cover is correctly positioned with narrow tapered lip of cover toward front panel.

3. Install four screws (1).



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END OF TASK

2-62. REMOVE TOP COVER

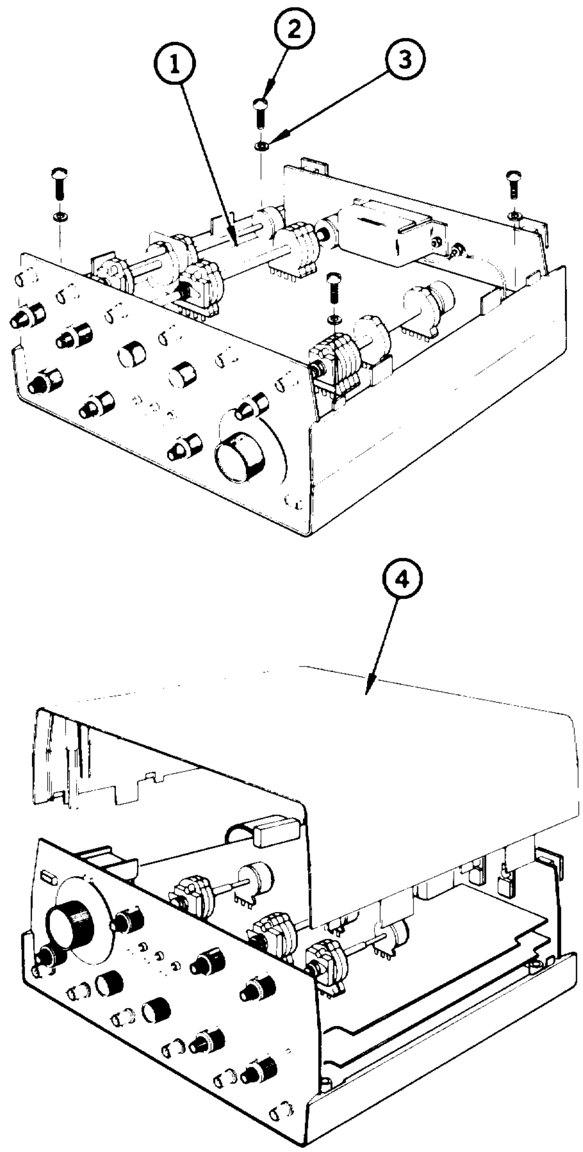
DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove bottom cover. See paragraph 2-61.



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REMOVE

1. Remove four screws (2) and lockwashers (3) holding main board (1) to top cover.
2 Install bottom cover but do not install screws.
3. Turn equipment right side up.
4 Remove top cover (4) by lifting straight up.

INSTALL

1. Place equipment right side up.

NOTE

Ensure that narrow tapered end of top cover is closest to front panel.

2. Install top cover (4).
3. Turn equipment upside down and lift off bottom cover.
4. Fasten main board (1) to top cover (4) using four stews (2) and lockwashers (3).

2-62. REMOVE TOP COVER (CONT)

NOTE

FOLLOW-ON MAINTENANCE. Install bottom cover See paragraph 2-61.

END OF TASK

2-63. REMOVE AUXILIARY BOARD A2.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove top cover. See paragraph 2-62.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

Ensure all control and switch knobs are set to full counterclockwise position prior to being removed This will aid in proper alignment of knobs during reinstallation.

2-63. REMOVE AUXILIARY BOARD A2 (CONT)

REMOVE

1. Remove all knobs in modulation generator section of front panel.

2. Remove connectors P6, P7 and P8 from J6 (2), J7 (9) and J8 (10).

3. Remove connector P2 from J2. (See paragraph 2-64).

4. Remove grey coaxial cables 9, 10, 11 and 12 from J9 (8), J10 (5). J11 (6), and J12 (7).

5. Remove power switch A4SW1. (See paragraph 2-67, steps 3 and 4).

6. Remove tour screws/lockwashers (3) that hold auxiliary board (1) to main board.

7. Lift rear of auxiliary board (1) while sliding control shafts (4) clear of front panel holes.

INSTALL

1. Position auxiliary board (1) so that control shafts (4) line up with correct holes in front panel.

2. Slide control shafts (4) into front panel holes while lowering auxiliary board (1) down onto main board until properly seated.

3. Fasten auxiliary board (1) to main board using 4 screws/lockwashers (3).

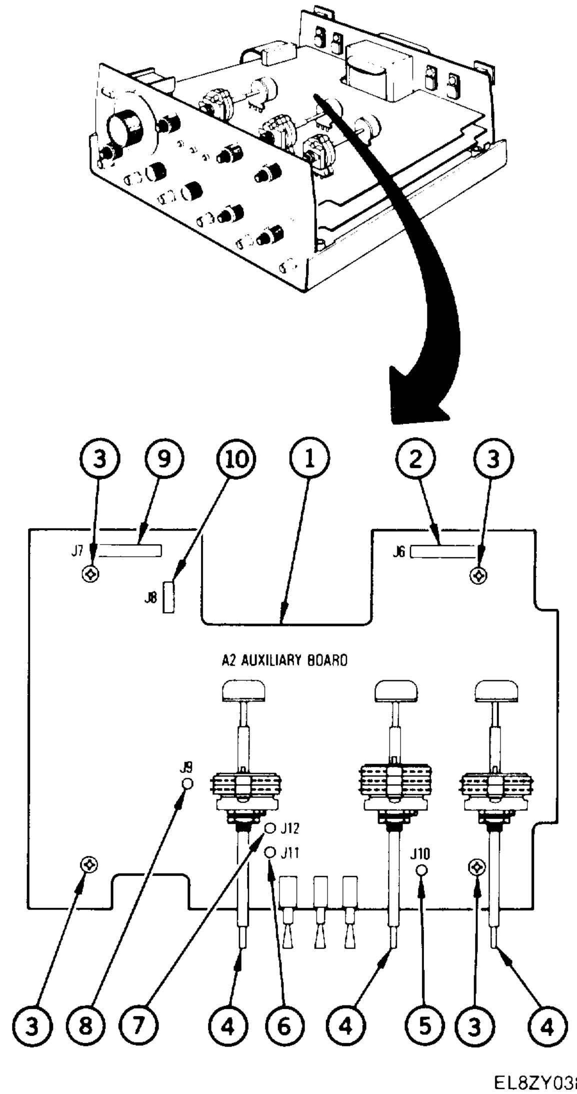
4. Install power switch A4SW1. (See paragraph 2-67, step 1)

5. Insert grey coax cables 9, 10, 11, and 12 into J9 (8), J10 (5), J11 (6), and J12 (7) respectively.

6. Insert connector P2 into J2, (See paragraph 2-64).

7. Insert connectors P6, P7 and P8 into J6 (2), J7 (9) and J8 (10).

8. Install all knobs, Ensure that all knob pointers are aligned correctly.



2-63. REMOVE AUXILIARY BOARD A2 (CONT)

NOTE

FOLLOW-ON MAINTENANCE: Install bottom cover. See paragraph 2-61.

END OF TASK

2-64. REMOVE MAIN BOARD A1

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove bottom cover. See paragraph 2-61.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to around to prevent electrical shock.

NOTE

Ensure that all control and switch knobs are set to the full counterclockwise position prior to being removed. This will aid in proper alignment of knobs during reinstallation.

2-64. REMOVE MAIN BOARD A1 (CONT)

REMOVE

1. Remove knobs on bottom row of front panel.

2. Remove P2 from J2 (3).

3. Remove grey coax cables 4 and 5 from J4 (7) and J5 (8).

4. Remove 3-wire cable plug PI 5 from J1 (6).

5. Remove Top cover. (See paragraph 2-62, step 1 only.)

6. Carefully lift front and rear panels at same time clear of top cover.

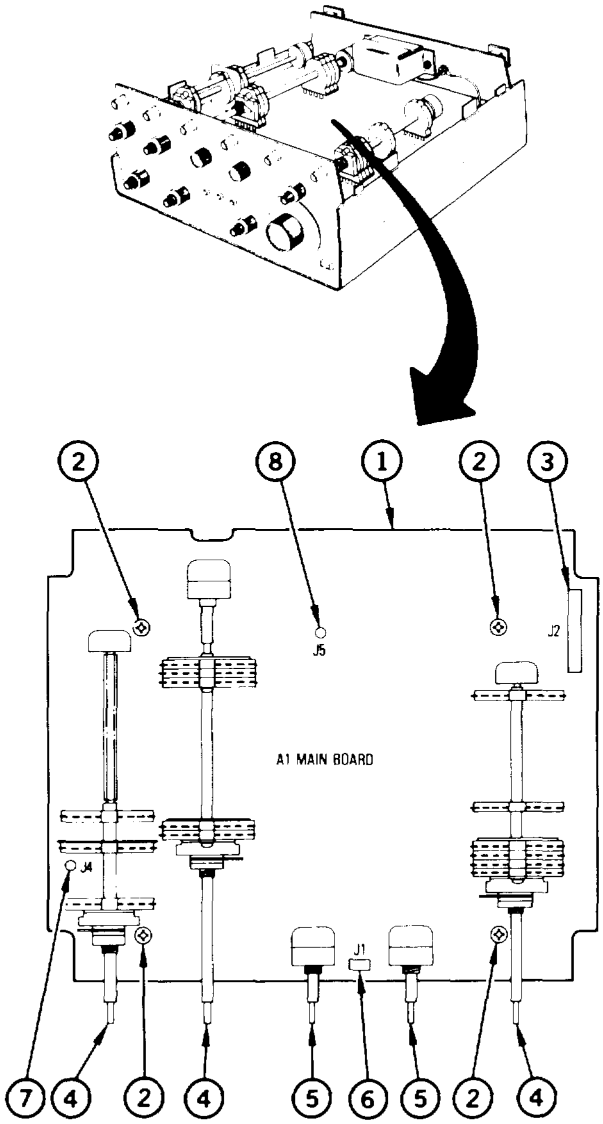
7. Move rear panel 2 to 3 inches away from main board (1) and reinstall front panel and circuit boards in top cover.

NOTE

Rear panel should be clear of lop cover and both boards.

8. Remove four screws/lockwashers (2).

9. Lift rear of main board (1) while sliding control shafts (4.5) clear of front panel holes.



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INSTALL

1. Align control shafts (4,5) with proper front panel holes and slide main board (1) down and forward until seated.

2. Install four screws/lockwashers (2) to secure main board (1) to auxiliary board.

3. Position rear panel against rear edge of main board (1) and lower assembly into top cover.

4. Install board assembly into top cover. (See paragraph 2-62 step 4).

5. Install 3-wire cable plug P15 into J1 (6) on main board.

6. Install grey coax cables 4 and 5 into J4 (7) and J5 (8) on main board.

2-64. REMOVE MAIN BOARD A1 (CONT)

7. Install P2 into J2 (3) on main board.

8. Install knobs on lower front panel control shafts (4,5) and ensure that they are properly aligned.

NOTE

FOLLOW-ON MAINTENANCE: Install bottom cover. See paragraph 2-61.

END OF TASK

2-65. REMOVE REAR PANEL A4.

DESCRIPTION

This procedure covers Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove bottom cover. See paragraph 2-61.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

2-65. REMOVE REAR PANEL AE (CONT)

REMOVE

1. Remove grounding lug (1) and wires from screw (10).
2. Unsolder signal wire (9) and shield wire (8) at SYNC IN connector (7).
3. Remove top cover (See paragraph 2-62).
4. Remove P6 (2) from J6 and P7 (6) from J7 on auxiliary board.
5. Remove power switch A4SW1 (5) from auxiliary board by removing screws (3,4).
6. Gently raise front and rear panels clear of bottom cover until rear panel separates from rest of equipment.
7. Return front panel and board assemblies to bottom cover.

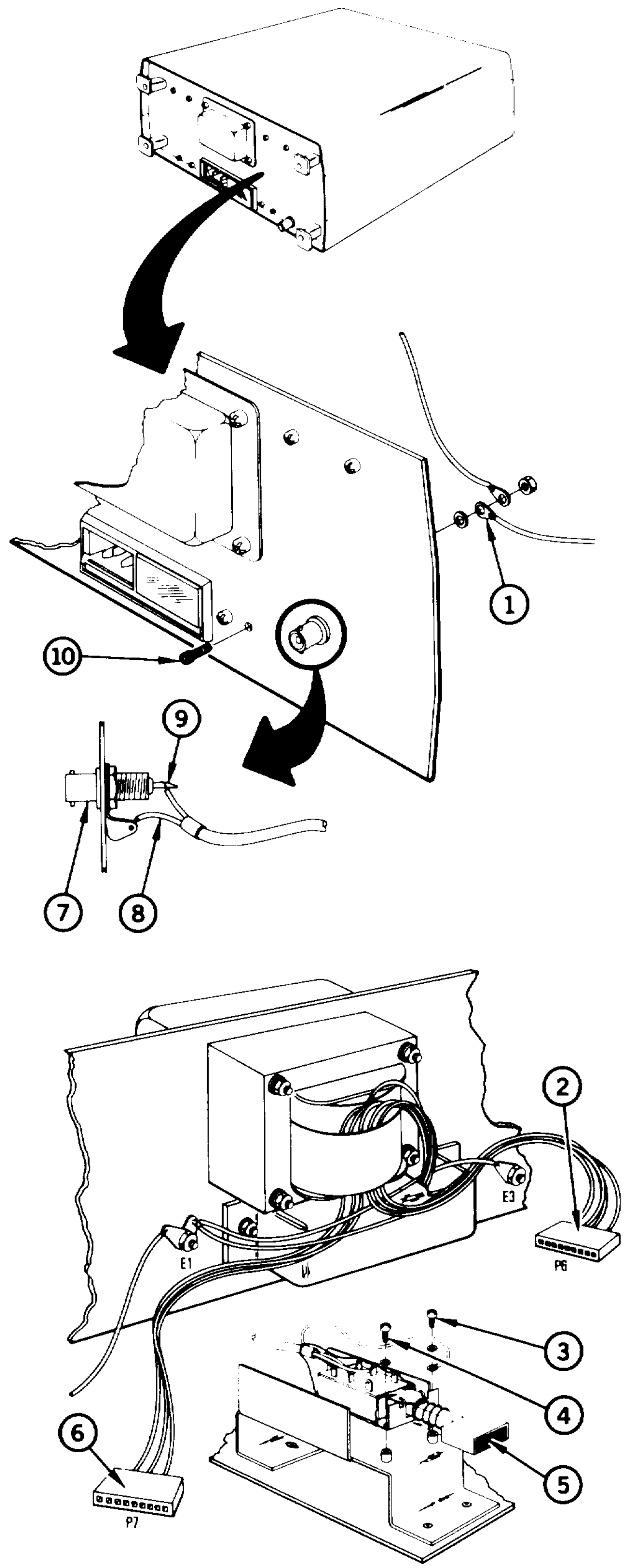
INSTALL

1. Position rear panel to the rear and outside of cover.
2. Install power switch A4SW1 (5) on auxiliary board using 2 screws/lockwashers (3,4).
3. Connect P6 (2) to J6 and P7 (6) to J7.
4. Gently raise front panel and board assemblies clear of bottom cover.

NOTE

In the next step be careful not to pinch the wires between the main board and the rear panel.

5. Position rear panel against main board. Main board will be between transformer A4T1 and power receptacle A4J15. Reinstall in bottom cover.
6. Install ground lug (1) on screw (10).
7. Solder signal wire (9) to center pin and ground wire (8) to ground plug of connector (7).



EL8ZY040

2-65. REMOVE REAR PANEL AE (CONT)

NOTE

FOLLOW-ON MAINTENANCE: Install top cover. See paragraph 2-62.

END OF TASK

2-66. REPLACE FRONT PANEL A3.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove bottom cover. See paragraph 2-61.

WARNING

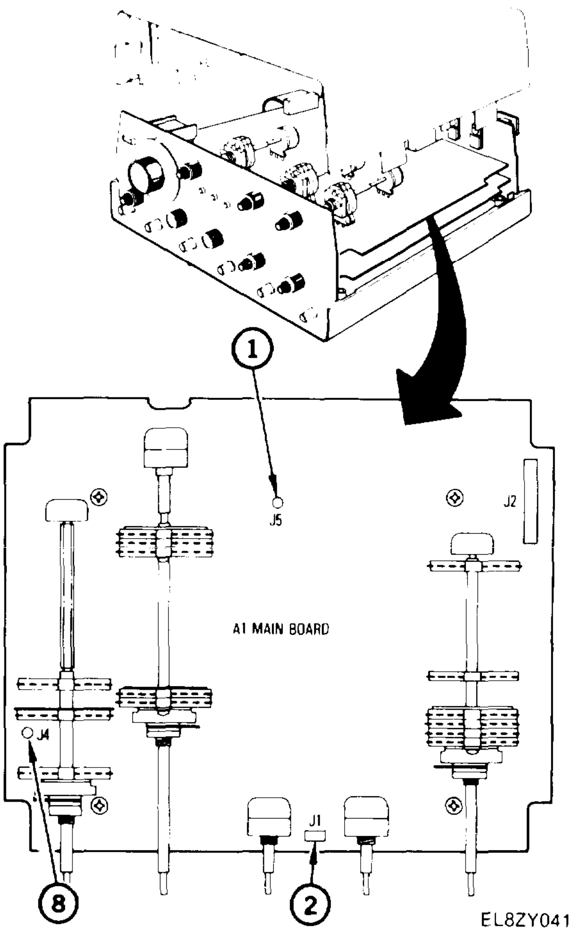
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

Ensure that all control and switch knobs are set to full counterclockwise position prior to being removed. This will aid in properly aligning knobs during reinstallation.

REMOVE

1. Remove all knobs from front panel controls.
2. Remove grey coax cables 4 from J4 (8) and 5 from J5 (1).
3. Remove P15 from J1 (2).
4. Remove top cover (See paragraph 2-62).
5. Remove P8 from J8 (7).
6. Remove grey coax cables 9, 10, 11 and 12 from J9 (6), J10 (3), J11 (4), and J12 (5).



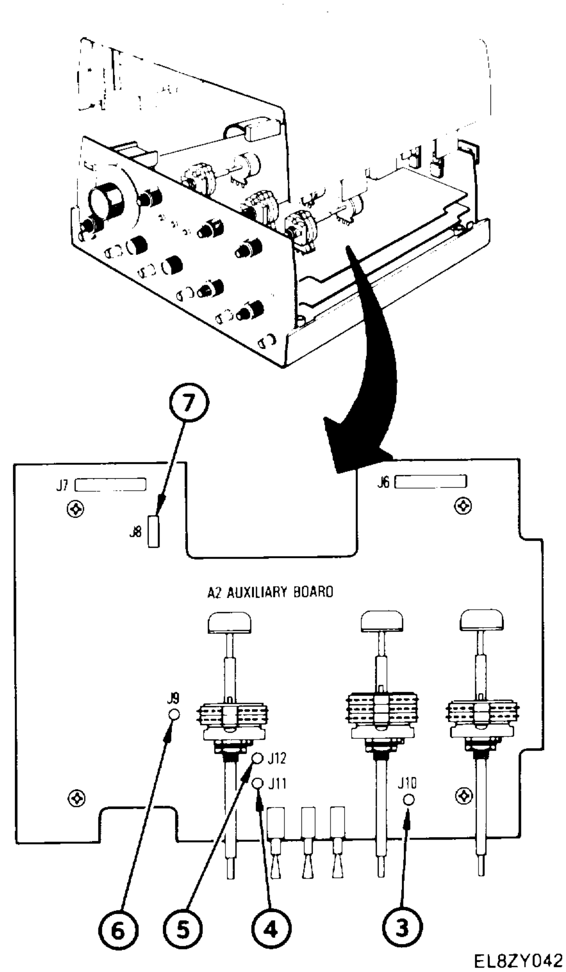
2-66. REPLACE FRONT PANEL A3 (CONT)

7. Remove nut (12) and ground lug (11) from screw (10).

8. Gently raise front and rear panels with both boards clear of bottom cover.

9. Remove front panel (9) from board assemblies and rear panel.

10. Return board assemblies and rear panel to bottom cover.



NOTES

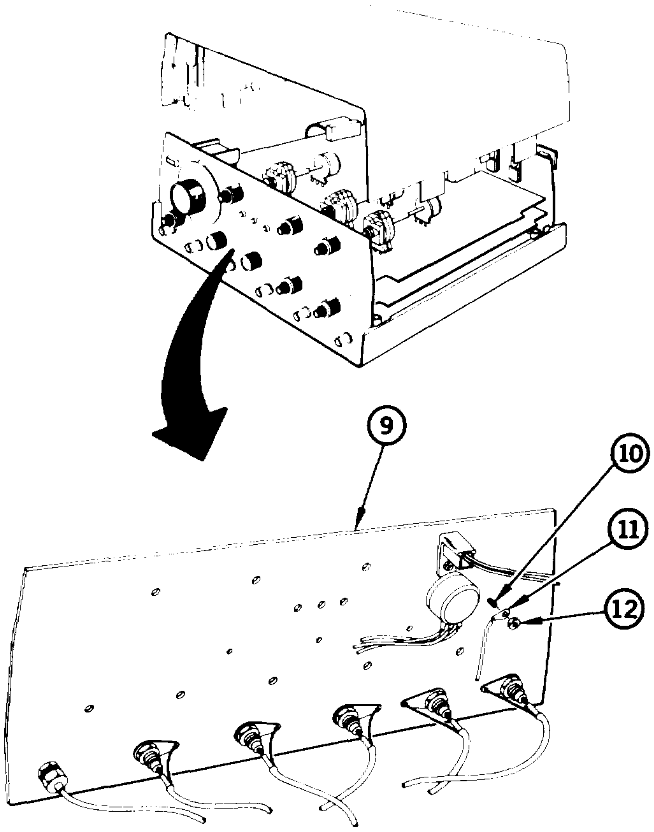
1. If the front panel is to be replaced, transfer the BNC connectors and dial pot to the new panel before installation.

2. Connector P15 wiring is to be routed through the notch at the front of the main board.

2-66. REPLACE FRONT PANEL A3 (CONT)

INSTALL

1. Lift main and auxiliary boards from bottom cover, position front panel (9) over control shafts and replace in bottom cover.
2. Insert grey coax cables 9, 10, 11 and 12 into J9 (6), J10 (3), J11 (4), and J12 (5) respectively.
3. Insert P8 into J8 (7).
4. Install top cover. (See paragraph 2-62 but do not install the bottom cover.)
5. Insert P15 into J1 (2).
6. Insert grey coax cable 4 into J4 (8) and cable 5 into J5 (1).
7. Install nut (12) and ground lug (11) on screw (10).
8. Install all front panel knobs (See TM 11-6625-3051-12).



EL8ZY043

NOTE

FOLLOW-ON MAINTENANCE. Install bottom cover. See paragraph 2-61.

END OF TASK

2-67. REPLACE POWER SWITCH A4SW1

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

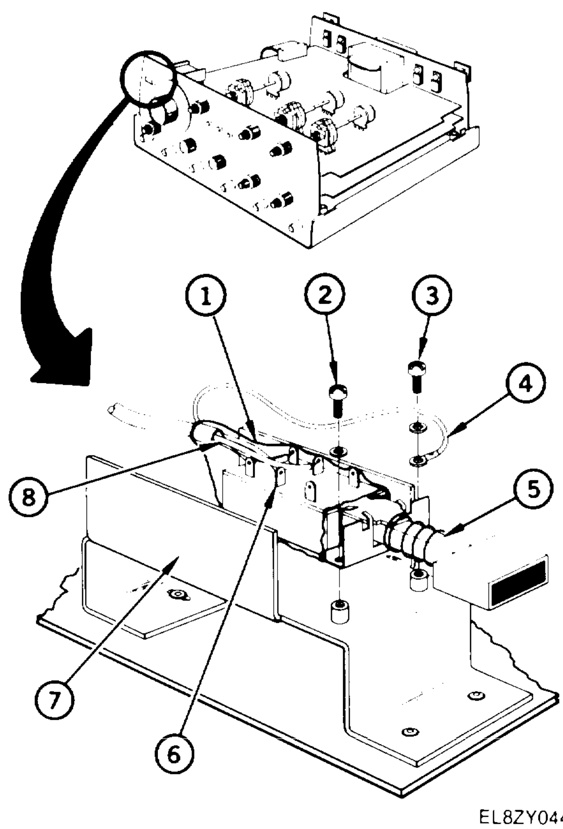
NOTE

PRELIMINARY PROCEDURE: Remove top cover. See paragraph 2-62.

2-67. REPLACE POWER SWITCH A4SW1 (CONT)

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.



REMOVE

1. Remove heat shrinkable insulation sleeve (1) from power switch (5).
2. Unsolder wires (8) from power switch (5) and tag.
3. Remove two screws/lockwashers (2, 3) holding power switch (5) to mounting bracket (7).
4. Remove power switch (5) from mounting bracket (7).

INSTALL

1. Install power switch (5) and ground wire lug (4) on mounting bracket (7) and secure with two screws/lockwashers (2, 3).
2. Install new heat shrinkable tubing (1) over cable end.
3. Solder tagged wires (8) to proper terminals (6).
4. Slide heat shrinkable tubing (1) over terminals (6) and shrink tubing.

NOTE

FOLLOW-ON MAINTENANCE. Install top cover See paragraph 2-62.

END OF TASK

2-68. REPLACE FREQUENCY DIAL POT A3R1.

DESCRIPTION

This procedure covers: Remove. Install.

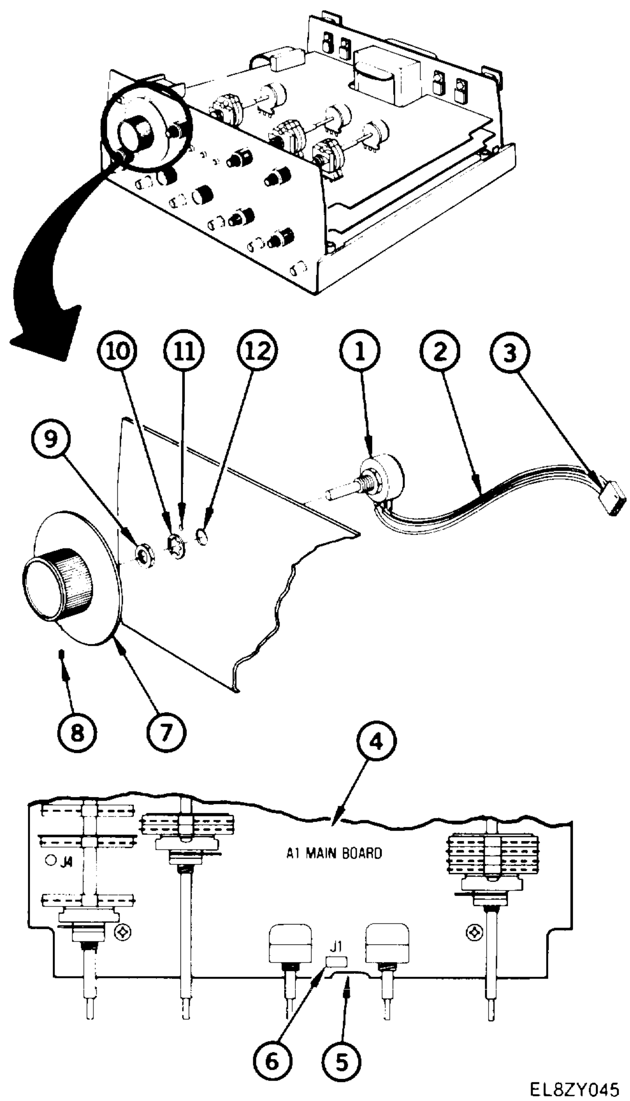
INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE. Remove bottom cover. See paragraph 2-61.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.



REMOVE

1. Remove P15 (3) from J1 (6).
2. Loosen setscrew (8) on frequency dial (7) and remove knob.
3. Remove top cover. (See paragraph 2-62).
4. Loosen and remove retaining nut (9) and lockwasher (10).
5. Remove dial pot (1).
6. Guide 3-wire cable (2) and plug P15 (3) through opening (5).
7. Unsolder 3-wire cable (2) from dial pot (1).

NOTE

The frequency dial and pot is a factory matched assembly and must be installed as such. After Installation the instrument must be calibrated.

2-68. REPLACE FREQUENCY DIAL POT A3R1 (CONT)

INSTALL

1. Solder the 3-wire cable (2) in same sequence to proper terminals on the dial pot (1).

2. Guide 3-wire cable (2) and plug P1 (3) down through opening (5) in main board (4).

3. Install dial pot (1) into hole (12) in the front panel and secure with lockwasher (10) and nut (9). Ensure that dial pot tab mates with alignment hole (11).

4. Rotate dial pot shaft full counterclockwise.

5. Install dial (7) on dial pot shaft and align 20 dial mark with indicator index.

6. Tighten dial setscrew (8).

7. Insert P15 (3) into J1 (6).

NOTE

FOLLOW-ON MAINTENANCE. Install top cover. See paragraph 2-62.

END OF TASK

2-69. REPLACE POWER RECEPTACLE A4J15.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove bottom cover. See paragraph 2-61.

WARNING

Capacitors hold electrical charges after power IS removed Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

2-69. REPLACE POWER RECEPTACLE A4J15 (CONT)

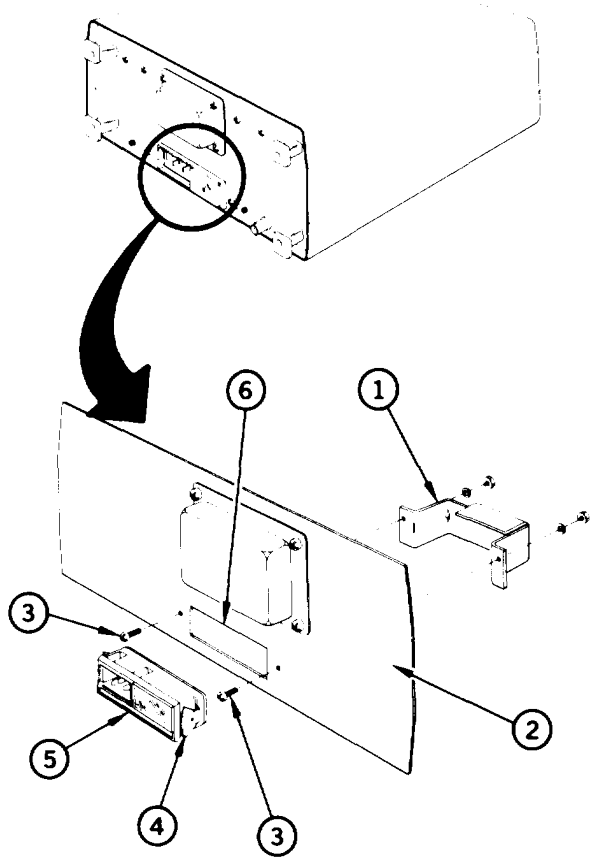
REMOVE

1. Remove two screws/lockwasher/nuts (3) holding power receptacle internal cover (1).
2. Remove power receptacle internal cover (1).
3. Depress retaining clips (4) on both sides of power receptacle (5) and remove power receptacle (5).

NOTE

Record wire removal sequence for use during wire installation.

4. Unsolder wires one at a time.



INSTALL

1. Solder wires to the power receptacle (5) using wire sequence recorded in step 4 of removal.
2. Insert power receptacle (5) into hole (6) in rear panel (2) until retaining clips (4) lock.
3. Install power receptacle internal cover (1) and secure using two screws/lockwashers/nuts (3).

NOTE

FOLLOW-ON MAINTENANCE: Install bottom cover. See paragraph 2-61.

END OF TASK

2-70. REPLACE TRANSFORMER A4T1.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove rear panel. See paragraph 2-65.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

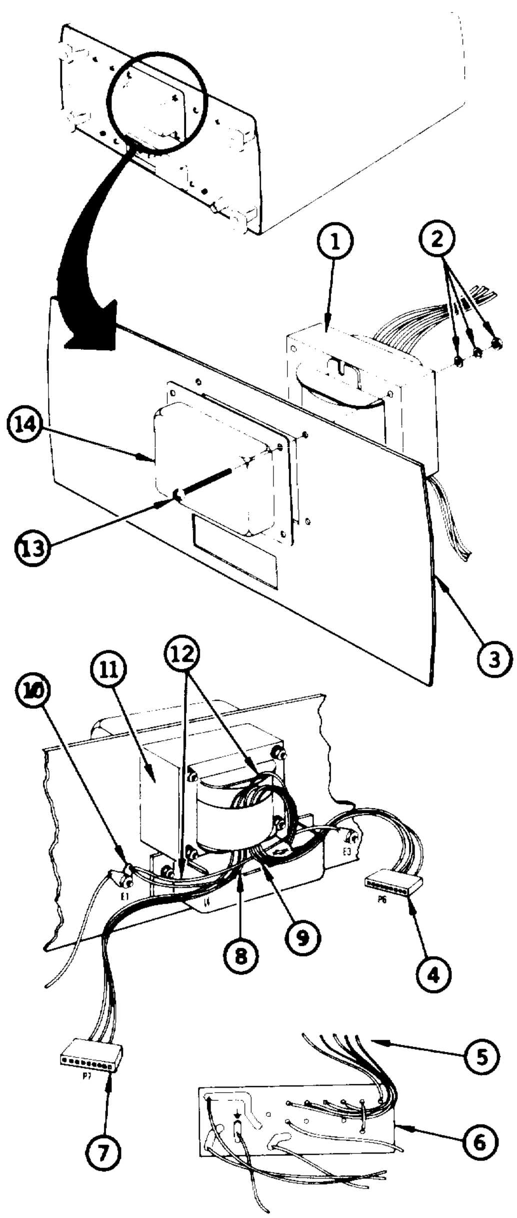
NOTE

1. Record connector wire sequence for use during wire installation.

2. Cut ty-wraps to free wires from cables if necessary.

REMOVE

1. Remove power receptacle internal cover (See paragraph 2-69).
2. Unsolder primary wires (5) from power receptacle (6).
3. Unsolder yellow/green wire (12) from ground lug (10).
4. Remove two blue and one white/blue wire (9) and their pins from connector A4P6 (4). (See paragraph 2-75, steps 1 and 2.)
5. Remove two red and one white/red wire (8) and their pins from connector A4P7 (7).
6. Remove four screws, washers, lockwashers, and nuts (2) holding power transformer (1) and end bell (14) to rear panel (3).
7. Remove power transformer (1) and end bell (14) from rear panel (3).



2-70. REPLACE TRANSFORMER A4T1 (CONT)

INSTALL

1. Prepare new power transformer by cutting and stripping each wire to proper length as follows:

• Red	12 inches
• Red	12 inches
• White/red	12 inches
• Blue	12 inches
• Blue	12 inches
• White/blue	12 inches
• Black	6 inches
• Orange	6 inches
• White/black	6 inches
• Green/yellow	6 inches
• Grey	6 inches
• Grey/white	6 inches

2. Install power transformer (1) and end bell (14) onto rear panel (3) using four screws, washers, lockwashers, and nuts (2).

3. Solder power transformer primary wires (5) to proper terminals on power receptacle (6) as recorded during removal procedures.

4. Install power receptacle internal cover (See paragraph 2-69).

5. Solder yellow/green wire (12) to ground lug (10).

6. Crimp new pins an two blue and one white/blue wires (9) and insert into A4P6 (4). (See paragraph 2-75, steps 2 and 3.)

7. Crimp new pins an two red and one white/red wires (8) and insert into A4P7 (7)

NOTE

FOLLOW-ON MAINTENANCE: Install rear panel. See paragraph 2-65.

END OF TASK

2-71. REPLACE BNC CONNECTORS A3J1 THRU A3J5 AND A4J1.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

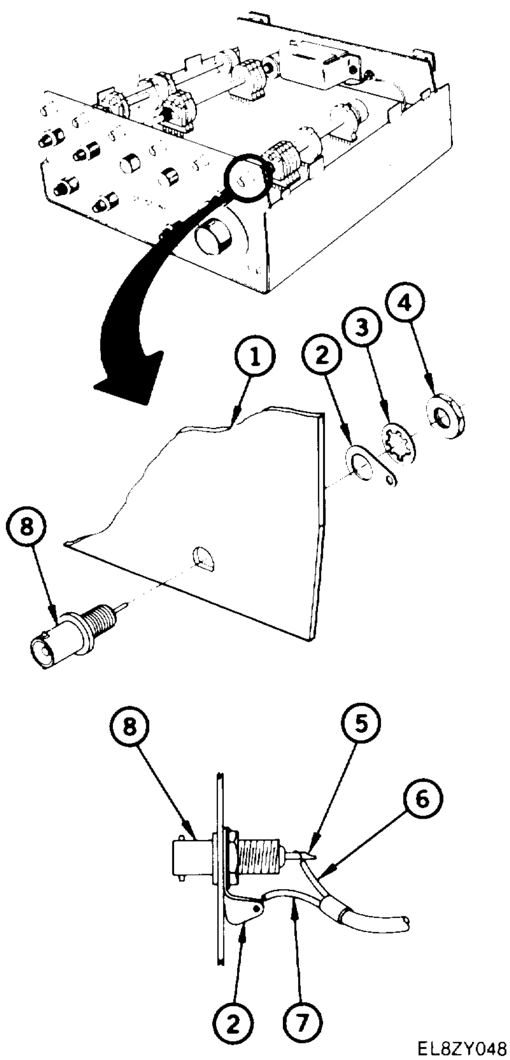
PRELIMINARY PROCEDURE: Remove bottom cover. See paragraph 2-61.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

This task is the same for BNC connectors A3J1 thru A3J5 and A4J1. Only A3J1 is shown.



REMOVE

1. Unsolder wire (6) from center pin (5) of connector A3J1 (8).

2. Unsolder shield wire (7) from grounding lug (2).

3. Loosen and remove nut (4), lockwasher (3) and grounding lug (2).

4. Remove connector A3J1 (8) from panel (1).

2-71. REPLACE BNC CONNECTORS A3J1 THRU A3J5 AND A4J1 (CONT)

INSTALL

1. Insert new connector A3J1 (8) into panel (1) with tabs in the vertical position.

2. Install ground lug (2), Iockwasher (3) and nut (4).

CAUTION

Before soldering, wrap wire around connector pin. The Insulation on the center wire should be 0.156 in. long.

3. Solder shield wire (7) to ground lug (2).

4. Solder center conductor wire (6) to center pin (5) of connector A3J1 (8).

NOTE

FOLLOW-ON MAINTENANCE: Install bottom cover. See paragraph 2-61.

END OF TASK

2-72. REPLACE BNC CONNECTOR A3J6.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE. Remove bottom cover. See paragraph 2-61.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

2-72. REPLACE BNC CONNECTOR A3J6 (CONT)

REMOVE

1. Unscrew and slide the large connector nut (6) away from connector A3J6 (1).

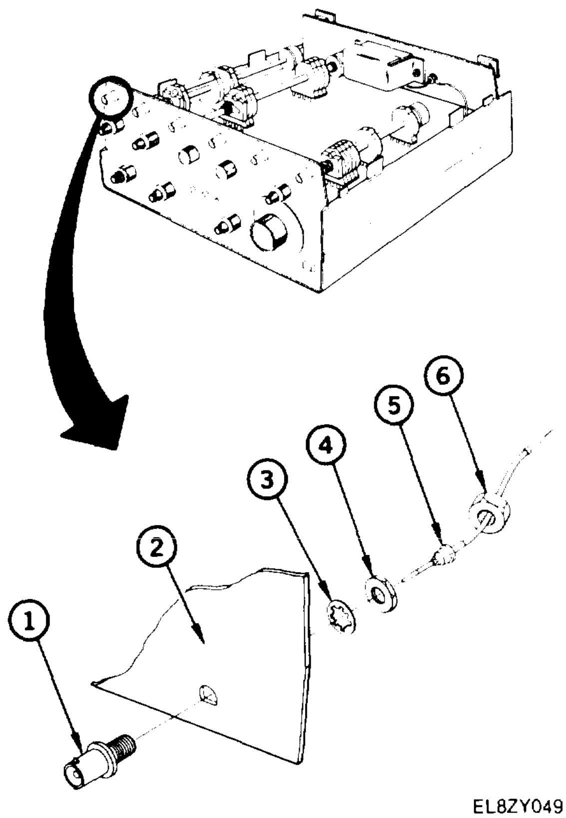
2. Remove cable assembly (5) from connector A3J6 (1).

NOTE

If coax pin assembly is damaged, replace with pin assembly from new BNC connector.

3. Unscrew and remove BNC connector nut (4) and lockwasher (3).

4. Remove BNC connector A3J6 (1) from front panel (2).



INSTALL

1. Insert BNC connector A3J6 (1) into panel (2) with tabs in the vertical position.

2. Install lockwasher (3), connector nut (4) and tighten.

3. Insert coaxial pin assembly (5) into rear of BNC connector (1).

4. Secure coaxial pin assembly (5) to rear of BNC connector A3J6 (1) with nut (6).

NOTE

FOLLOW-ON MAINTENANCE: Install bottom cover. See paragraph 2-61.

END OF TASK

2-73. REPLACE VOLTAGE REGULATORS A4VR1 THRU A4VR4.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

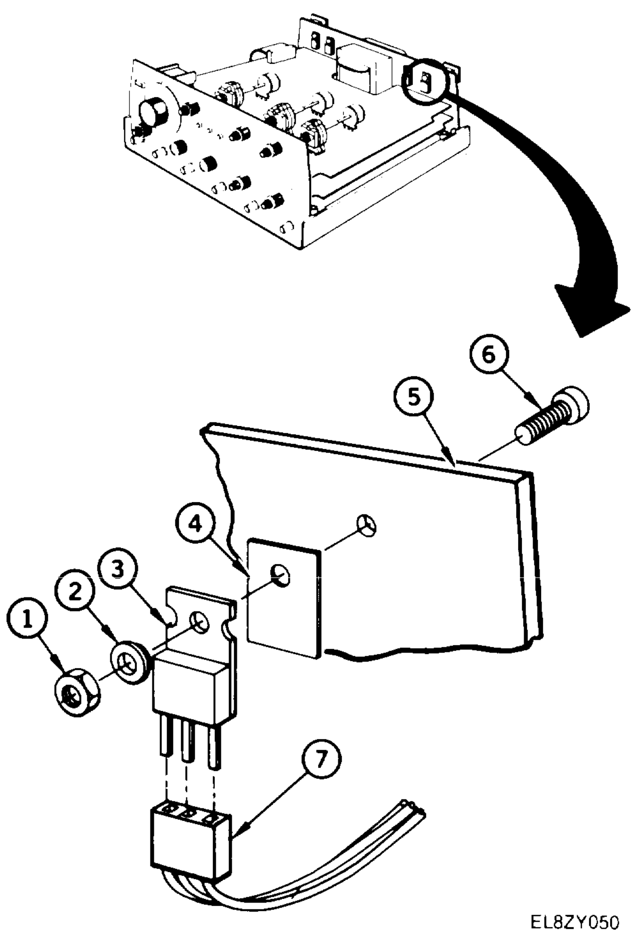
PRELIMINARY PROCEDURE: Remove top cover. See paragraph 2-62.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

This task is the same for voltage regulators A4VR1 thru A4VR4. Only A4VR4 is shown.



REMOVE

1. Remove socket (7) from voltage regulator A4VR4 (3) leads.
2. Remove nut (1) and shoulder washer (2) from mounting screw (6).
3. Remove voltage regulator A4VR4 (3) and Insulator (4) from panel (5).

INSTALL

1. Coat insulator (4) and back of voltage regulator A4VR4 (3) with thermal compound (Wakefield #120-2).
2. Install screw (6) thru panel (5), insulator (4), voltage regulator A4VR4 (3) and insulation sleeve (2).

CAUTION

Ensure that the shoulder washer fits properly into the hole to prevent shorting the regulator to ground.

2-73. REPLACE VOLTAGE REGULATORS A4VR1 THRU A4VR4 (CONT)

3. Install nut (1) on screw (6) and tighten.

4. Install socket (7) on voltage regulator A4VR4 (3) leads.

NOTE

FOLLOW-ON MAINTENANCE: Install top cover. See paragraph 2-62.

END OF TASK

2-74. REPLACE VOLTAGE REGULATORS A1VR1 THRU A1VR3.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove main board. See paragraph 2-62.

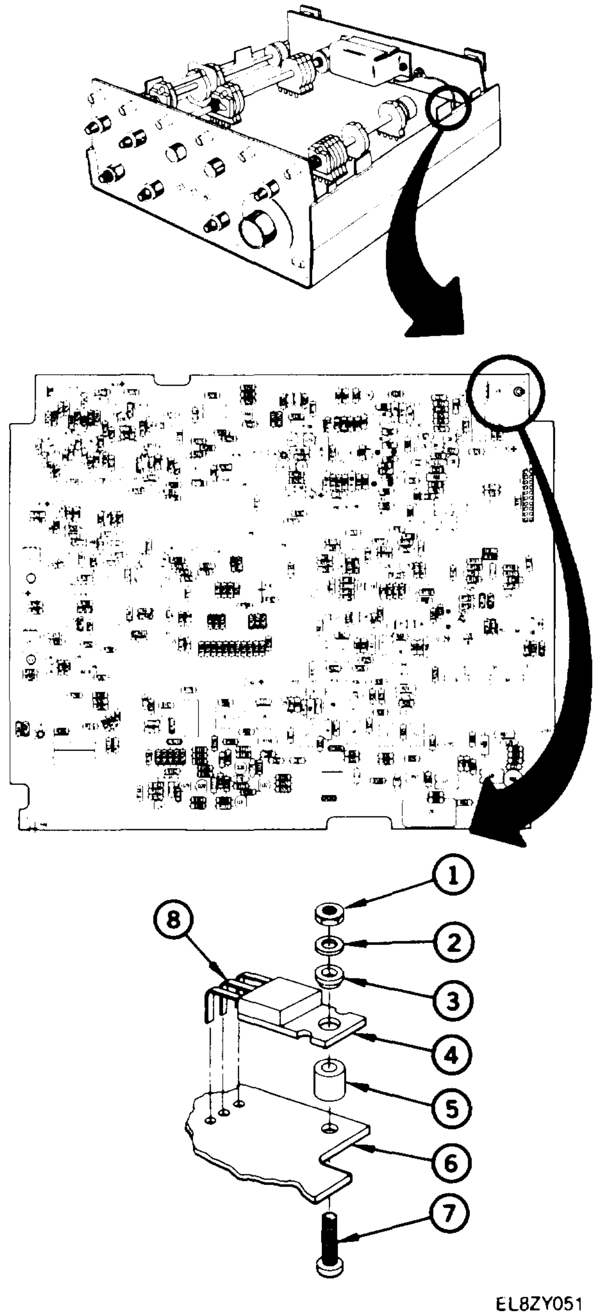
WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment discharge all capacitors to ground to prevent electrical shock.

NOTE

This task is the same for voltage regulators A1VR1 thru A1VR3. Only A1VR1 is shown.

2-74. REPLACE VOLTAGE REGULATORS A1VR1 THRU A1VR3 (CONT)



REMOVE

1. Carefully unsolder all three regulator A1VR1 leads (8).
2. Remove nut (1), lockwasher (2), and shoulder washer (3) from mounting screw (7).
3. Remove voltage regulator A1VR1 (4), metal standoff (5), and screw (7) from main board (6).

INSTALL

1. Position voltage regulator A1VR1 leads (8) and insert into proper holes in main board.
2. Install screw (7) through the main board (6) and metal standoff (5).
3. Carefully bend voltage regulator A1VR1 over and insert onto screw (7).
4. Install shoulder washer (3), lockwasher (2), nut (1) and tighten.
5. Carefully solder voltage regulator A1VR1 leads (8) to main board.

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-75. REPLACE CONNECTOR A4P6 OR A4P7.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove top cover. See paragraph 2-62.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

This task is the same for A4P6 or A4P7. Only A4P6 is shown.

REMOVE

1. Remove connector A4P6 (2) from A2J6 socket and position on flat surface (1) as shown.

2. Insert small straight slot screwdriver in tab slot (3) and press down just enough to release tab.

3. Remove wire and pin (4) while releasing tab. Perform this operation for all wires and pins.

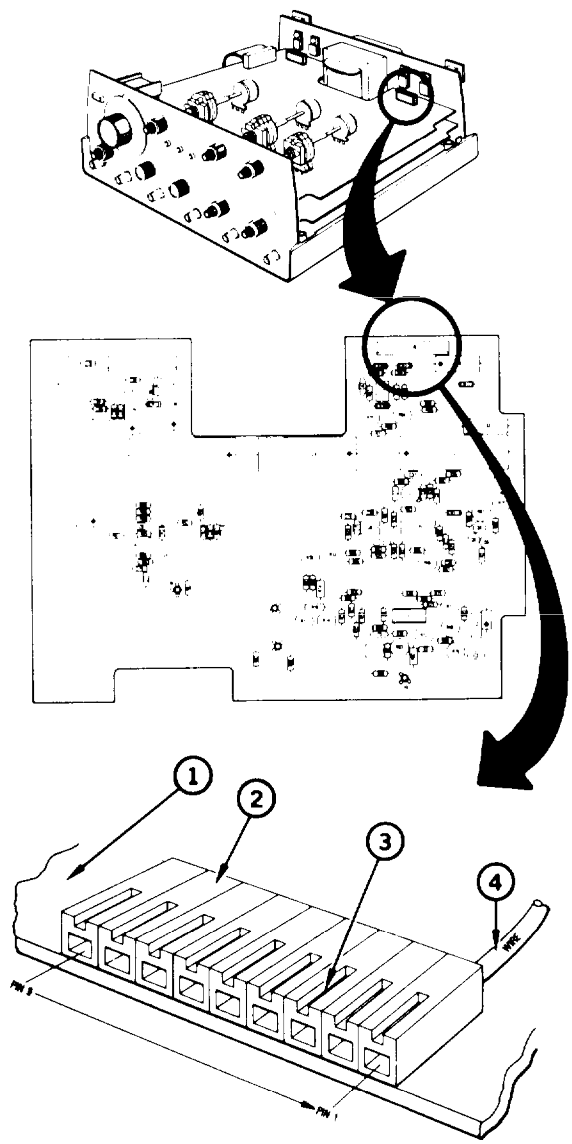
NOTE

Clip only those pins that are damaged or defective.

4. Clip pins from wires as close to pins as possible.

NOTE

Perform steps 1 and 2 only if pins were clipped off during removal.



EL8ZY052

2-75. REPLACE CONNECTOR A4P6 or A4P7 (CONT)

INSTALL

1. Remove 0.375 inch (3/8 inch) insulation from clipped wires.
2. Crimp new pins to clipped wires.
3. Position pins and wires with tab upwards and insert into proper connector slots until tabs lock.
4. Install connector A4P6 (2) into A2J6 socket on auxiliary board.

NOTE

FOLLOW-ON MAINTENANCE: Install top cover. See paragraph 2-62.

END OF TASK

2-76. REPLACE SWITCH/CONTROL ASSEMBLY A1SW1.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

Refer to figure 2-4 for location and identification of wires.

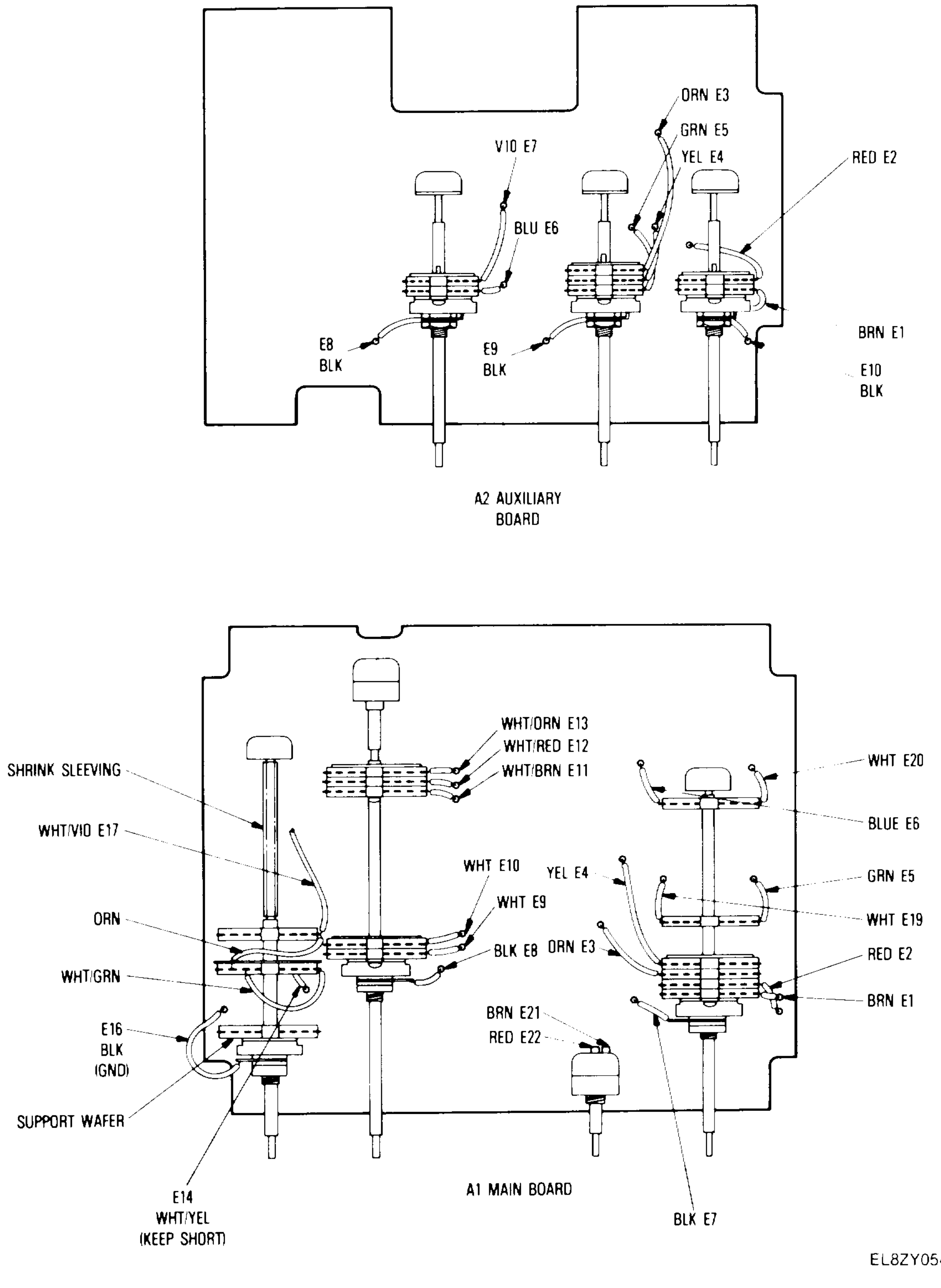


Figure 2-4. Switch/Control Assembly Wire Locations

2-76. REPLACE SWITCH/CONTROL ASSEMBLY A1SW1 (CONT)

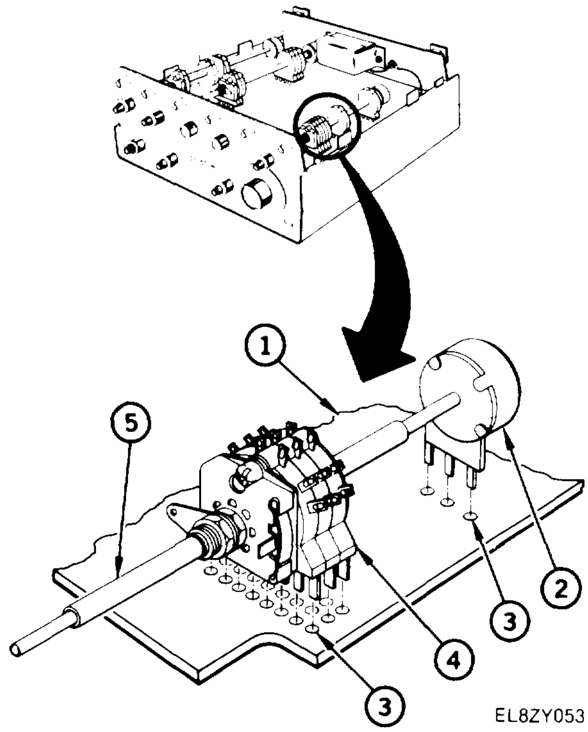
REMOVE

1. Unsolder wires A1E1 thru A1E7, A1E19, and A1E20 from main board.

2. Unsolder all switch assembly wafer (4) to main board solder joints.

3. Unsolder control A1R1 (2) from main board (1).

4. Carefully remove switch/control assembly (5) from main board (1).



INSTALL

1. Check all switch/control assembly (5) to main board (1) solder holes (3) to ensure that they are open.

2. Install switch/control assembly (5) on main board (1).

3. Solder printed circuit terminals of switch assembly wafers (4) and control A1R1 (2) to main board (1).

4. Solder wires A1E1 thru A1E7, A1E19, and A1E20 to terminals of switch assembly (5).

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-77. REPLACE SWITCH/CONTROL ASSEMBLY A1SW4.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

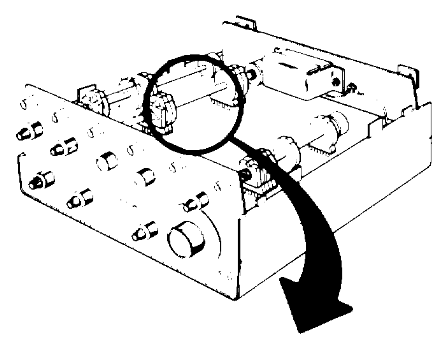
PRELIMINARY PROCEDURE. Remove main board. See paragraph 2-64.

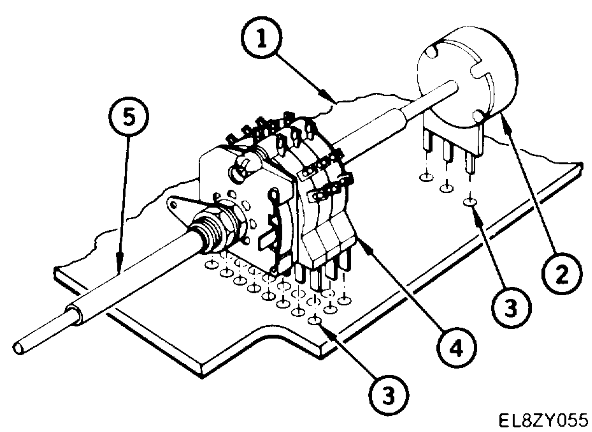
WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

Refer to figure 2-4 for location and identification of wires.





REMOVE

1. Unsolder wires A1E8 thru A1E13 from main board (1).
2. Unsolder all switch assembly wafer (4) to main board (1) solder joints.
3. Unsolder control A1R4 (2) to main board (1) solder joints.
4. Carefully remove switch/control assembly (5) from main board (1).

INSTALL

1. Check all switch/control assembly (5) to main board (1) solder holes (3) to ensure that they are open.
2. Install switch/control assembly (5) onto circuit board (1).

2-77. REPLACE SWITCH/CONTROL ASSEMBLY A1SW4 (CONT)

3. Solder all printed circuit terminals of switch assembly wafers (4) and control A1R4 (2) to main board (1).

4. Solder wires A1E8 thru A1E13 to main board (1)

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-78. REPLACE SWITCH/CONTROL ASSEMBLY A1SW5.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE. Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

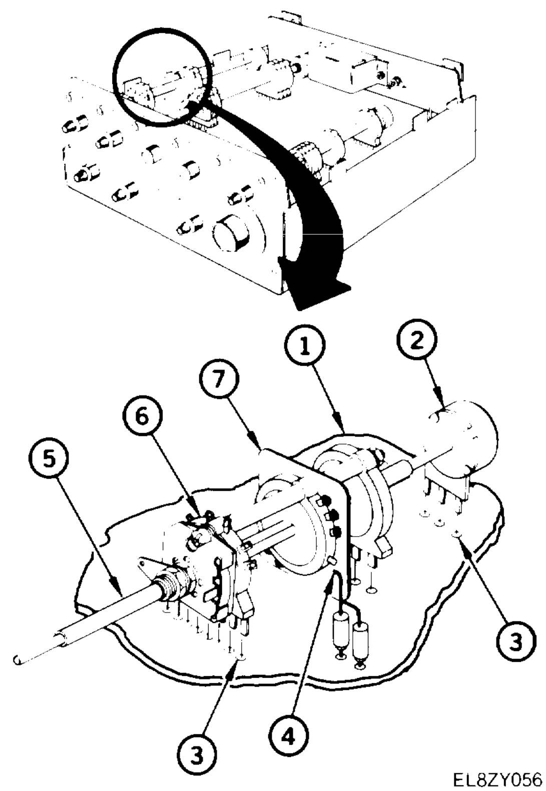
NOTE

Refer to figure 2-4 for location and identification of wires.

2-78. REPLACE SWITCH/CONTROL ASSEMBLY A1SW5 (CONT)

REMOVE

1. Unsolder resistor A1R304 (4) from A1SW5 (5).
2. Unsolder wires A1E16 and A1E17 from main board (1).
3. Unsolder all switch assembly wafer (6) to main board (1) solder joints.
4. Unsolder control A1R5 (2) to main board (1) solder joints.
5. Unsolder ground shield plate (7) (between A1SW5 wafers B and C) from main board (1).
6. Carefully remove switch/control assembly (5) from mai board (1).



INSTALL

1. Check all switch/control assembly wafer (6) to main board (1) solder holes to ensure that they are open.
2. Install switch/control assembly (5) on main board (1).
3. Solder printed circuit terminals of switch assembly wafers and control A1R5 (2) to main board (1).
4. Solder ground shield plate (7) (between A1SW5 wafers B and C) to main board (1).
5. Solder wires A1E16 and A1E17 to main board (1).
6. Solder resistor A1R304 (4) to A1SW5 wafer B.

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-79. REPLACE SWITCH/CONTROL ASSEMBLY A2SW1.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove auxiliary board. See paragraph 2-63.

WARNING

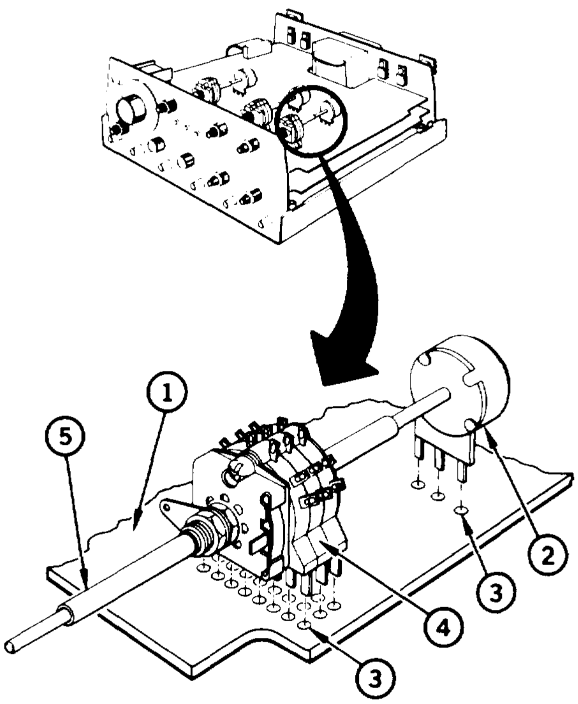
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

Refer to figure 2-4 for location and identification of wires.

REMOVE

1. Unsolder wires A2E6, A2E7, and A2E8 from auxiliary board (1).
2. Unsolder all switch assembly wafer (4) to auxiliary board (1) solder joints.
3. Unsolder control A2R1 (2) from auxiliary board (1).
4. Carefully remove switch/control assembly (5) from auxiliary board (1).



INSTALL

1. Check all switch/control assembly wafer (4) to auxiliary board (1) solder holes (3) to ensure that they are open.
2. Install switch/control assembly (5) onto auxiliary board (1).
3. Solder all terminals of switch assembly wafers (4) and control A2R1 (2) to auxiliary board (1).
4. Solder wires A2E6, A2E7, and A2E8 to auxiliary board (1).

2-79. REPLACE SWITCH/CONTROL ASSEMBLY A2SW1 (CONT)

NOTE

FOLLOW-ON MAINTENANCE: Install auxiliary board. See paragraph 2-63.

END OF TASK

2-80. REPLACE SWITCH/CONTROL ASSEMBLY A2SW5.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove auxiliary board. See paragraph 2-63.

WARNING

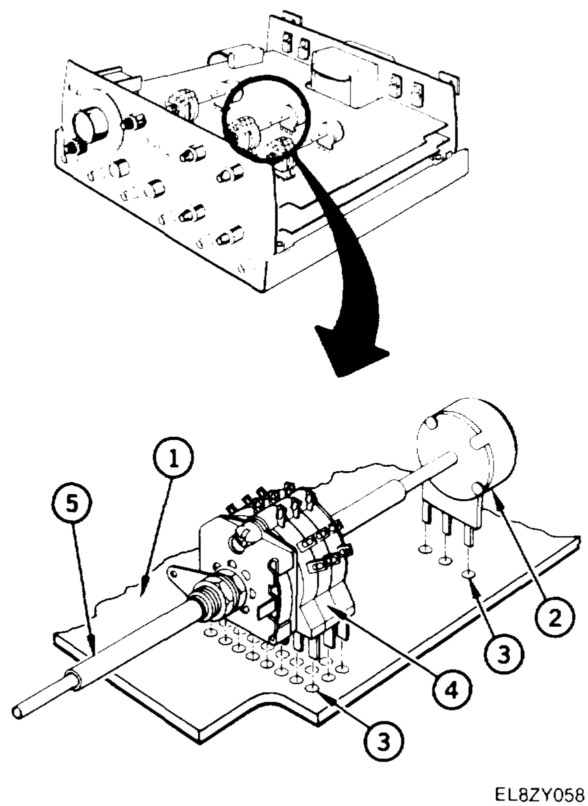
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

NOTE

Refer to figure 2-4 for location and identification of wires.

REMOVE

1. Unsolder wires A2E3 thru A2E5 and A2E9 from auxiliary board (1).
2. Unsolder all switch assembly wafer (4) to auxiliary board (1) solder joints.
3. Unsolder control A2R5 (2) to auxiliary board (1) solder joints.
4. Carefully remove switch/control assembly (5) from circuit board (1).



2-80. REPLACE SWITCH/CONTROL ASSEMBLY A2SW5 (CONT)

INSTALL

1. Check all switch/control assembly wafer (4) to auxiliary board (1) solder holes (3) to ensure that they are open.

2. Install switch/control assembly (5) onto auxiliary board (1).

3. Solder all terminals of switch assembly wafers (4) and control A2R5 (2) auxliliary board (1).

4. Solder wires A2E3 thru A2E5 and A2E9 of switch assembly (5) to auxiliary board (1).

NOTE

FOLLOW-ON MAINTENANCE. Install main board. See paragraph 2-64.

END OF TASK

2-81. REPLACE SWITCH/CONTROL ASSEMBLY A2SW6.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove auxiliary board. See paragraph 2-63.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

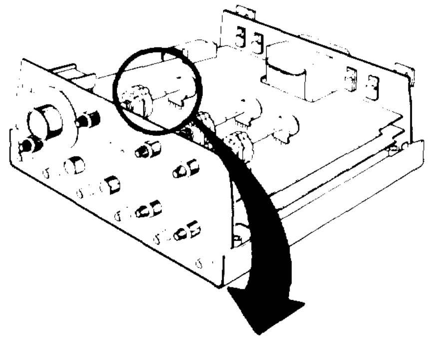
NOTE

Refer to figure 2-4 for location and identification of wires.

2-81. REPLACE SWITCH/CONTROL ASSEMBLY A2SW6 (CONT)

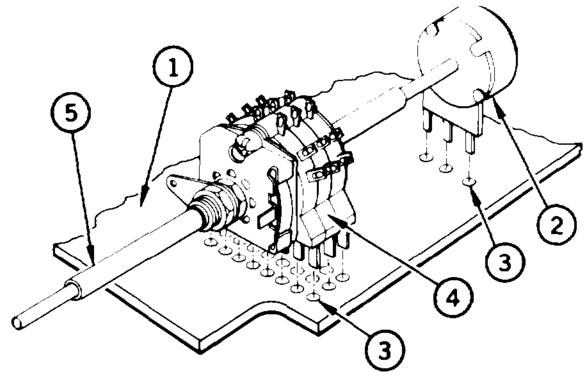
REMOVE

1. Unsolder wires A2E1, A2E2, and A2E10 from auxiliary board (1).
2. Unsolder all switch assembly wafer (3) to auxiliary board (1) solder joints.
3. Unsolder control A2R6 (2) auxiliary board (1) solder joints.
4. Carefully remove switch/control assembly (5) from auxiliary board (1).



INSTALL

1. Check all switch/control assembly wafer (4) to auxiliary board (1) solder holes (3) to ensure that they are open.
2. Install switch/control assembly (5) onto auxiliary board (1).
3. Solder all terminals of switch assembly wafers (4) and control A2R6 (2).
4. Solder wires A2E1, A2E2, and A2E10 to auxiliary board (1).



EL8ZY059

NOTE

FOLLOW-ON MAINTENANCE: Install auxiliary board. See paragraph 2-63.

END OF TASK

2-82. REPLACE CAPACITOR A1C7 OR A1C26.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove main board. See paragraph 2-64.

WARNING

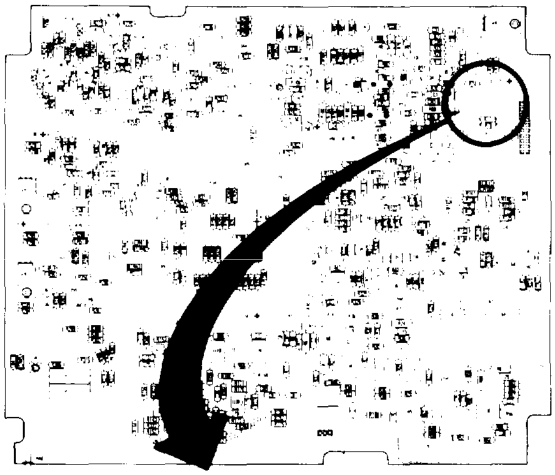
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

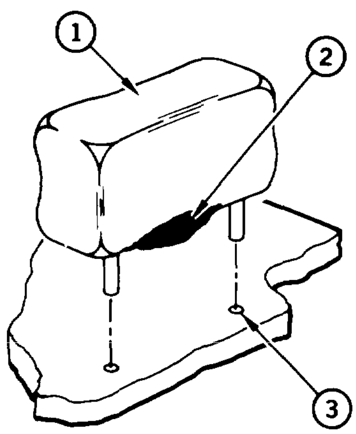
CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

NOTE

This task is the same for capacitors A1C7 and A1C26. Only A1C7 is shown.





EL8ZY060

REMOVE

1. Unsolder both leads of A1C7 (1) from printed circuit board.

2. Cut silicon adhesive (2) holding capacitor (1) to printed circuit board.

3. Remove capacitor A1C7 (1) from printed circuit board.

CAUTION

Prevent the silicon adhesive from contacting capacitor leads or lead holes on the printed circuit board.

2-82. REPLACE CAPACITOR A1C7 or A1C26 (CONT)

INSTALL

1. Apply a ¼ inch diameter ball of silicon adhesive Dow Corning RTV 3145, to the printed circuit board directly between the capacitor lead holes (3).

2. Insert capacitor A1C7 (1) into printed circuit board holes until firmly seated in silicon adhesive (2) against printed circuit board.

3. Solder leads of A1C7 (1) to the printed circuit board.

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-83. REPLACE OUTPUT TRANSISTORS A1Q47, A1Q49, A1Q54, or A1Q55.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

The output transistors are located directly below control shafts. Use care during removal to avoid damage to transistor, heat sink or to the control shaft insulation.

2-83. REPLACE OUTPUT TRANSISTORS A1Q47, A1Q49, A1Q54, or A1Q55 (CONT)

NOTE

This task is the same for output transistors A1047, A1Q49, A1Q54 or A1Q55. Only A1Q54 is shown.

REMOVE

1. If used, remove silicon adhesive (1) from heat sink (2).

2. Remove heat sink (2) from output transistor A1Q54 (5).

3. Unsolder all three leads (3) of output transistor A1Q54 (5).

4. Remove output transistor A1Q54 (5) and transistor standoff (4) from printed circuit board.

CAUTION

The transistor leads must be installed in the proper holes or equipment and/or component damage will result.

INSTALL

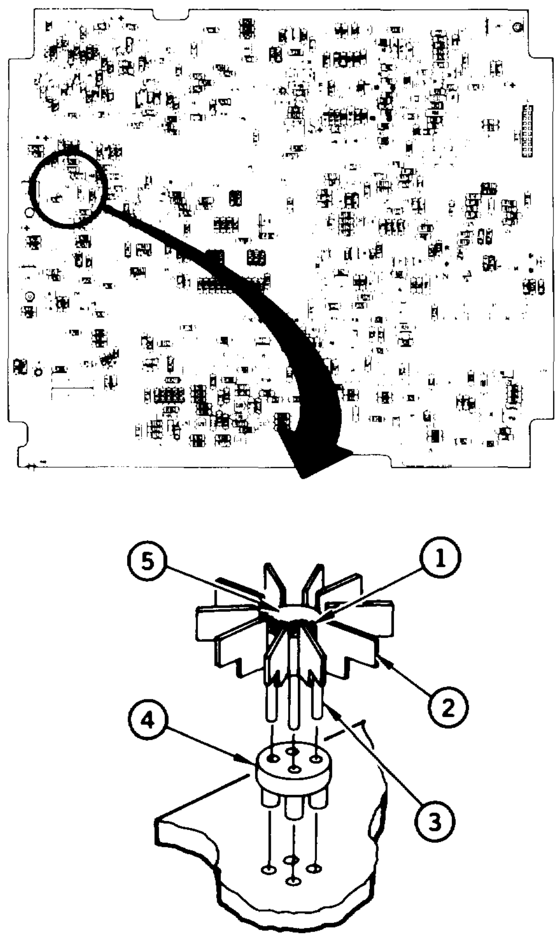
Install insulating standoff (4) on output transistor A1Q54 leads (3).

2. Install output transistor A1Q54 (5) with insulating standoff (4) onto the printed circuit board.

3. Solder output transistor A1Q54 leads (3) to the printed circuit board.

4. Insert heat sink (2) over top of output transistor A1Q54 (5).

5. If required, secure with small amount of silicon adhesive (2), DOW CORNING RTV 3145.



EL8ZY061

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-84. REPLACE RIBBON CABLE ASSEMBLY

DESCRIPTION

This procedure covers Remove Install

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURE: Remove auxiliary board. See paragraph 2-63

WARNING

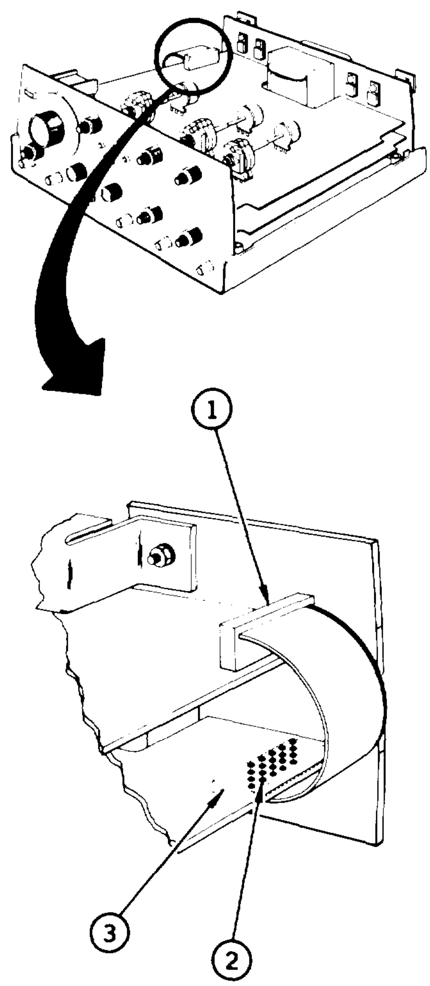
Capacitors hold electrical charges after power IS removed Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards Be careful when soldering and unsoldering components or equipment will be damaged.

CAUTION

Take care not to place any strain on the POWER OFF/ON switch cable.



EL8ZY062

REMOVE

1. Working on circuit side of board, unsolder cable termination P5 (3) solder connections (2) on printed circuit board.

2. Working on component side of board, separate cable termination P5 (3) from printed circuit board.

3. Disconnect P2 (1) from main board.

INSTALL

1. Working on component side of board, insert cable termination P5 leads through holes (2) in printed circuif board.

2-84. REPLACE RIBBON CABLE ASSEMBLY (CONT)

2. Working on circuit side of board, solder all connections (2) on cable termination P5 (3).

3. Connect P2 (1) to J2 on main board.

NOTE

FOLLOW-ON MAINTENANCE Install auxiliary board See paragraph 2-63.

END OF TASK

2-85. REPLACE AXIAL LEAD CAPACITORS.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES. Remove auxiliary board See paragraph 2-63.

WARNING

Capacitors hold electrical charges after power IS removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment wiII be damaged.

2-85. REPLACE AXIAL LEAD CAPACITORS (CONT)

NOTE

This task is the same for all axial lead capacitors on both boards. Only A2C26 is shown.

REMOVE

1. Working on circuit side of board, unsolder both leads (1) on axial lead capacitor A2C26 (3).

2. Working on component side of board, lift axial lead capacitor A2C26 (3) off of board.

INSTALL

CAUTION

For polarized capacitors, match the " + " and/or "-" markings on capacitor with those on the circuit board.

1. Position axial lead capacitor A2C26 (3) on the component side of board and insert the leads into correct holes (2).

2. Working on circuit side of board, solder both leads (1).

NOTE

FOLLOW-ON MAINTENANCE. Install auxiliary board See paragraph 2-63.

END OF TASK

2-86. REPLACE AXIAL LEAD RESISTORS.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES Remove auxiliary board. See paragraph 2-63.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

NOTE

This task is the same for all axial lead resistors on both boards. Only A2R52 is shown.

REMOVE

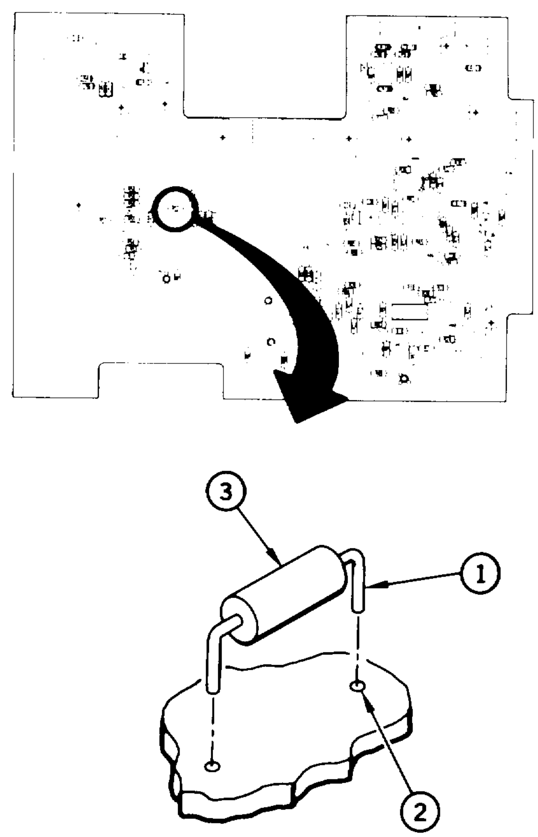
1. Working on circuit side of board, unsolder both leads (1) on axial lead resistor A2R52 (3).

2. Working on component side of board, lift axial lead resistor A2R52 (3) off of board.

INSTALL

1. Working on circuit side of board, position axial lead resistor A2R52 (3) and insert leads into holes (2).

2. Working on circuit side of board, solder both leads (1) of axial lead resistor A2R52 (3).



EL8ZY064

2-86. REPLACE AXIAL LEAD RESISTORS (CONT)

NOTE

FOLLOW-ON MAINTENANCE: Install auxiliary board. See paragraph 2-63.

END OF TASK

2-87. REPLACE AXIAL LEAD DIODES.

DESCRIPTION

This procedure covers. Remove Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES. Remove auxiliary board. See paragraph 2-63.

WARNING

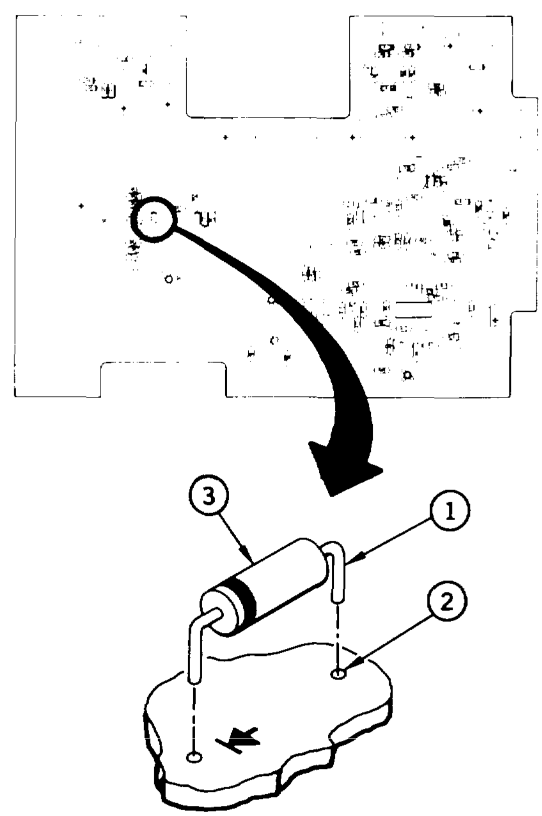
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

NOTE

This task IS the same for all axial lead diodes on both boards. Only A2CR3 IS shown.



EL8ZY065

REMOVE

1. Working on circuit side of board, unsolder both leads (1) on axial lead diode A2CR3 (3).

2. Working on component side of board, lift axial lead diode A2CR3 (3) off of board.

2-87. REPLACE AXIAL LEAD DIODES (CONT)

CAUTION

Match the banded or cathode end of the diode with the similiar marking on the circuit board to prevent component damage.

INSTALL

1. Position axial lead diode A2CR3 (3) on component side of board and insert leads into holes (2).

2. Working on circuit side of board, solder both leads (1) of axial lead diode A2CR3 (3).

NOTE

FOLLOW-ON MAINTENANCE. Install auxiliary board. See paragraph 2-63.

END OF TASK

2-88. REPLACE RADIAL LEAD CAPACITORS.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove auxiliary board. See paragraph 2-63.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

2-88. REPLACE RADIAL LEAD CAPACITORS (CONT)

NOTE

This task is the same for all radial lead capacitors on both boards. Only A2C16 is shown.

REMOVE

1. Working on circuit side of board, unsolder both leads (1) on radial lead capacitor A2C16 (3).

2. Working on component side of board, lift radial lead capacitor A2C16 (3) off of board.

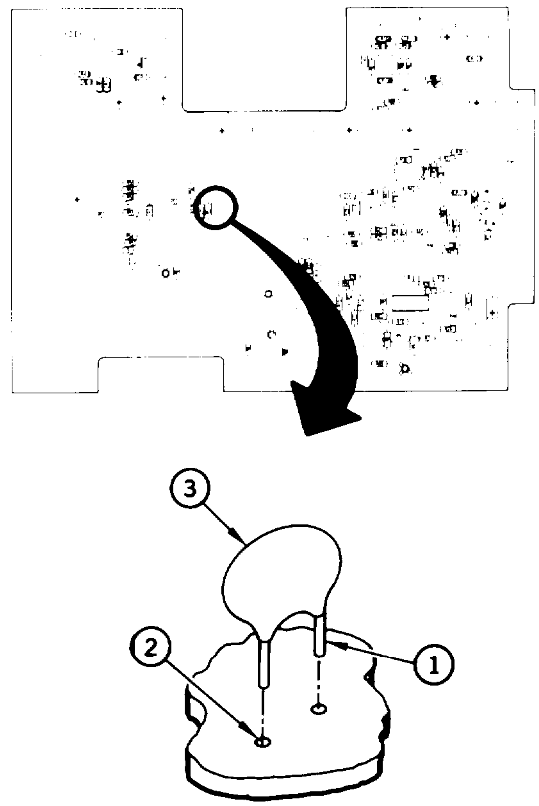
CAUTION

For polarized capacitors, match the " + " and/or "-" markings on capacitor with those on the circuit board.

INSTALL

1. Position radial lead capacitor A2C16 (3) on component side of board and insert leads (1) into holes (2).

2. Working on circuit side of board, solder both leads (1) of radial lead capacitor A2C16 (3).



EL8ZY066

NOTE

FOLLOW-ON MAINTENANCE: Install auxiliary board. See paragraph 2-63.

END OF TASK

2-89. REPLACE RADIAL LEAD THERMISTOR A1R183.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

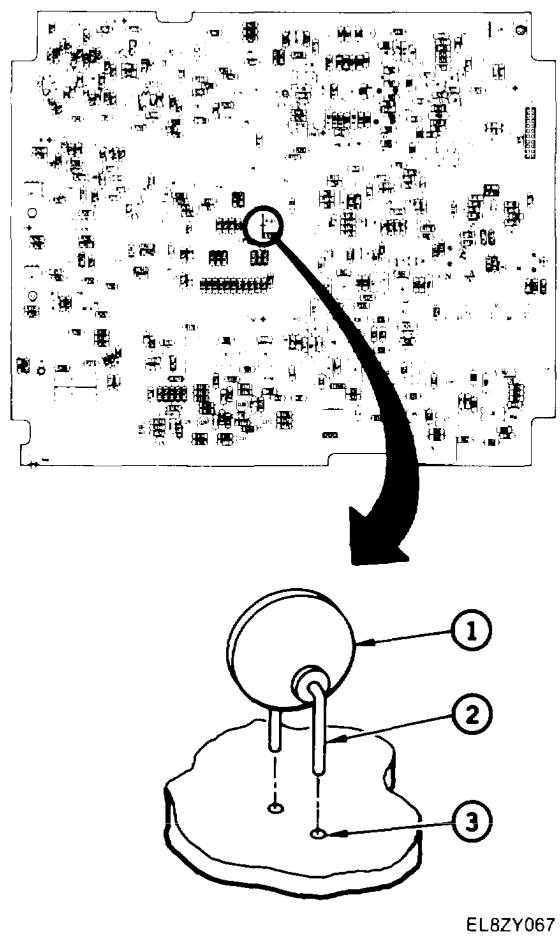
PRELIMINARY PROCEDURES: Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.



REMOVE

1. Working on circuit side of board, unsolder both leads (2) on radial lead thermistor A1R183 (1).
2. Working on component side of board, lift radial lead thermistor A1R183 (1) off of board.

INSTALL

1. Position radial lead thermistor Al RI 83 (1) on component side of board and insert leads (2) into holes (3).
2. Working on circuit side of board, solder both leads (2) of radial lead thermistor A1R183 (1).

NOTE

FOLLOW-ON MAINTENANCE. Install main board. See paragraph 2-64.

END OF TASK

2-90. REPLACE RADIAL LEAD TRIMPOTS.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES. Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards Be careful when soldering and unsoldering components or equipment will be damaged.

NOTE

This task is the same for all radial lead trimpots on both boards. Only A1R347 is shown.

REMOVE

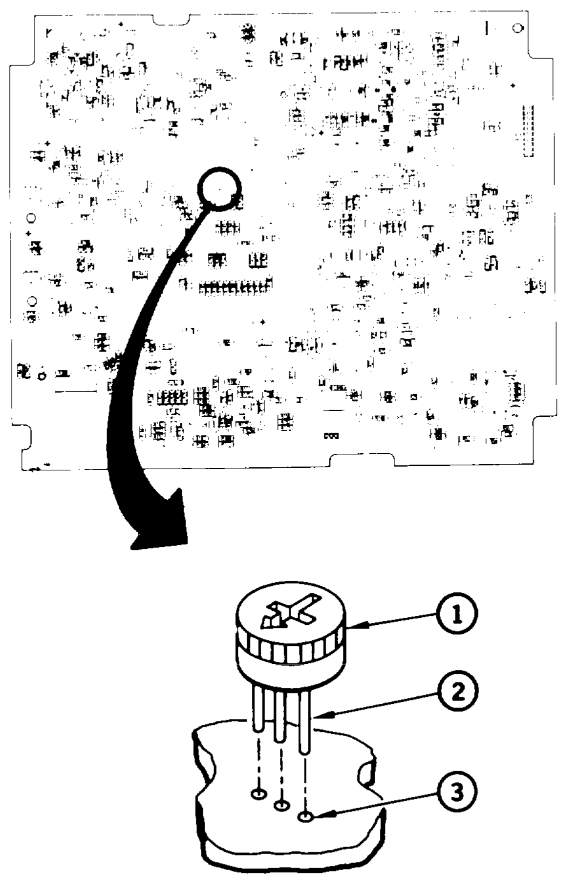
1. Working on circuit side of board, unsolder all three leads (2) on radial lead trimpot A1R347 (1).

2. Working on component side of board, lift radial lead trimpot A1R347 (1) off of board.

INSTALL

1. Position radial lead trimpot A1R347 (1) on component side of board as indicated by the drawing on the printed circuit board and insert leads (2) into holes (3).

2. Working on circuit side of board, solder leads (2) of radial lead trimpot A1R347 (1).



EL8ZY068

2-90. REPLACE RADIAL LEAD TRIMPOTS (CONT)

NOTE

FOLLOW-ON MAINTENANCE. Install main board. See paragraph 2-64.

END OF TASK

2-91. REPLACE RADIAL LEAD SWITCHES A2SW2 THRU A2SW4.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove auxiliary board. See paragraph 2-63.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

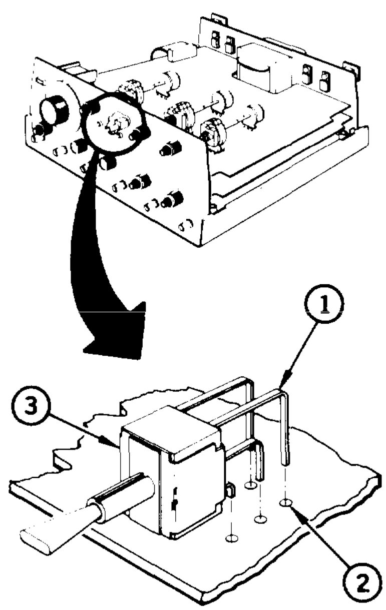
NOTE

This task is the same for radial lead switches A2SW2 thru A2SW4. Only A2SW3 is shown.

REMOVE

1. Working on circuit side of board, unsolder all leads (1) on radial lead switch A2SW3 (3).

2. Working on component side of board, lift radial lead switch A2SW3 (3) off of board.



EL8ZY069

2-91. REPLACE RADIAL LEAD SWITCHES A2SW3 THRU A2SW4 (CONT)

INSTALL

1. Position radial lead switch A2SW3 (3) on component side of board and insert leads (1) into holes (2).

2. Working on circuit side of board solder all leads (1) of radial lead switch A2SW3 (3).

NOTE

FOLLOW-ON MAINTENANCE. Install auxiliary board. See paragraph 2-63.

END OF TASK

2-92. REPLACE TO-92 STYLE TRANSISTORS.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment wiII be damaged.

2-92. REPLACE TO-92 STYLE TRANSISTORS (CONT)

NOTE

This task is the same for all TO-92 style transistors on both boards Only A1Q26 is shown.

REMOVE

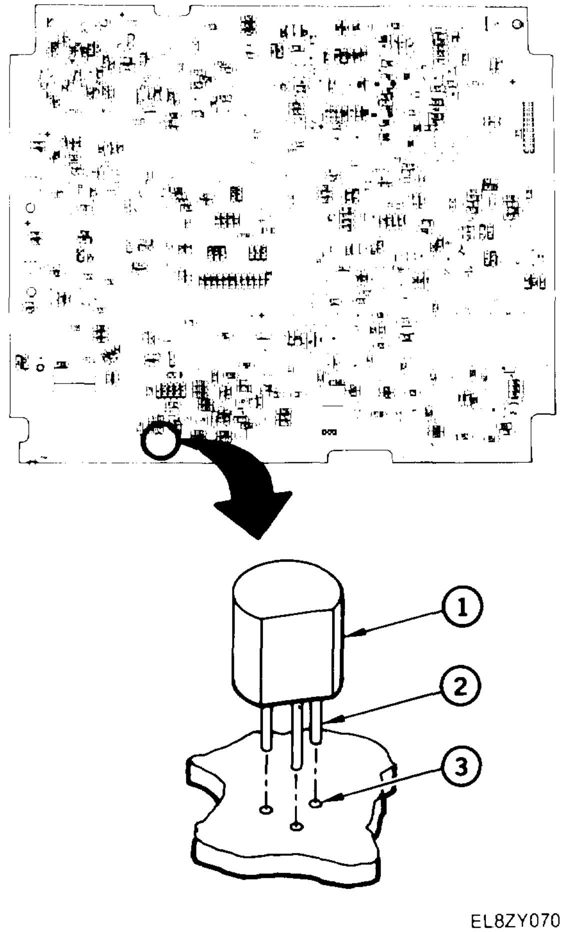
1. Working on circuit side of board, unsolder leads (2) on transistor A1Q26 (1).
2. Working on component side of board, lift transistor A1Q26 (1) off of board.

CAUTION

Transistor leads must be installed in the proper holes as indicated by the outline drawing on the printed circuit board or component and/or equipment damage will result.

INSTALL

1. Position transistor A1Q26 (1) on component side of board and insert leads (2) into holes (3).
2. Working on circuit side of board, solder all leads (2) of transistor A1Q26 (1) to printed circuit board.



NOTE

FOLLOW-ON MAINTENANCE. Install main board. See paragraph 2-64.

END OF TASK

2-93. REPLACE TO-5 STYLE TRANSISTORS.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

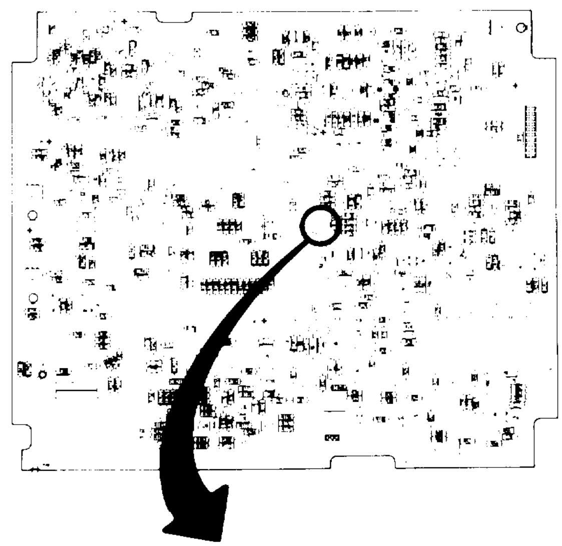
NOTE

PRELIMINARY PROCEDURES. Remove main board. See paragraph 2-64.

2-93. REPLACE TO-5 STYLE TRANSISTORS (CONT)

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.



CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

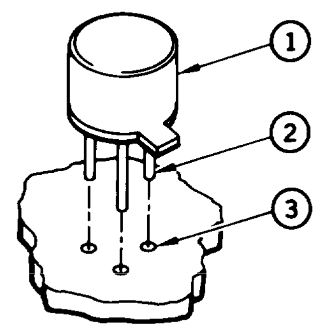
NOTE

This task is the same for all TO-5 style single or dual transistors. Only A1Q22 is shown

REMOVE

1. Working on circuit side of board, unsolder leads (2) on transistor A1Q22 (1).

2. Working on component side of board, lift transistor A1Q22 (1) off of board.



EL8ZY071

CAUTION

Transistor leads must be Installed in the proper holes as indicated by the outline drawing on the printed circuit board or component and/or equipment damage will result.

INSTALL

1. Position transistor A1Q22 (1) on component side of board and insert leads (2) into holes (3).

2 Working on circuit side of board, solder all leads (2) of transistor A1Q22 (1) to printed circuit board.

NOTE

FOLLOW-ON MAINTENANCE. Install main board. See paragraph 2-64.

END OF TASK

2-94. REPLACE DUAL INLINE INTEGRATED CIRCUITS.

DESCRIPTION

This procedure covers: Remove. Install

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove main board See paragraph 2-64

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

NOTE

This task is the same for all dual inline integrated circuits (8, 14, and 16 pin) on both boards Only A1U12 is shown.

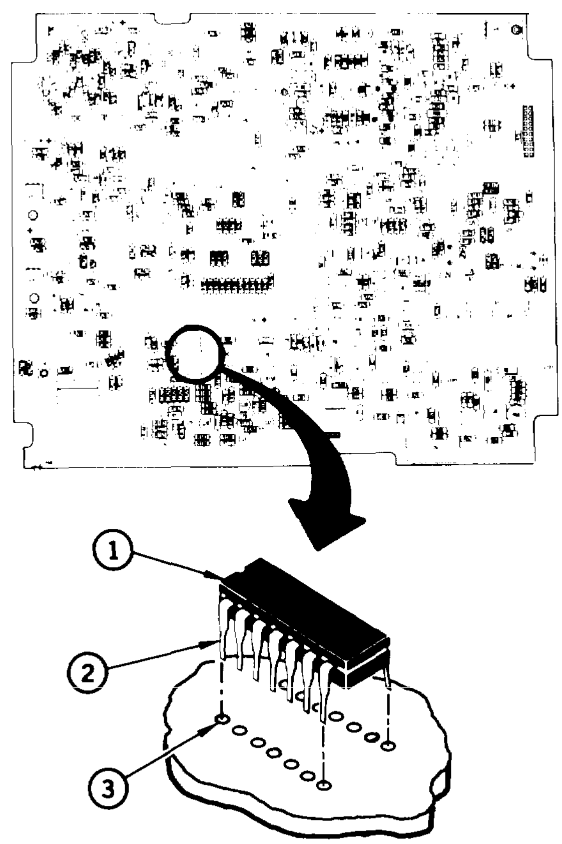
REMOVE

1 Working on circuit side of board, unsolder all leads (2) on dual inline Integrated circuit A1U12 (1)

2 Working on component side of board, lift dual inline integrated circuit A1U12 (1) off of board.

CAUTION

Dot and/or notch on integrated circuit shows the correct position for installation Install the integrated circuit with dot or notch at similiar notch in drawing on the printed circuit board.



EL8ZY072

2-94. REPLACE DUAL INLINE INTEGRATED CIRCUITS (CONT)

INSTALL

1. Positon dual inline integrated circuit A1U12 (1) on the component side of board and insert leads (2) into holes (3).

2. Working on circuit side of board, solder all leads (2) of dual inline Integrated circuit A1U12 (1) to printed circuit board.

NOTE

FOLLOW-ON MAINTENANCE. Install main board. See paragraph 2-64.

END OF TASK

2-95. REPLACE DUAL INLINE INTEGRATED CIRCUIT SOCKET.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES. Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment discharge all capacitors to ground to prevent electrical shock.

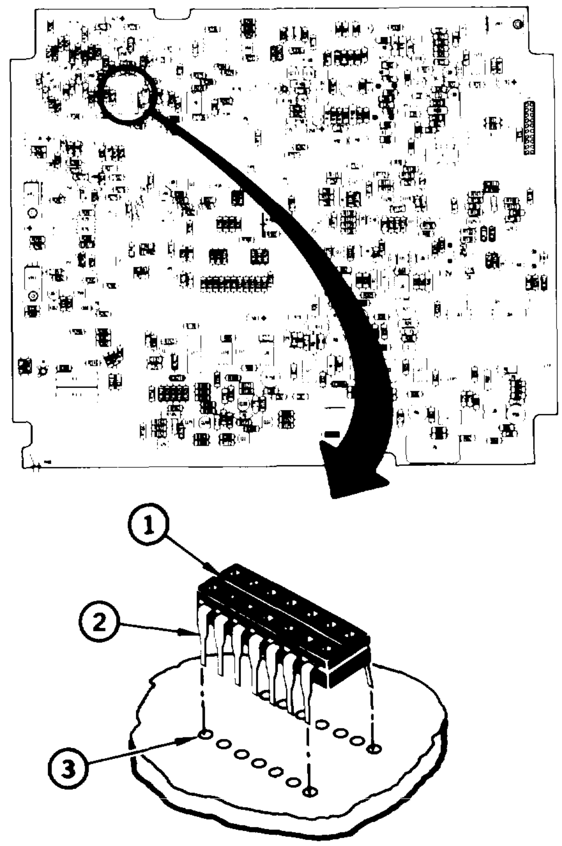
CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

2-95. REPLACE DUAL INLINE INTEGRATED CIRCUIT SOCKET (CONT)

NOTE

This task is the same for all dual inline integrated circuit sockets on both boards. Only A1XU15 is shown.



EL8ZY073

REMOVE

1. Working on circuit side of board, unsolder all leads (2) on Integrated circuit socket AIXU15 (1).

2. Working on component side of board, lift integrated circuit socket A1XU15 (1) off of board.

CAUTION

Notch on dual inline integrated circuit socket shows the correct position for installation. Install with notch in socket matching similiar notch in drawing on the printed circuit board.

INSTALL

1 Position dual inline integrated circuit socket A1XU1 5 (1) on component side of board and insert leads (2) into holes (3).

2. Working on circuit side of board, solder all leads (2) of dual inline integrated circuit socket (1) to printed circuit board.

NOTE

FOLLOW-ON MAINTENANCE. Install main board. See paragraph 2-64.

END OF TASK

2-96. REPLACE TO-5 STYLE INTEGRATED CIRCUITS.

DESCRIPTION

This procedure covers. Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES. Remove main board. See paragraph 2-64.

WARNING

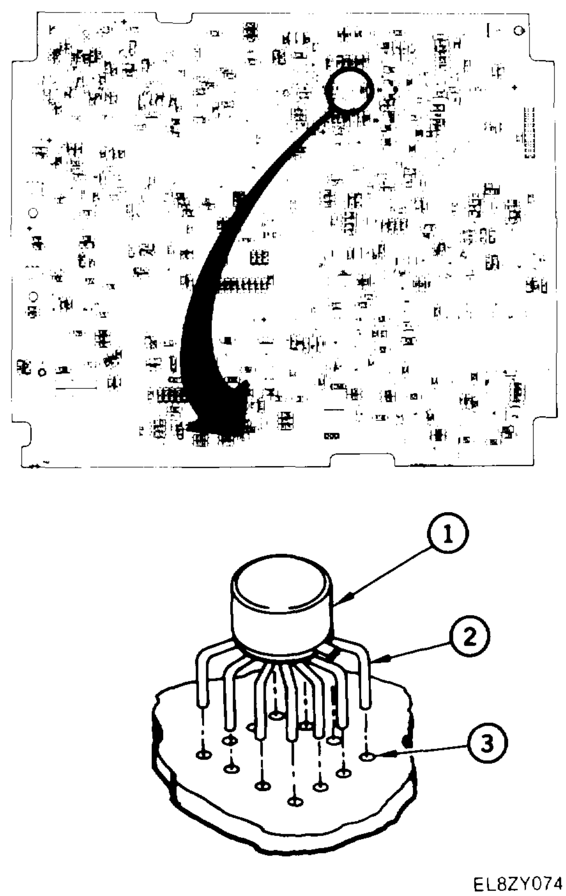
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment wiII be damaged.

NOTE

This task is the same for all TO-5 style integrated circuits on both boards Only A1U14 is shown.



REMOVE

1. Working on circult side of board, unsolder all leads (2) on TO-5 style integrated circuit A1lU14 (1).

2. Working on component side of board, lift TO-5 style integrated circuit A1U14 (1) off of board.

CAUTION

Tab on integrated circuit shows the correct position for installation. Install the integrated circuit with tab matching tab in drawing on the printed circuit board.

2-96. REPLACE TO-5 STYLE INTEGRATED CIRCUITS (CONT)

INSTALL

1. Position TO-5 style Integrated circuit A1U14 (1) on the component side of board as shown and insert leads (2) into holes (3).

2. Working on circuit side of board, solder all leads (2) of TO-5 style integrated circuit A1U14 (1) to printed circuit board.

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-97. REPLACE SYMMETRY CONTROL A1R2.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove main board. See paragraph 2-64.

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

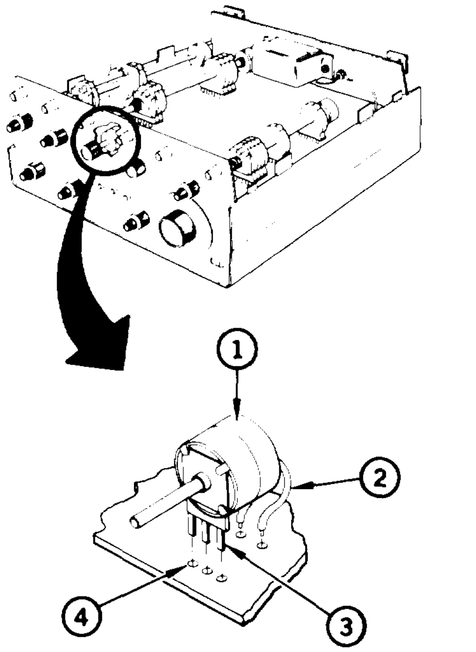
CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment wiII be damaged.

2-97. REPLACE SYMMETRY CONTROL AIR2 (CONT)

NOTE

Refer to figure 2-5 for Iocation and identification of wires.



REMOVE

1. Working on circuit side of board, unsolder all symmetry control A1R2 leads (3) and wires (2) from printed circuit board.
2. Working on component side of board, lift symmetry control A1R2 (1) and wires (2) off of board.

INSTALL

1. Position symmetry control A1R2 (1) on component side of board and insert leads (3) and wires (2) into holes (4).
2. Working on circuit side of board, solder leads (3) and wires (2) of symmetry control A1R2 to printed circuit board.

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-98. REPLACE DC OFFSET CONTROL A1R3.

DESCRIPTION

This Procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove main board. See paragraph 2-64.

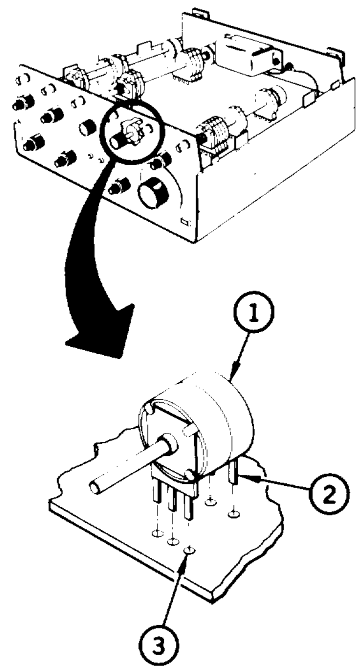
2-98. REPLACE DC OFFSET CONTROL A1R3 (CONT)

WARNING

Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.



EL8ZY076

REMOVE

1. Working on circuit side of board, unsolder all DC OFFSET control A1R3 (1) leads (2) from printed circuit board.

2. Working on component side of board, lift DC OFF SET control A1R3 (1) off of board.

INSTALL

1. Position DC OFFSET control A1R3 (1) on component side of board and insert leads (2) into holes (3).

2. Working on circuit side of board, solder leads (2) of DC OFFSET control A1R3 (1) to printed circuit board.

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-99. REPLACE CERAMIC TRIM CAPACITORS A1C62, A1C68, or A1C125.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove main board. See paragraph 2-64.

WARNING

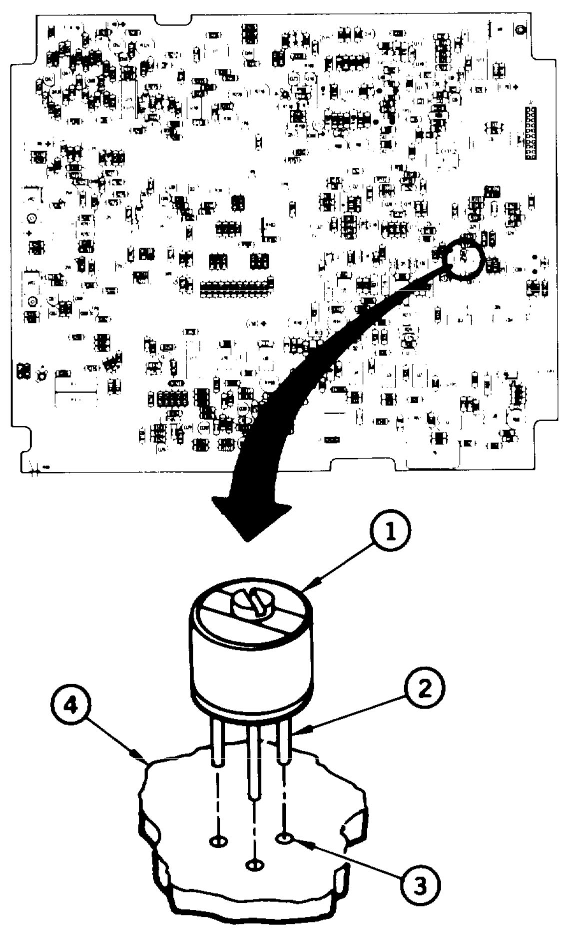
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

CAUTION

Too much heat can damage printed circuit boards. Be careful when soldering and unsoldering components or equipment will be damaged.

NOTE

This task is the same for ceramic trim capacitors A1C62, A1C68, or A1C125. Only A1C62 is shown.



EL8ZY077

REMOVE

1. Working on circuit side of board, unsolder all ceramic trim capacitor A1C62 (1) leads (2) from main board (4).

2. Working on component side of board, lift ceramic trim capacitor A1C62 (1) off of main board (4).

INSTALL

1. Position ceramic trim capacitor A1C62 (1) on component side of board and insert leads (2) into holes (3).

2. Working on circuit side of board, solder leads (2) of ceramic trim capacitor A1C62 (1) to main board (4).

2-99. REPLACE CERAMIC TRIM CAPACITORS A1C62, A1C68, OR A1C125 (CONT)

NOTE

FOLLOW-ON MAINTENANCE: Install main board. See paragraph 2-64.

END OF TASK

2-100. REPLACE DIAL LIGHT ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES: Remove top cover. See paragraph 2-62.

WARNING

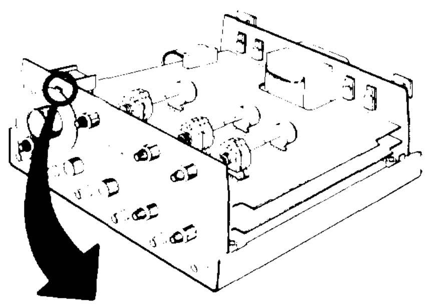
Capacitors hold electrical charges after power is removed. Before working on equipment, discharge all capacitors to ground to prevent electrical shock.

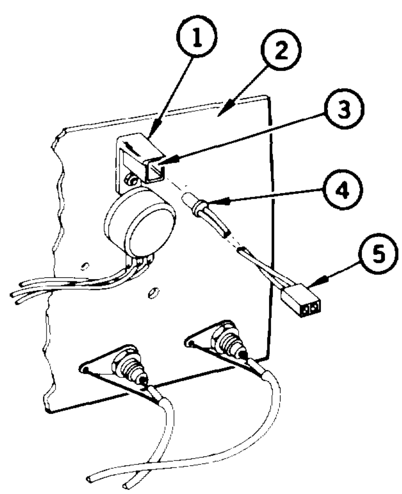
REMOVE

1. Disconnect P8 (5) from J8 on main board,
2. Working on rear of front panel (2) remove silicone rubber (3) holding dial indicator lamp (4) in lampholder (1).
3. Remove dial indicator lamp (4) from lampholder (1).

INSTALL

1. Connect P8 (5) to J8 on main board.
2. Apply a small amount of silicone rubber (3) around the inside of the lamp opening on lampholder (1).
3. Insert dial indicator lamp (4) into lampholder (1) on front panel (2).





EL8ZY078

2-100. REPLACE DIAL LIGHT ASSEMBLY (CONT)

NOTE

FOLLOW-ON MAINTENANCE: Install rnain board. See paragraph 2-64.

END OF TASK

2-101. ALIGNMENT.

DESCRIPTION

Alignment must be performed if the signal generator fails any maintenance procedure, or after troubleshooting and repair of any malfunction.

INITIAL SETUP

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

PRELIMINARY PROCEDURE:

- Remove bottom cover (para 2-61) when performing main circuit board adjustments.
- Remove top cover (para 2-62) when performing auxiliary circuit board adjustments.

1. Set signal generator controls as follows:

CONTROL	SETTING	CONTROL	SETTING
POWER OFF/ON	OFF	AMPLITUDE	CW
Frequency Dial	2.0	Mode	CONT
FREQ MULT (Hz)	1K	TRIGGER LEVEL	CW
VERNIER	CW	MODULATION GENERATOR	
SYMMETRY	OFF	MODULATION SWITCHES	OFF
DC OFFSET	OFF	FUNCTION	Square
FUNCTION	Square	MOD AMPLITUDE	CW
TRIG START/STOP	0°CAL	FREQ/PERIOD MULT (Hz/s)	1K/1m to 100 K/10μ
ATTENUATION (dB)	0 to 20	VARIABLE	CW

2 Connect signal generator power cord to 115 Vac power source Set POWER switch to ON, allow 30 minutes for warm-up prior to starting the alignment procedure m table 2-2.

NOTES

For all measurements made while monitoring the FUNCTION OUT (50Ω) connector, the cable must be terminated with 50Ω at the tester.

For all measurements made while monitoring the MODULATION GENERATOR OUT (600Ω) connector, the cable must be terminated with 600Ω at the tester.

All measurements taken on board A1 are referenced to A1TP9 unless otherwise specified.

All voltage and waveform measurements taken on board A2 are referenced to the negative (–) side of A2C24 unless otherwise specified

Table 2-2. Alignment

Step	Test	TMDE	Test Point	Control Setting	Adjust	Results	Remarks
Steps 1 through 18 are A2 Auxillary Circuit Board Adjustments (See Figure FO-5). All control setting changes are for modulation generator controls.							
1	Power Supply	DMM	C26 +	Paragraph 2-101 step 1		+ 24V ± 1.2V	
2	Regulators		C29 –			– 24V ± 1.2V	
3			C33 +		A2R64	+ 15V ± 30 mV	
4			C34 –		A2R70	– 15V ± 30 mV	
5	Top of Scale Frequency	Frequency Counter	MOD GEN OUT (terminate with 600Ω)		A2R48	100 kHz (+ 0.4/ – 0 kHz)	
6	Bottom of Scale Frequency			FREQ/PERIOD VARIABLE: ccw	A2R93	1kHz (+ 0/ – 40 Hz)	
7	Hi Freq Symmetry	Oscillo-scope		FUNCTION: FREQ/PERIOD MULT: 10 I 1K FREQ/PERIOD VARIABLE: cw	A2R14	Positive and negative portions are symmetrical	Trigger on negative going edge, not auto trigger. Display one cycle. Out of adjustment condition will be a non symmetrical square wave.
8	Lo Freq Symmetry			FREQ/PERIOD VARIABLE: ccw	A2R17		Steps 7 and 8 interact; repeat if necessary.
9	Lo Freq Hi Range Symmetry			FREQ/PERIOD MULT. 1K I 100K	A2R75		
10	Top of Scale Frequency	Frequency Counter		FREQ VARIABLE	A2R48	100 kHz (+ 0.4/ – 0 kHz)	
11	Bottom of Scale Frequency			FREQ/PERIOD VARIABLE:ccw	A2R93	1kHz (+ 0/ – 40 Hz)	

Table 2-2. Alignment (Continued)

Step	Test	TMDE	Test Point	Control Setting	Adjust	Results	Remarks
[illegible]	∿ Zero Adjustment	DMM		FUNCTION ∿ FREQ/PERIOD MULT 10 1K FREQ/PERIOD VARIABLE [illegible]	A2R34	0V ± 10 mV	
[illegible]	⊓ Zero Adjustment			FUNCTION ⊓	A2R35		
[illegible]	∿ [illegible]	Distortion Analyzer		FUNCTION ∿	A2R11 A2R12	Minimum distortion	Less than 5.0
[illegible]	∿ Zero Adjustment	DMM			A2R76	0V ± 10 mV	
[illegible]	Ramp [illegible]	[illegible]		FUNCTION /|/|	A2R46 A2R30	Slopes coincide	Trigger on negative going edge, not auto trigger. Display four ramps. Out of adjustment condition will give double rising edges on each ramp
[illegible]	Ramp Baseline	[illegible]	MOD GEN OUT	FUNCTION |\\\|\\	A2R30	Remove + error	Steps 16 and 17 interact; repeat if necessary
[illegible]	Ramp Zero				A2R81	Negative peaks on 0 Vdc	

Steps 19 through 35 are A1 Main Circuit Board Adjustments (see Figure FO-4).

Step	Test	TMDE	Test Point	Control Setting	Adjust	Results	Remarks
[illegible]	Top of Dial Symmetry	Oscilloscope	FUNCTION OUT (terminate with 50Ω)	Paragraph 2-101 step 1	A1R36	Positive and negative portions are symmetrical	
	[illegible] Symmetry			Dial .02 FREQ MULT 100K Adjust FREQ VERNIER for 200 Hz	A1R23		Disregard jitter in waveform
[illegible]	VCG Null			FREQ VERNIER ccw FM EXT	A1R13	Minimum frequency shift	Set scope for one or two cycles. Observe shift in trailing edge of cycle as EXT MOD BNC is alternately shorted and opened. Disregard symmetry shift.
	Distortion	Distortion Analyzer		Dial 1.0 FREQ MULT 1K FUNCTION ∿ FM OFF	A1R87 A1R90	Minimum Distortion	Less than 0.5%
[illegible]	Top of Dial Frequency	Frequency Counter		FREQ MULT 10K FUNCTION ⊓	A1R10	20 kHz ± 300 Hz	If necessary, trim frequency with
[illegible]	Bottom of Dial Frequency			Dial .02	A1R8	200 ± 10 Hz	
[illegible]	X10 MHz Frequency			Dial 2.0 FREQ MULT 10M	A1C68	20 ± 0.6 MHz	C127

Table 2-2. Alignment (Continued)

Step	Test	TMDE	Test Point	Control Setting	Adjust	Results	Remarks
26	X1 MHz Frequency			FREQ MULT: 1M	A1C115	2 MHz ± 40 kHz	C133
27	X100K Frequency			FREQ MULT: 100K	A1C62	200 ± 2 kHz	C125
28	Capacitance Multiplier Zero	DMM	TP1	FREQ MULT: 1K	A1R56	0 Vdc ± 1 mV	TP2 ground
29	Capacitance Multiplier Frequency	Frequency Counter	FUNCTION OUT (terminate with 50Ω)	FREQ MULT: 10	A1R51	Period of 50 ms ± 2 ms	
30	Output Amplifier Zero	DMM		FUNCTION: DC AMPLITUDE: ccw FREQ MULT: 10K	A1R347	0 Vdc ± 20 mV	
31	Modulator Balance	Oscilloscope		FUNCTION: ⊓⊔ AMPLITUDE: cw Modulator FUNCTION: ∿ AM: EXT	A1R210	Merge both traces to coincide (not necessarily at 0V)	Scope sensitivity 0.1 V/div, sweep 0.1 ms/div, sync internally
32	Modulation Linearization and Carrier Balance	Oscilloscope	FUNCTION OUT (terminate with 50Ω)	FREQ MULT: 100K Modulator FREQ/PERIOD MULT: 10 I 1K Modulator FUNCTION: ∿ Modulator FUNCTION: ∿	A1R343 A1R226	All peaks equal in amplitude centered at zero	Scope sensitivity 2V/div. Connect modulation generator OUT to EXT MOD IN. Set scope display per figure 2-5. Decrease output amplitude to prevent overdriving.
33	Multiplier Zero	DMM		FUNCTION: ∿ FREQ/MULT: 1K AM: OFF	A1R218	0 Vdc ± 20 mV	A low pass filter may be necessary if the dc meter is affected by the large ac signal.
34	Multiplier Gain			FUNCTION: ⊓⊔	A1R324	7.5 to 7.75 Vrms	Steps 30 through 35 interact, repeat if necessary.
35	Baseline Zero			FUNCTION: ∿ Mode: INT TRIG	A1R159	0 Vdc ± 100 mV	Rotate dial from 2.0 to .1

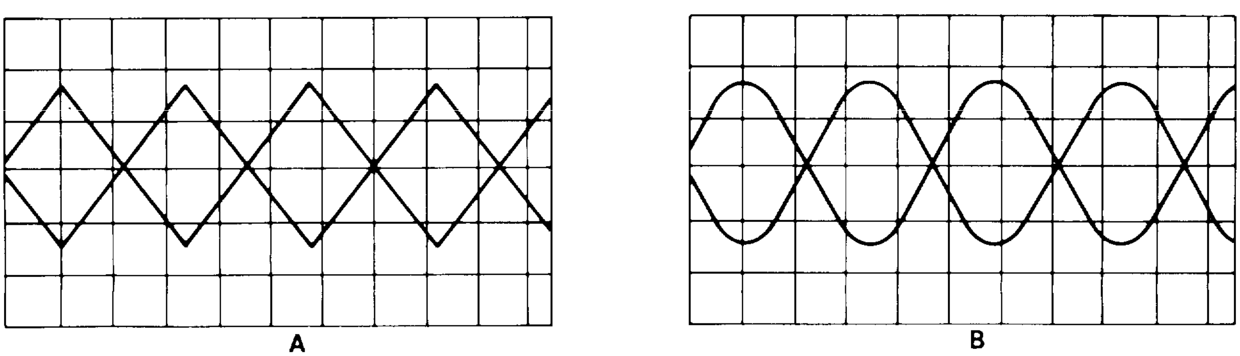


Figure 2-5. Carrier Balance and Modulation Linearization

2-102. PERFORMANCE TEST.

DESCRIPTION

This procedure covers:

Output Frequency Test.	External Synchronization Test.
Sine Distortion Test.	Attenuation Output Test.
Frequency Response Test.	Output Voltage Test.
Frequency Stability Test.	Voltage Control Frequency Test.
Output Signal Test.	Trigger and Gate Start/Stop Test.
DC Offset Test.	Sweep Test.
Pulse Width Test.	Sweep Output Test.
Symmetry Test.	Amplitude Modulation Test.
Pulse Transition Time Test.	Phase Modulation Test.
Synchronization Output Test.	

NOTES

- Performance test procedure steps must be done in the order given.
- A Performance Test Checklist is provided at end of the performance test procedures Use the checklist while doing the test procedures.
- Allow an inital 20 minute warm up period when performing the first performance test to allow the signal generator to stabilize.
- Allow signal generator 5 minutes to stabilize if turned off for more than 2 minutes during the performance tests.
- The inital setup of signal generator controls is to be performed prior to doing the entire performance test sequence or if only one test is going to be performed.

INITIAL SETUP

Table 2-3 gives the inital control settings for the signal generator to be used as a starting point for all of the performance tests. Each performance test will change only a minimum number of controls from these basic settings.

Table 2-3. Initial Signal Generator Control Settings

Control	Setting
Frequency Dial	1.0
FREQ MULT	1K
VERNIER	Clockwise
SYMMETRY	OFF detent
DC OFFSET	OFF detent
FUNCTION (lower switch row)	Square Wave
TRIG START/STOP	0°CAL detent
ATTENUATION	0/20
AMPLITUDE (lower switch row)	Clockwise
Generator Mode (EXT GATE, etc)	CONT
TRIGGER LEVEL	Counterclockwise
MODULATION Switches	OFF
FUNCTION (Modulation Generator)	Sine Wave
MOD AMPLITUDE	Clockwise
FREQ/PERIOD MULT	10/1K
VARIABLE	Clockwise
POWER	ON

OUTPUT FREQUENCY TEST

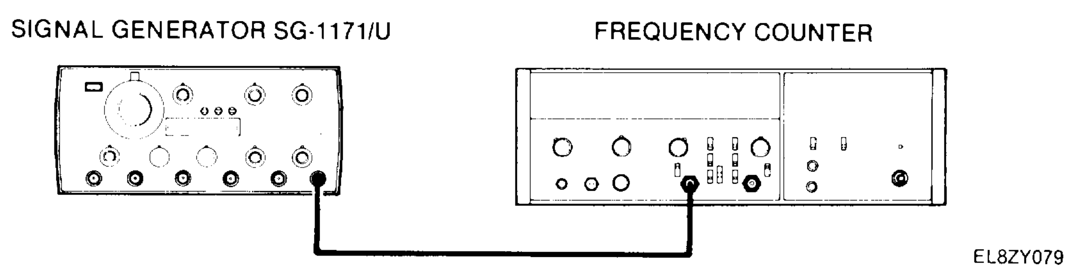
1. Set frequency counter controls as follows:

FUNCTION	FREQ A
GATE TIME/DISPLAY POSITION	AUTO
SAMPLE RATE	As Required
CHANNEL A LEVEL	Mid-Range
CHANNEL A SLOPE	+ or –
CHANNEL A ATTEN	X10
CHANNEL A Coupling	AC
CHANNEL A Input Impedance	50Ω
CHECK/COM A/SEP	SEP

2. Verify that the signal generator controls are set according to table 2-3.

3. Connect signal generator FUNCTION OUT to frequency counter CHAN A input.

4. Change signal generator and/or frequency counter controls as indicated in table 2-4 and verify that the frequency/time indications are within tolerances.



OUTPUT FREQUENCY TEST (CONT)

Table 2-4. Signal Generator Test Frequencies

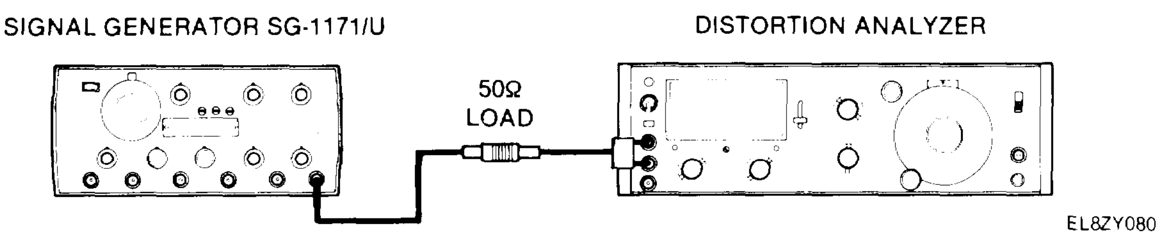
Signal Generator		Frequency Counter	
Frequency Dial	**FREQ MULT Switch**	**FUNCTION**	**Indication**
2.0	10M	FREQ A	19.0 to 21.0 MHz
2.0	1M	FREQ A	1.94 to 2.06 MHz
2.0	100K	FREQ A	194 to 206 kHz
2.0	10K	FREQ A	19.4 to 206 kHz
2.0	100	FREQ A	192 to 208 Hz
2.0	10	PERIOD A	48 to 52 ms
2.0	1	PERIOD A	480 to 520 ms
2.0	1	PERIOD A	4.8 to 5.2 sec
2.0	.01	PERIOD A	48 to 52 sec
2.0	1K	FREQ A	1940 to 2060 Hz
1.8	1K	FREQ A	1742 to 1858 Hz
1.6	1K	FREQ A	1544 to 1656 Hz
1.4	1K	FREQ A	1346 to 1454 Hz
1.2	1K	FREQ A	1148 to 1252 Hz
1.0	1K	FREQ A	950 to 1050 Hz
8	1K	FREQ A	752 to 848 Hz
6	1K	FREQ A	554 to 646 Hz
4	1K	FREQ A	356 to 444 Hz
2	1K	FREQ A	158 to 242 Hz
1	1K	FREQ A	59 to 141 Hz

5. Return all signal generator controls to positions given in initial setup.

6. Disconnect signal generator from frequency counter.

SINE DISTORTION TEST

1 Connect signal generator FUNCTION OUT to distortion analyzer input. Use a BNC (F) to banana pin (M) adapter. Terminate distortion analyzer end of cable with a 50Ω load.



SINE DISTORTION TEST (CONT)

2. Verify that the signal generator controls are set according to table 2-3

3. Set disstortion analyzer controls as follows

FUNCTION	SET LEVEL
SENSITIVITY	Center of Range
VERNIER	Center of Range
METER RANGE	0
MODE	MANUAL
FREQUENCY RANGE	X100
COARSE BALANCE	Center of Range
FINE BALANCE	Center of Range
Frequency Dial	10
HIGH PASS FILTER	OUT
Input Switch	NORM

4. Set signal generator FUNCTION switch (main generator) to sine wave position.

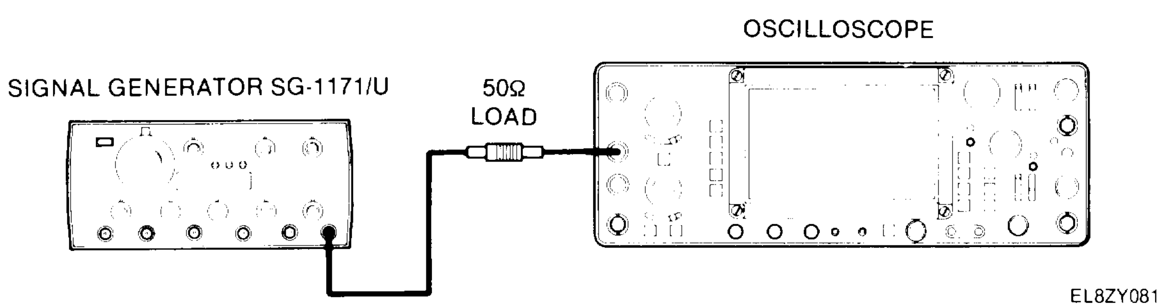
5. Verify that sine distortion is less than 0.5%.

6. Return all signal generator controls to positions given in initial setup.

7. Disconnect signal generator from distortion analyzer.

FREQUENCY RESPONSE TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate cable at oscilloscope input with a 50 ohm load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set signal generator FUNCTION switch (main generator) to sine wave position.

4. Set oscilloscope controls as follows.

CH 1 VOLTS/DIV	1 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1

FREQUENCY RESPONSE TEST (CONT)

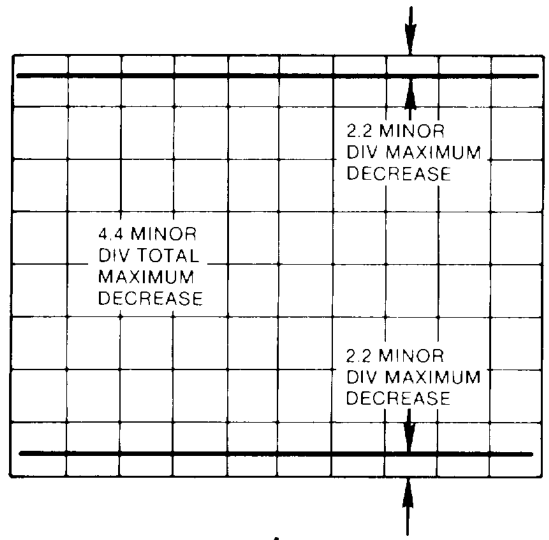
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
A, and B TIME/DIV	2 ms/DIV

5. Set oscilloscope INTENSITY and FOCUS controls for sharp and clear display waveform.

6. Adjust oscilloscope vertical VAR control so that peak to peak sine wave is 8 major divisions (40 minor divisions). Each minor division will then equal 2 5 percent of sine wave.

7. Set signal generator FREQ MULT switch (main generator) to 10M and observe oscilloscope display (see waveform A).

8. Compare step 7 with step 6 Step 7 must not be more than 107 percent (4.4 minor divisions) smaller than step 6.



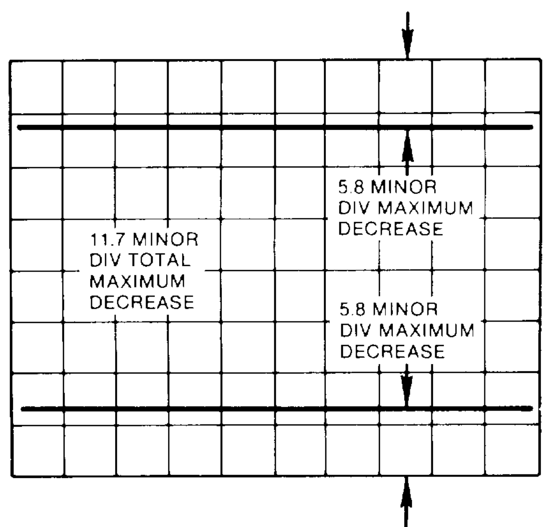
A

9. Set signal generator frequency dial to 20 and observe oscillosope display (see waveform B).

10. Compare step 9 with step 6. Step 9 must not be more than 293 percent (11.7 minor divisions) smaller than step 6.

11. Return all signal generator controls to positions given in initial setup.

12. Disconnect signal generator from oscilloscope.



B

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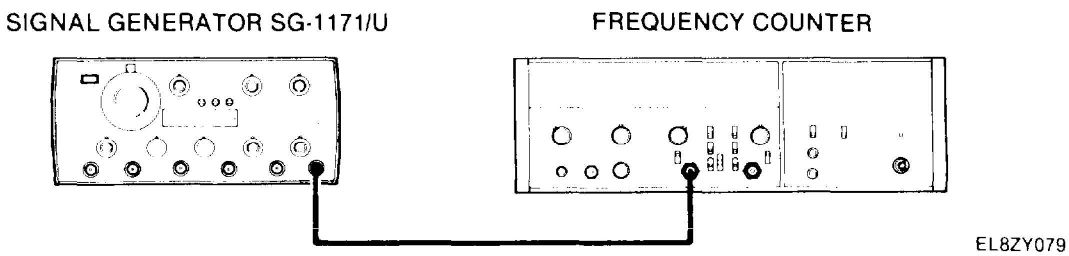
FREQUENCY STABILITY TEST

1. Set frequency counter controls as follows:

FUNCTION	FREQ A
GATE TIME/DISPLAY POSITION	AUTO
SAMPLE RATE	As Required
CHANNEL A LEVEL	Mid-Range
CHANNEL A SLOPE	+ or –
CHANNEL A ATTEN	X10
CHANNEL A Coupling	AC
CHANNEL A Input Impedance	50Ω
CHECK/COM A/SEP	SEP

2. Verify that the signal generator controls are set according to table 2-3.

3. Connect signal generator FUNCTION OUT to frequency counter CHAN A input.



4. Set signal generator FREQ MULT switch (main generator) to 10M.

5. Adjust signal generator frequency dial to exactly 10.000 MHz using frequency counter as indicator.

6. Wait 10 minutes without adjusting frequency dial.

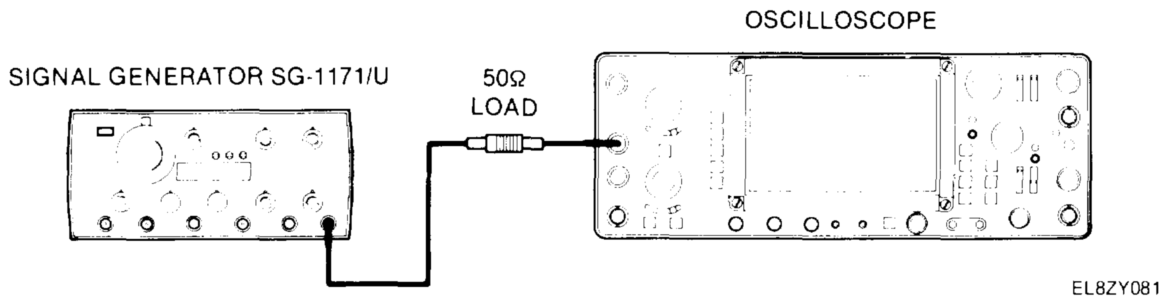
7. Verify that total frequency change (from step 5) on frequency counter is less than ± 0.05 MHz.

8. Return all signal generator controls to positions given in initial setup.

9. Disconnect signal generator from frequency counter.

OUTPUT SIGNAL TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate oscilloscope end of cable with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	2 V/DIV
CH 1 VOLTSDIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
A and B TIME/DIV	.5 ms/DIV

4. Set oscilloscope INTENSITY and FOCUS controls for a sharp and clear display waveform.

5. Rotate signal generator FUNCTION switchl (main generator) through each position.

6. Verify presence of each indicated waveform.

7. Set oscilloscope sweep to 2 ms/DIV.

8. Set signal generator FUNCTION switch (main generator) to triangle position.

9. Rotate signal generator SYMMETRY control out of detent and though its entire range.

10. Vertfy presence of variable triangle waveform.

11. Set signal generator FUNCTION switch (main generator) to square wave position.

12. Rotate signal generator SYMMETRY control out of detent and though its entire range.

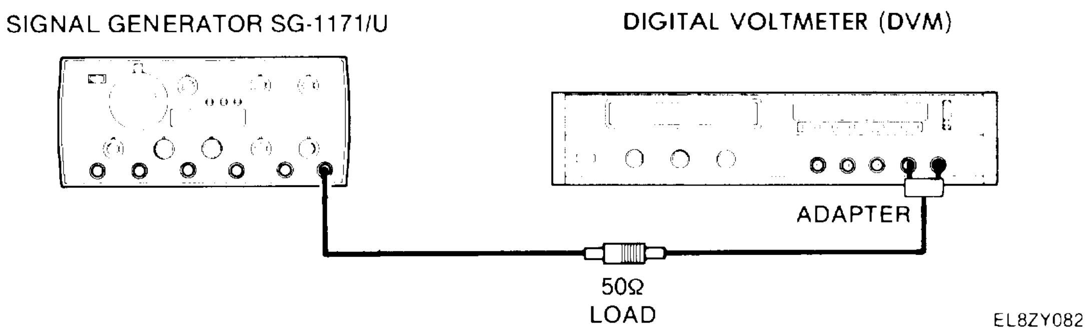
13. Verify presence of variable duty cycle square wave.

14. Return all signal generator controls to positions given in initial setup.

15. Disconnect signal generator from oscilloscope.

DC OFFSET TEST

1. Connect signal generator FUNCTION OUT to DVM input. Use a BNC (F) to banana (M) adapter. Terminate DVM end of cable with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set signal generator FUNCTION switch (main generator) to DC.

4. Verify that DVM reads 0 Vdc ± 250 mV.

5. Rotate signal generator DC OFFSET control out of OFF detent Leave control as far counterclockwise as possible without being in OFF detent.

6. Verify that DVM reads – 7.5 V ±0.5 V.

7. Rotate signal generator DC OFFSET control full clockwise.

8. Verify that DVM reads + 7.5 V ±0.5 V.

9. Set signal generator FUNCTION switch (main generator) to square wave position.

10. Verify that signal generator OVERLOAD indicator illuminates.

11.Rotate signal generator DC OFFSET control from full clockwise through 'O' position to full counterclockwise. Signal generator OVERLOAD Indicator wiIl be illuminated on both sides of 'O' position and go out at 'O' position.

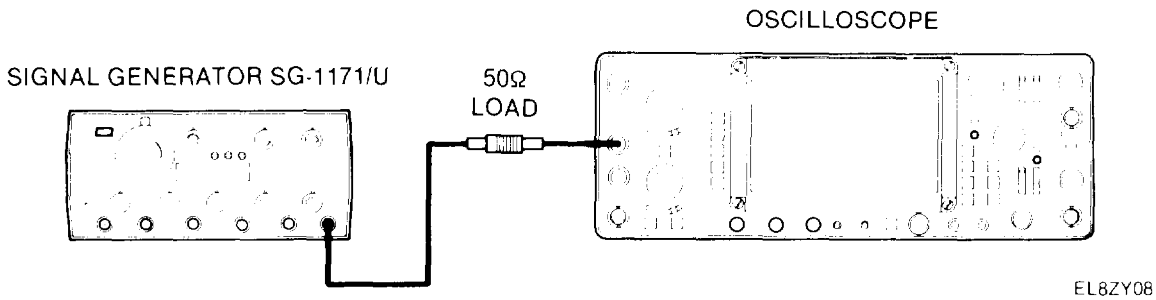
12. Set signal generator DC OFFSET control to OFF Verify that signal generator OVERLOAD indicator goes out (not illuminated).

13. Return all signal generator controls to positions given in initial setup.

14. Disconnect signal generator from DVM.

PULSE WIDTH TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate cable at oscilloscope with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set signal generator FUNCTION switch (main generator) to positive pulse position, FREQ MULT switch to 10M and frequency dial to 2.0.

4. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	2 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	NORM
COUPLING	AC
SOURCE	NORM
SLOPE	Positive (+)
LEVEL	Positive (+)
A and B TIME/DIV	02 μs/DIV

5. Adjust oscilloscope vertical POSITION and horizontal POSITION controls as necessary to measure waveform 50 percent points.

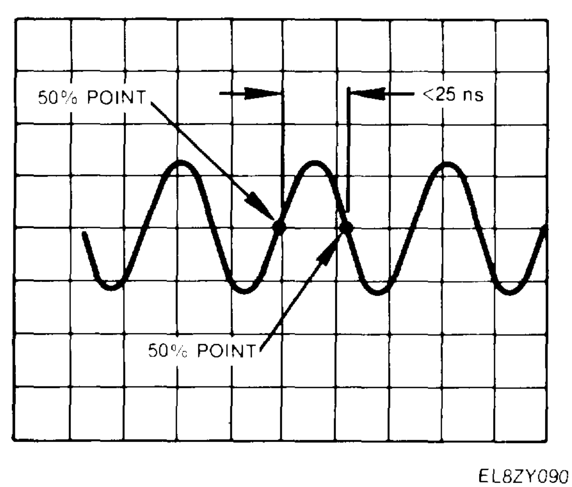
6. Verify that pulse width is 25 ±2 ns.

7. Set signal generator FREQ MULT switch (main generator) to 10.

8. Set oscilloscope horizontal sweep to 20 ms/DIV.

9. Adjust oscilloscope vertical and horizontal POSITION controls to start waveform at left edge of display.

10. Verify that pulse width is 25 ±2 ns.



PULSE WIDTH TEST (CONT)

11. Set signal generator FREQ MULT switch (main generator) to 1 and frequency dial to 1.0.

12. Set oscilloscope sweep to 1.0 s/DIV.

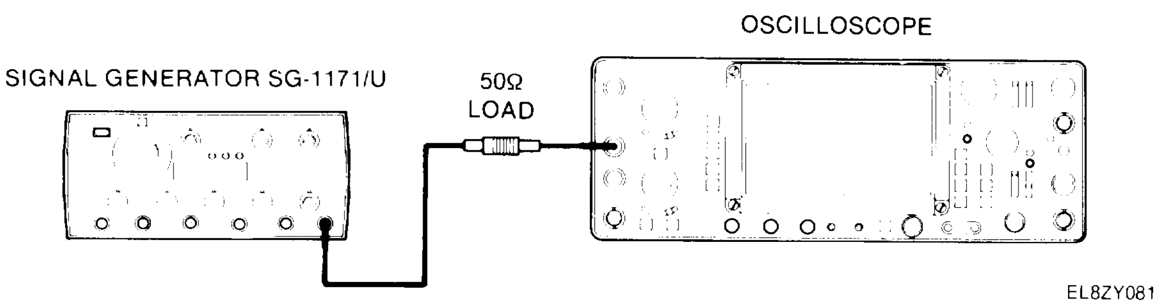
13. Verify that pulse width is 5 ±0.2 sec.

14. Return all signal generator controls to positions given in initial setup.

15. Disconnect signal generator from oscilloscope.

SYMMETRY TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input Terminate cable at oscilloscope with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set oscilloscope controls as follows:

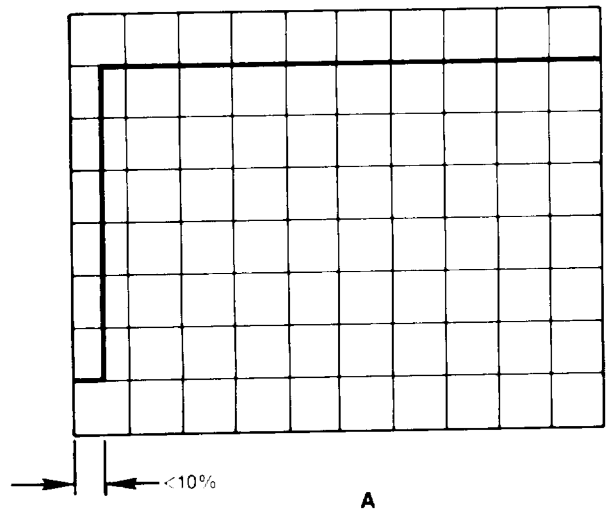
CH 1 VOLTS/DIV	2 V/DIV
CH 1 VOLTS/DIV VAR	Cal Posit Ion
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
SLOPE	Negative (–)
LEVEL	Negative (–)
A and B TIME/DIV	1 ms/DIV

4. Set signal generator SYMMETRY control clockwise just out of OFF detent.

SYMMETRY TEST (CONT)

5. Adjust oscilloscope horizontal VAR control and horizontal POSITION control to display one complete waveform cycle. Place leading edge of negative portion of waveform at left edge of screen.

6. Verify that width of negative portion of waveform is less than 10 percent (see waveform A).



A

7. Set signal generator SYMMETRY control full clockwise.

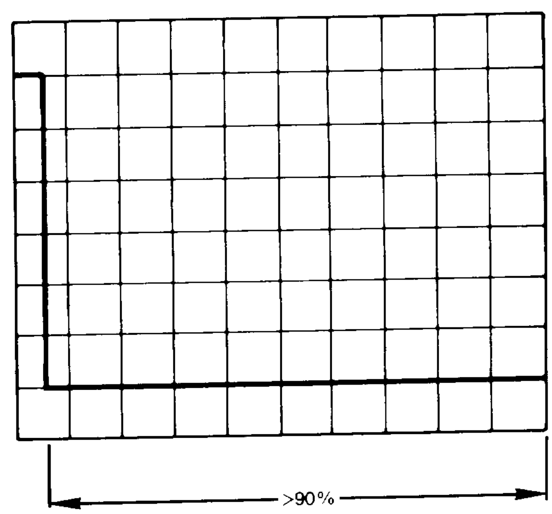
8. Set oscilloscope SLOPE control and LEVEL control to positive (+) position.

9. Adjust oscilloscope horizontal VAR control and horizontal POSITION control to display one complete waveform cycle. Place leading edge of positive portion of waveform at left edge of screen.

10. Verify width of negative portion of waveform as greater than 90 percent (see waveform B).

11. Return all signal generator controls to positions given in initial setup.

12. Disconnect signal generator from oscilloscope.



B

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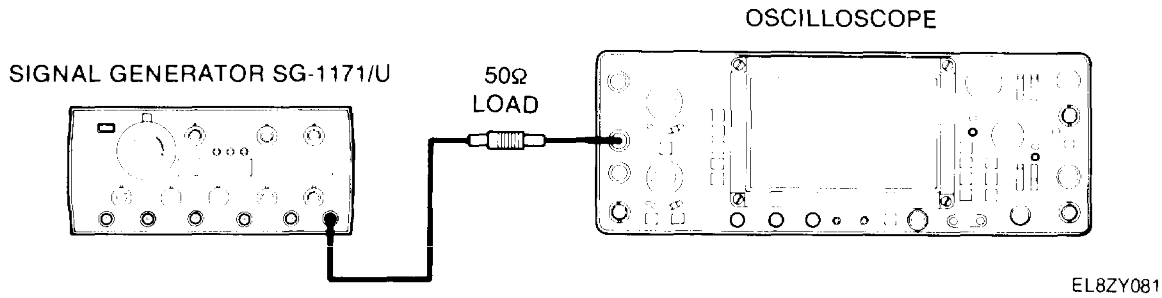
PULSE TRANSITION TIME TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input Terminate cable at oscilloscope with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set signal generator FREQ MULT switch (main generator) to 1M.

4. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	1 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
SLOPE	Negative (–)
LEVEL	Negative (–)
A and B TIME/DIV	1 μs/DIV

5. Adjust oscilloscope vertical VAR control and vertical POSITION control to place square wave peaks at the 0 and 100 percent amplitude lines on display screen.

6. Turn on 10X horizontal magnifier.

7. Verify positive-going transition time between the 10 and 90 percent marks as less than 25 ns. Adjust horizontal POSITION control if necessary.

8. Set oscilloscope SLOPE control and LEVEL control to positive (+) position.

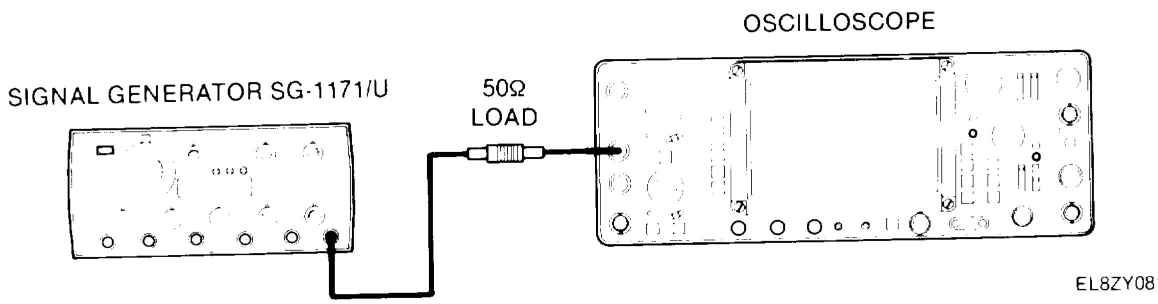
9. Verify negative-going transition time.

10. Return all signal generator controls to positions given in initial setup.

11. Disconnect signal generator from oscilloscope.

SYNCHRONIZATION OUTPUT TEST

1. Connect signal generator SYNC OUT to oscilloscope CH 1 vertical input. Terminate oscilloscope end of cable with a 100a load.



2. Verfy that the signal generator controls are set according to table 2-3.

3. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	1 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
A and B TIME/DIV	2 ms/DIV
X10 MAG	OFF

4. Verfy that amplitude of waveform is greater than 2 Vp-p.

5. Insert 100 ohm termination load between oscilloscope input and signal generator SYNC OUT.

6. Verify that ampiltude of waveform is greater than 1 Vp-p.

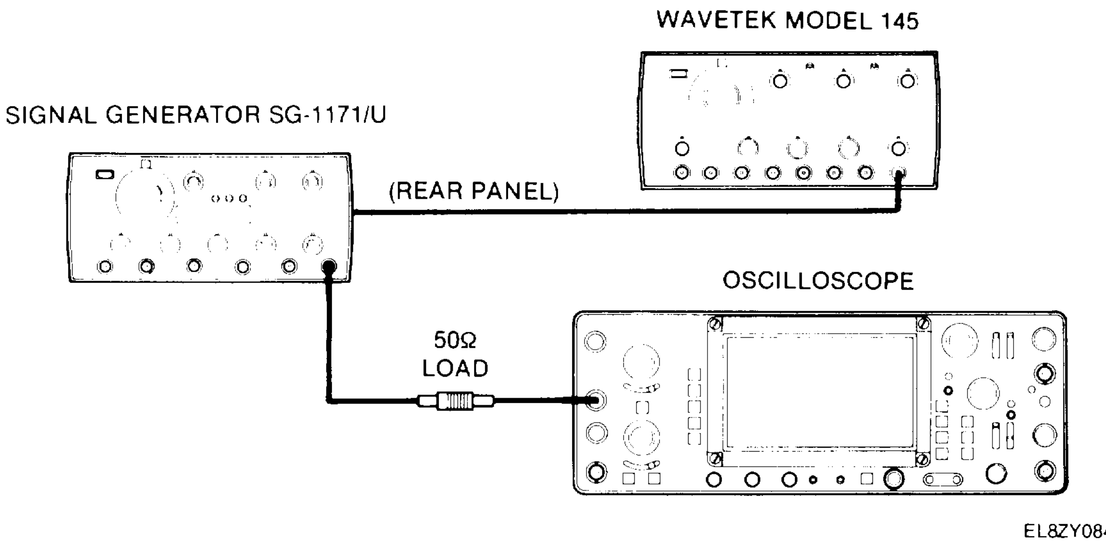
7. Return all signal generator controls to positions given in initial setup.

8. Disconnect signal generator from oscilloscope.

EXTERNAL SYNCHRONIZATION TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate oscilloscope end of cable with a 50Ω load.

2. Connect signal generator SYNC IN (rear panel) to test generator (Wavetek 145) FUNCTION OUT.



3. Verify that the signal generator controls are set according to table 2-3.

4. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	2 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
A and B TIME/DIV	.5 μs/DIV

5. Set signal generator FREQ MULT switch (main generator) to 1M.

6. Set test generator (Wavetek 145) controls as follows:

FREQ/PERIOD MULT	1M
VERNIER (FREQ)	Cal Position
Frequency Dial	10
TRIGGER START/STOP	CAL detent
DC OFFSET	OFF
FUNCTION	Sine Position
GENERATOR MODE	CONT
ATTENUATION	20/0
VERNIER (ATTEN)	FULL CLOCKWISE

EXTERNAL SYNCHRONIZATION TEST (CONT)

7. Slowly increase test generator frequency toward 1.2 MHz. Observe oscilloscope and verify waveform jitter (loss of synchronization).

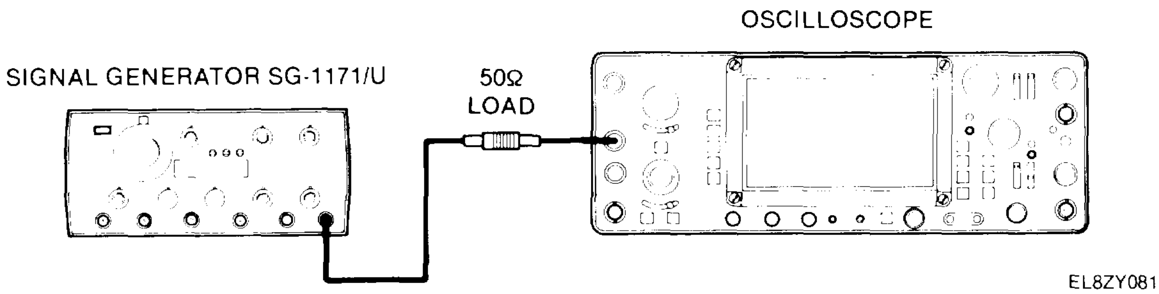
8. Slowly lower test signal generator frequency to 0.8 MHz. Observe oscilloscope and verify stabilization of waveform as frequency approaches and passes 1.0 MHz. Waveform jitter should appear as frequency approaches 0.8 MHz.

9. Return all signal generator controls to positions given in initial setup.

10. Disconnect signal generator from oscilloscope and test generator.

ATTENUATION OUTPUT TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate oscilloscope end of cable with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set oscilloscope controls as follows.

CH 1 VOLTS/DIV	5 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
A and B TIME/DIV	2 ms/DIV

4. Adjust oscilloscope VAR control (vertical gain) to display waveform exactly 3 major divisions high.

5. Rotate signal generator AMPLITUDE control full counterclockwise.

6. Set oscilloscope vertical gain to 0.5 V/DIV.

7. **Verify wavetorm is three major divisions or less.**

8. Rotate signal generator AMPLITUDE control full clockwise and set ATTENUATION switch to 40/20 position.

ATTENUATION OUTPUT TEST (CONT)

9. **Verify waveform is three major divisions or less.**

10. Set signal generator ATTENUATION switch to 60/40 position.

11. Set oscilloscope vertical gain to 50 mV/DIV.

12. **Verify waveform is three major divisions or less.**

13. Set signal generator ATTENUATION switch to 80/60 position.

14. Set oscilloscope vertical gain to 5 mV/DIV.

15. **Verify waveform is three major divisions or less.**

16. Rotate signal generator AMPLITUDE control full counterclockwise.

17. Set oscilloscope VAR control (vertical gain) to CAL position.

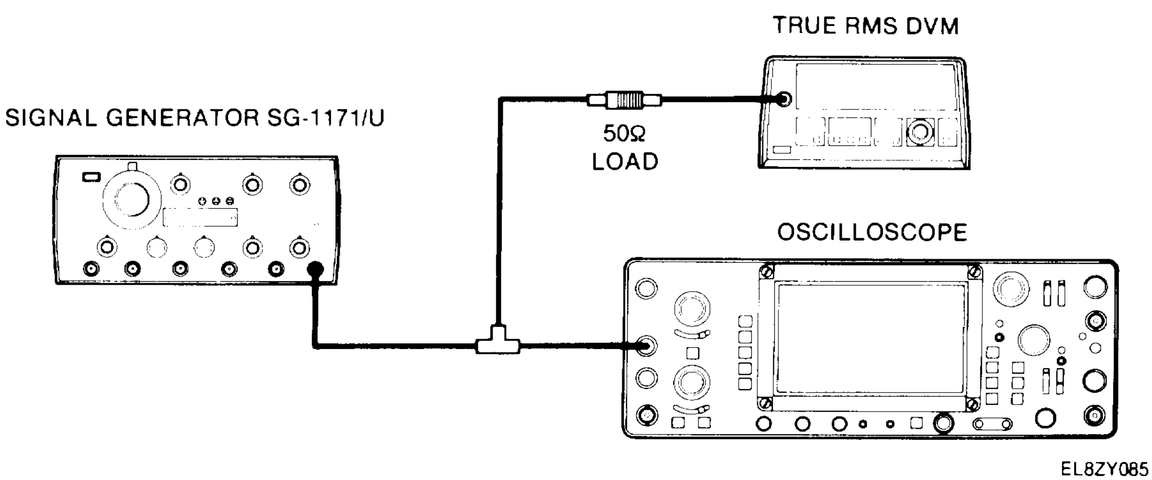
18. Verify waveform is less than 4.75 mVp-p.

19. Return all signal generator controls to positions given in initial setup.

20. Disconnect signal generator from oscilloscope.

VOLTAGE OUTPUT TEST

1. Connect signal generator FUNCTION OUT to true rms DVM input and to oscilloscope CH A vertical input Terminate true rms DVM end of cable with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set signal generator FUNCTION switch (main generator) to square wave position. Check oscilloscope for square wave display.

VOLTAGE OUTPUT TEST (CONT)

4. Verify that true rms DVM indicates 7.5 to 7.75 Vrms.

5. Set signal generator FUNCTION switch (main generator) to sine wave position. Check oscilloscope for sine wave display.

6. Verify that true rms DVM indicates 5.3 to 5.48 Vrms.

7. Set signal generator FUNCTION switch main generator) to triangle wave position. Check oscilloscope for triangle wave display.

8. Verify that true rms DVM indicates 4.33 to 4.48 Vrms.

9. Remove 50Ω load from input to true rms DVM and connect output of signal generator directly to input of true rms DVM.

10. Verfy that true rms DVM indicates 8.66 to 8.96 Vrms.

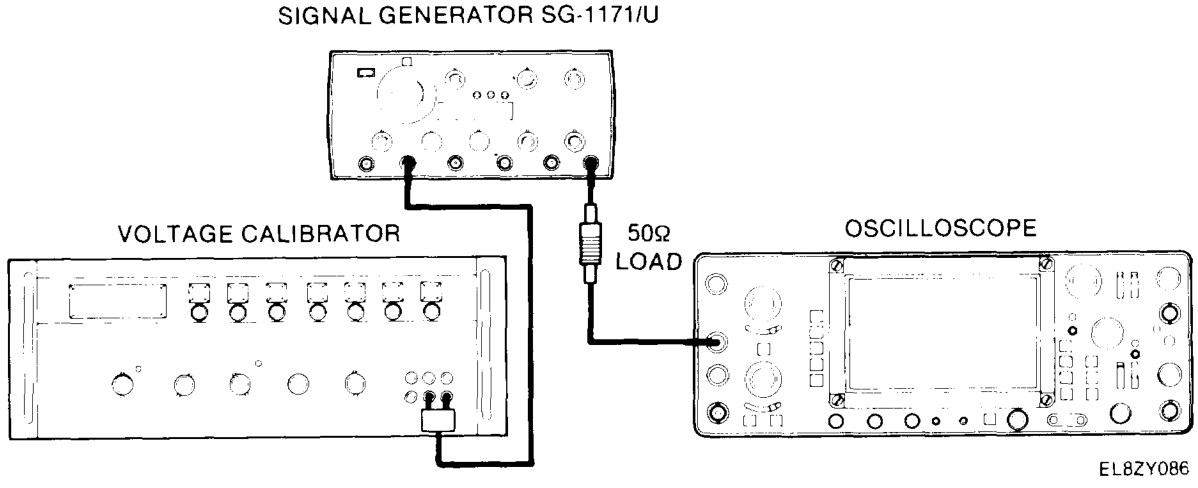
11. Return all signal generator controls to positions given in initial setup.

12. Disconnect signal generator from oscilloscope and true rms DVM.

VOLTAGE CONTROL FREQUENCY TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate cable at oscilloscope with a 50Ω load

2. Connect signal generator EXT MOD IN to voltage calibrator output Use a BNC (f) to banana (M) adapter.



3. Verify that the signal generator controls are set according to table 2-3.

VOLTAGE CONTROL FREQUENCY TEST (CONT)

4. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	5 V/DIV
CH 1 VOLTS/DIV VAR	Cal Posit Ion
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
A and B TIME/DIV	50 μs/DIV

5. Set voltage calibrator to 0.0 Vdc.

6. Set signal generator FREQ MULT switch (main generator) to 100K and frequency dial to .02.

7. Adjust oscilloscope horizontal VAR control to display one complete cycle of waveform.

8. Set signal generator FM/SWP MODULATION switch to EXT.

9. Set oscilloscope sweep to .5 μs/DIV and voltage calibrator to produce + 5V output.

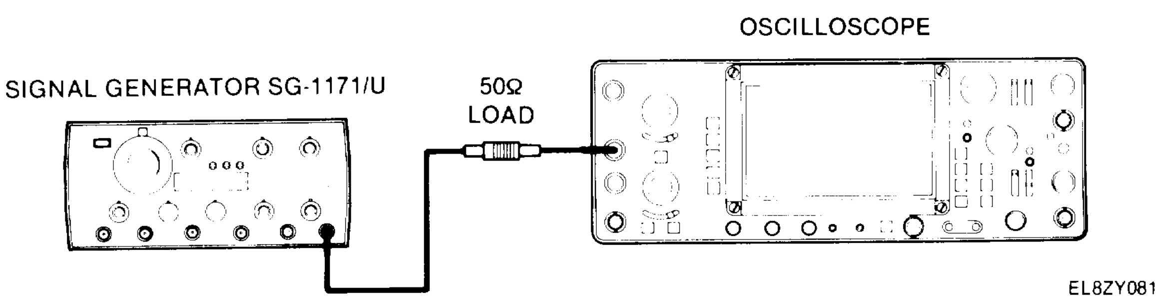
10. Verify approximately one full cycle of waveform on oscilloscope.

11. Return all signal generator controls to positions given in initial setup.

12. Disconnect signal generator from oscilloscope and voltage calibrator.

TRIGGER AND GATE START/STOP TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate cable at oscilloscope with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

TRIGGER & GATE START/STOP TEST (CONT)

3. Set oscilioscope controls as follows:

CH 1 VOLTS/DIV	5 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
SLOPE	Positive (+)
LEVEL	Positive (+)
A and B TIME/DIV	50 μs/DIV

4. Reset the signal generator controls as follows:

FUNCTION switch (main gen)	Triangle
FREQ MULT switch (main gen)	10K
FUNCTION switch (mod gen)	Triangle
Mode (mod gen)	INT TRIG
FREQ/PERIOD switch (mod gen)	1K/100K

5. Rotate signal generator TRIG START/STOP control clockwise from 0° CAL position until continuous waveform appears (see waveform A).

6. Reset signal generator TRIG START/STOP control to 0° CAL position.

7. Rotate TRIGGER LEVEL control clockwise until a continuous waveform appears (see waveform A).

8. Verify that triangle waveform (internal triggered) appears when signal generator TRIGGER LEVEL control is rotated through mid range and disappears near minimum and maximum of control range.

9. Set signal generator Mode (modulation generator) to EXT TRIG position.

10. Set oscilloscope vertical gain to .5 V/DIV and verify that the waveform baseline dc voltage is 0 Vdc ±0.5 V and does not oscillate.

11. Set oscilloscope vertical gain to 5V/Div and A and B Time/Div to 100μs/Div.

TRIGGER & GATE START/STOP TEST (CONT)

12. Set signal generator FREQ/PERIOD switch to 10/1 K.

13. Connect a BNC to BNC cable from signal generator OUT (600 Ω) to signal generator EXT TRIG IN.

14. Verify that a triangle waveform (external triggered) appears as TRIGGER LEVEL control is rotated (see waveform B).

15. Set signal generator Mode (modulation generator) to EXT GATE.

16. Verify external gating action as signal generator TRIGGER LEVEL control is rotated.

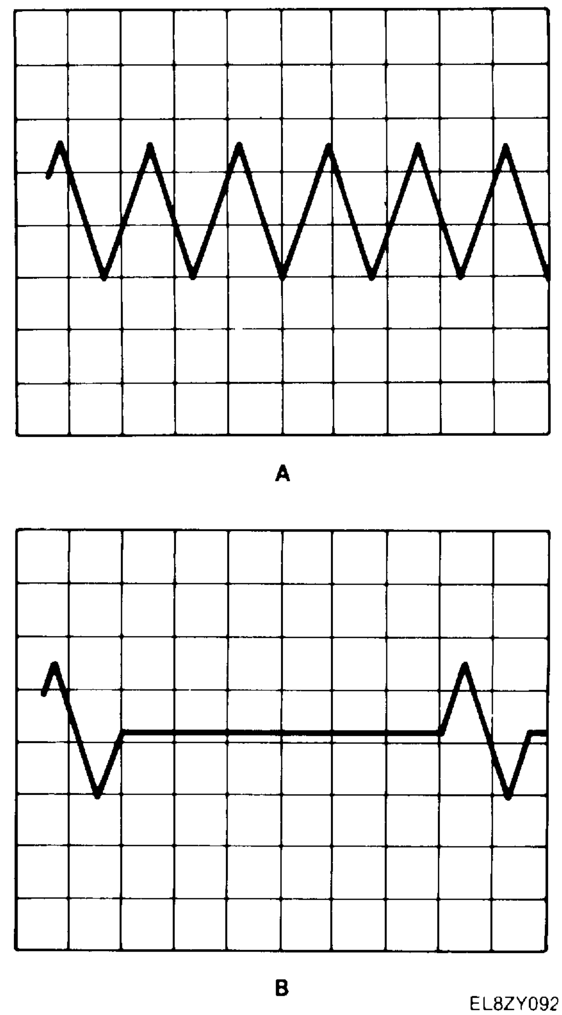
17. Set signal generator Mode (modulation generator) to INT GATE and remove BNC to BNC cable used in step 13.

18. Rotate signal generator TRIGGER LEVEL control through entire range.

19. Verify internal gating action for signal generator as TRIGGER LEVEL control is rotated.

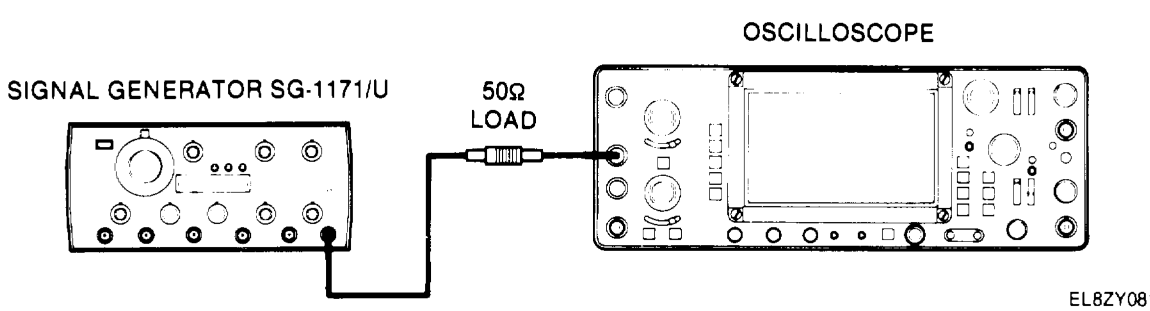
20. Retun all signal generator controls to positions given in initial setup.

21. Disconnect signal generator from oscilloscope.



SWEEP TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input Terminate oscilloscope end of cable with a 50Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

SWEEP TEST (CONT)

3. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	5 V/DIV
CH 1 VOLTS/DIV VAR	Cal Posit Ion
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
A and B TIME/DIV	.5μs/DIV

4. Reset signal generator controls as follows:

MODULATION FM/SWP switch	INT
FUNCTION switch (mod gen)	SWP SET
MOD AMPLITUDE	Full counterclockwise
FREQ MULT (main gen)	10OK
Frequency Dial	02

5. Adjust signal generator VERNIER control for one full cycle on oscilloscope. Use oscilloscope horizontal POSITION control if required.

6. Set oscilloscope sweep to .5 μs/DIV

7. Set signal generator VERNIER control and MOD AMPLITUDE control to full clockwise.

8. Verify approximately one full cycle on oscilloscope (see waveform A).

9. Rotate signal generator FUNCTION switch (modulation generator) to positive-going ramp position and FUNCTION switch (main generator) to triangle position.

10. Verlfy sweeping operation (similar to waveform B).

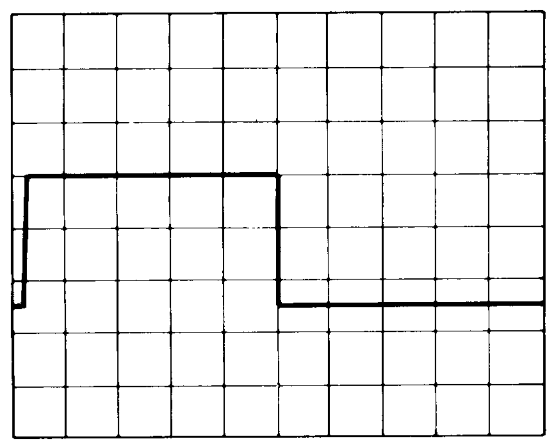
11. Set signal generator MODULATION FM/SWP switch to EXT.

12. Connect a BNC to BNC cable between signal generator OUT (600Ω) and signal generator EXT MOD IN.

13. Verify sweeping operaton (similar to waveform B).

14. Return all signal generator controls to positions given initial setup.

15. Disconnect signal generator from oscilloscope.



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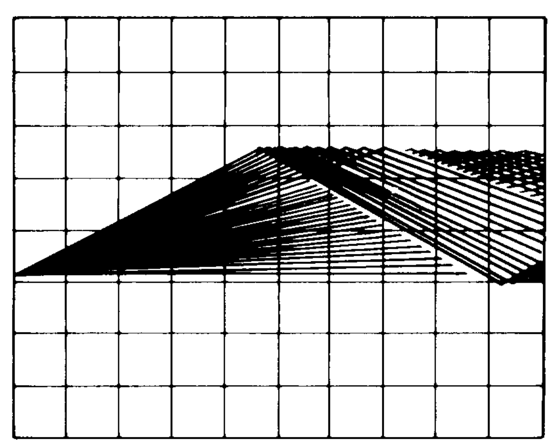

B

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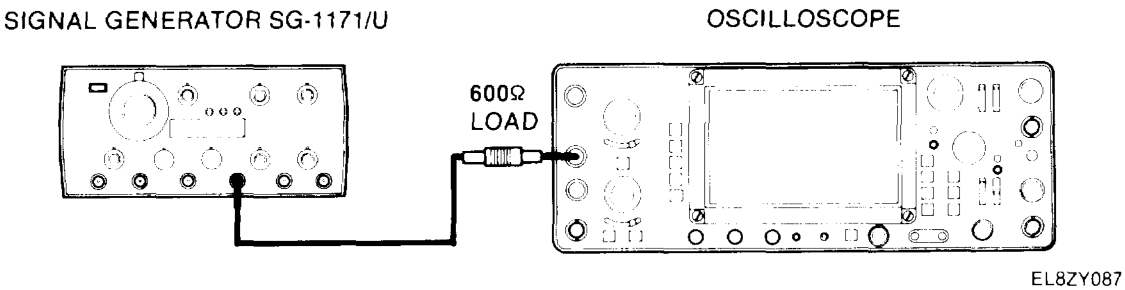
SWEEP OUTPUT TEST

1. Connect signal generator OUT (600Ω) to oscilloscope CH 1 vertical input. Terminate oscilloscope end of cable with a 600Ω load.



2. Verify that the signal generator controls are set according to table 2-3.

3. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	1 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
SLOPE	Negative (–)
LEVEL	Negative (–)
A and B TIME/DIV	.2 ms/DIV

4. Set signal generator FUNCTION switch (modulation generator) to positive-going SWEEP RAMP position.

5. Verify positive-going ramp waveform of approximately 0 to + 5 volts on oscilloscope.

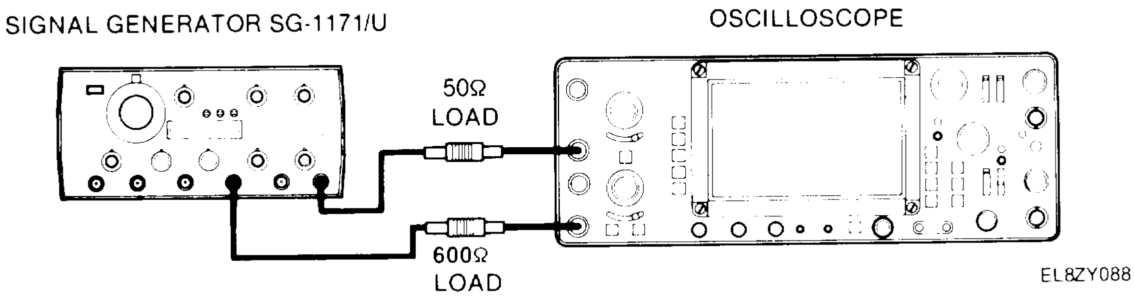
6. Return all signal generator controls to positions given in initial setup.

7. Disconnect signal generator from oscilloscope.

AMPLITUDE MODULATION TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 2 vertical input. Terminate oscilloscope end of cable with a 50Ω load.

2. Connect signal generator OUT (600Ω) to oscilloscope CH 1 vertical input. Terminate oscilloscope end of cable with a 600Ω load.



3. Verify that the signal generator controls are set according to table 2-3.

4. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	2 V/DIV
CH 2 VOLTS/DIV	5 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
CH 2 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1 and CH 2
TRIG MODE	NORM
COUPLING	AC
SOURCE	CH 1
A and B TIME/DIV	.2 ms/DIV

5. Reset signal generator controls as follows:

Frequency Dial	2.0
FREQ MULT switch (main gen)	10K
FUNCTION switch (main gen)	Sine Position
FUNCTION switch (mod gen)	Triangle Position
MODULATION AM switch	INT

AMPLITUDE MODULATION TEST (CONT)

6. Rotate signal generator MOD AMPLITUDE control throughout its range while observing oscilloscope CH 1 waveform.

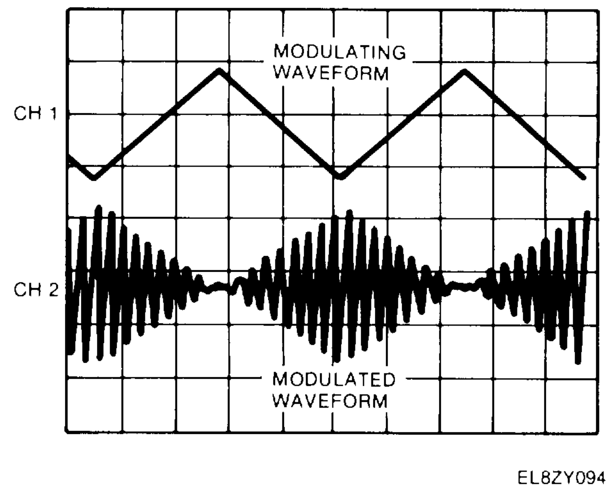
7. Verify that the CH 1 waveform will change from a modulated waveform to a continuous waveform.

8. Set signal generator MOD AMPLITUDE control to full clockwise.

9. Verify that oscilloscope CH 1 waveform minimum modulation occurs at same time as positive peak of CH 2 waveform and maximum modulation occurs at same time as negative peak of CH 2 waveform.

10. Return all signal generator controls to positions given in initial setup.

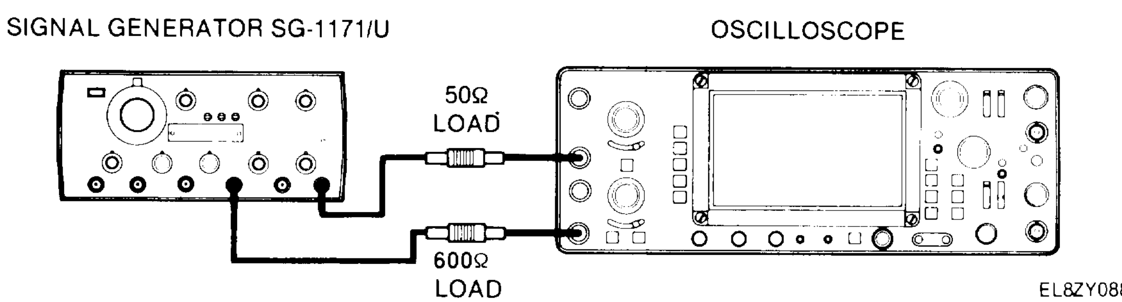
11. Disconnect signal generator from oscilloscope.



PHASE MODULATION TEST

1. Connect signal generator FUNCTION OUT to oscilloscope CH 1 vertical input. Terminate oscilloscope end of cable with a 50Ω load.

2. Connect signal generator OUT (600Ω) to oscilloscope CH 2 vertical input. Terminate oscilloscope end of cable with a 600Ω load.



3. Verify that the signal generator controls are set according to table 2-3.

PHASE MODULATION TEST (CONT)

4. Set oscilloscope controls as follows:

CH 1 VOLTS/DIV	5 V/DIV
CH 2 VOLTS/DIV	2 V/DIV
CH 1 VOLTS/DIV VAR	Cal Position
CH 2 VOLTS/DIV VAR	Cal Position
Vertical Coupling	DC
VERT MODE	FULL BW OUT
Vertical Input	CH 1 and CH 2
TRIG MODE	AUTO
COUPLING	AC
SOURCE	CH 1
SLOPE	Positive (+)
LEVEL	Positive (+)
A and B TIME/DIV	1 ms/DIV

5. Set signal generator FREQ MULT control (main generator) to 100, frequency dial to 1.3 and FUNCTION switch (main generator) to sine wave position.

6. Set oscilloscope vertical mode to CHOPPED.

7. Adjust oscilloscope sweep VAR control to display four complete cycles of CH 1 waveform (see waveform A).

8. Set oscilloscope trigger SOURCE to CH 2.

9. Adjust signal generator VARIABLE control to display two complete cycles of CH 2 waveform (see waveform A).

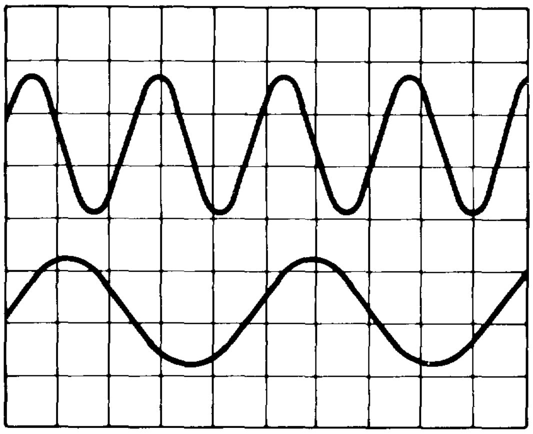
10. Set signal generator MODULATION PM (ϕ) switch to INT.

11. Verify that phase of oscilloscope CH 1 waveform varies in phase as the amplitude of CH 2 waveform increases or decreases (see waveform B).

12. Return all signal generator controls to positions given in initial setup.

13. Set signal generator and oscilloscope power switches to OFF.

14. Disconnect signal generator from oscilloscope.



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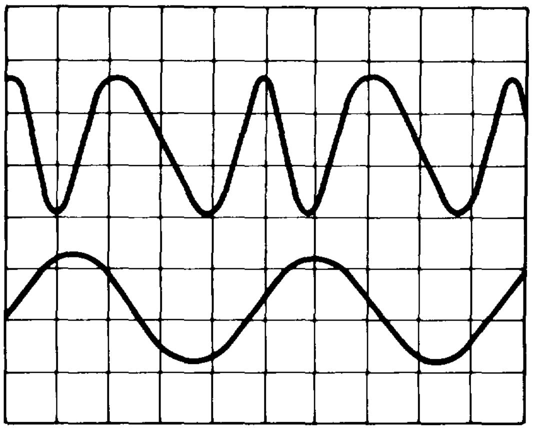

B

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Performance Test Checklist

Test and Step	Measured Value	Desired Value
OUTPUT FREQUENCY TEST		
Step 4	______ MHz	19.0 to 21.0 MHz
	______ MHz	1.94 to 2.06 MHz
	______ kHz	194 to 206 kHz
	______ kHz	19.4 to 20.6 kHz
	______ Hz	192 to 208 Hz
	______ ms	48 to 52 ms
	______ ms	480 to 520 ms
	______ sec	4.8 to 5.2 sec
	______ sec	48 to 52 sec
	______ Hz	1940 to 2060 Hz
	______ Hz	1742 to 1858 Hz
	______ Hz	1544 to 1656 Hz
	______ Hz	1346 to 1454 Hz
	______ Hz	1148 to 1252 Hz
	______ Hz	950 to 1050 Hz
	______ Hz	752 to 848 Hz
	______ Hz	554 to 646 Hz
	______ Hz	356 to 444 Hz
	______ Hz	158 to 242 Hz
	______ Hz	59 to 141 Hz
SINE DISTORTION TEST		
Step 6	______ %	Less than 0.5%
FREQUENCY RESPONSE TEST		
Step 8	______ %	Less than 10.7%
Step 10	______ %	Less than 29.3%
FREQUENCY STABILITY TEST		
Step 7	______ MHz	9.95 to 10.05 MHz
OUTPUT SIGNAL TEST		
Step 6	______ yes/no	Sine waveform
	______ yes/no	Triangle waveform
	______ yes/no	Square waveform
	______ yes/no	Positive square waveform
	______ yes/no	Negative square waveform
Step 10	______ yes/no	Variable triangle waveform
Step 13	______ yes/no	Variable square waveform

Performance Test Checklist (Continued)

Test and Step	Measured Value	Desired Value
DC OFFSET TEST		
Step 4	_______ Vdc	0 Vdc ±250mV
Step 6	_______ Vdc	−7.5V ±0.5V
Step 8	_______ Vdc	+7.5V ±0.5V
Step 10	_______ yes/no	Indicator is ON
Step 11	_______ yes/no	Indicator is OFF, then ON, then OFF
Step 12	_______ yes/no	Indicator is OFF
PULSE WIDTH TEST		
Step 6	_______ ns	25 ±2 ns
Step 10	_______ ms	25 ±2 ms
Step 12	_______ sec	5 ±0.2 sec
SYMMETRY TEST		
Step 6	_______ %	Less than 10%
Step 10	_______ %	Greater than 90%
PULSE TRANSITION TIME TEST		
Step 7	_______ ns	Less than 25 ns
Step 9	_______ ns	Less than 25 ns
SYNCHRONIZATION OUTPUT TEST		
Step 4	_______ Vp-p	Greater than 2 Vp-p
Step 6	_______ Vp-p	Greater than 1 Vp-p
EXTERNAL SYNCHRONIZATION TEST		
Step 7	_______ yes/no	Frequency jitter appears
Step 8	_______ yes/no	Frequency synchronizes
ATTENUATION OUTPUT TEST		
Step 7	_______ div	Less than 3 div
Step 9	_______ div	3 ±0.5 div
Step 12	_______ div	3 ±0.5 div
Step 15	_______ div	3 ±0.5 div
Step 18	_______ mVp-p	< 4.75 mVp-p

Performance Test Checklist (Continued)

Test and Step	Measured Value	Desired Value
OUTPUT VOLTAGE TEST		
Step 4	________ Vrms	7.5 to 7.75 Vrms
Step 6	________ Vrms	5.3 to 5.48 Vrms
Step 8	________ Vrms	4.33 to 4.48 Vrms
Step 10	________ Vrms	8.66 to 8.96 Vrms
VOLTAGE CONTROL FREQUENCY TEST		
Step 11	________ yes/no	Approximately one full cycle displayed
TRIGGER AND GATE START/STOP TEST		
Step 5	________ yes/no	Triangle waveform appears
Step 7	________ yes/no	Triangle waveform appears
Step 8	________ yes/no	Internal triggered waveform
Step 10	________ Vdc	Steady waveform baseline at 0 Vdc ±0.5V
Step 14	________ yes/no	External triggered waveform
Step 16	________ yes/no	External gated waveform
Step 19	________ yes/no	Internal gated waveform
SWEEP TEST		
Step 8	________ yes/no	One complete cycle displayed
Step 10	________ yes/no	Sweeping action
Step 13	________ yes/no	Sweeping action
SWEEP OUTPUT TEST		
Step 5	________ yes/no	0 to +5V ramp waveform
AMPLITUDE MODULATION TEST		
Step 7	________ yes/no	Waveform changes from modulated to cw
Step 9	________ yes/no	Modulation peaks are in phase with modulating waveform peaks
PHASE MODULATION TEST		
Step 11	________ yes/no	CH 1 waveform varies in phase as amplitude of CH 2 waveform increases or decreases

Section V. PREPARATION FOR STORAGE OR SHIPMENT

2-103. PREPARATION FOR STORAGE OR SHIPMENT.

If original packing material was saved, pack imstrument in same manner as received. When using packing materials other than original use the following guidelines:

- Wrap instrument in plastic packing material.
- Use double-wall cardboard shipplng container.
- Protect all sides with shock-absorbing material such as styrofoam dunnage to prevent. Instrument movement within the container.
- Seal shipping container with approved sealing tape.
- Mark FRAGILE on all sides, top and bottom of shipping container.

2-104. INFORMATION FOR STORAGE

This instrument should be stored in a clean, dry environment. The following Iimitations apply to both storage and reshipment.

- Temperature within – 55°C to + 75° C range.
- Relativity humidity not to exceed 95% at + 25°C and sea level (noncondensing).
- Altitude from sea level to 40,000 feet.

APPENDIX A

REFERENCES

A-1 . SCOPE

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS

Recommended Changes to Publications and Blank Forms	DA Form 2028
Recommended Changes to Equipment Technical Manuals	DA Form 2028-2
Quality Deficiency Report	Form SF 368
Report of Discrepancy	Form SF 364

A-3. FIELD MANUALS

First Aid for Soldlers	FM 21-11

A-4. TECHNICAL MANUALS

The Army Maintenance Management System (TAMMS)	DA Pam 738-750
Procedures for Destruct Ion of Electronics Material to Prevent Enemy Use (Electronics Command)	TM 750-244-2
Organizational, Direct Support, and General Support Repair Parts and Special Tools List for Signal Generator SG-1171/U (NSN 6625-01-133-6160)	TM 11-6625-301-24P
Operator's and Organizational Maintenance Manual for Signal Generator SG-1171/U (NSN 6625-01-133-6160)	TM 11-6625-3051-12

A-5. MISCELLANEOUS PUBLICATIONS

Consolidated Index of Army Publications and Blank Forms	DA Pam 310-1
Safety Precautions for Maintenance of Electrical/Electronic Equipment	TB 385-4
Calibration Procedure for Signal Generator SG-1171/U (NSN 6625-01-133-6160)	TB 9-6625-2102-35

APPENDIX B

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

B-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain Signal Generator SG-1171/U. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

B-2. EXPLANATION OF COLUMNS.

a Column (1) – Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g "Use cleaning compound, item 5, App. D").

b Column (2) — Level. This column Identifies the lowest level of maintenance that requires the listed item. (enter as applicable)

C — Operator/Crew
O — Organizational Maintenance
F — Direct Support Maintenance
H — General Support Maintenance

c. Column (3) — National Stock Number. This is the national stock number assigned to the item, use it to request or requistion the item.

d. Column (4) — Description. Indicates 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 the manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5) — Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g ea, 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 AND MATERIALS

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	H	8040-01-148-2434	ADHESIVE/SEALANT (71984) RTV 3145-3	OZ
2	H	5970-00-443-1183	THERMAL COMPOUND (05820) 120-2	OZ

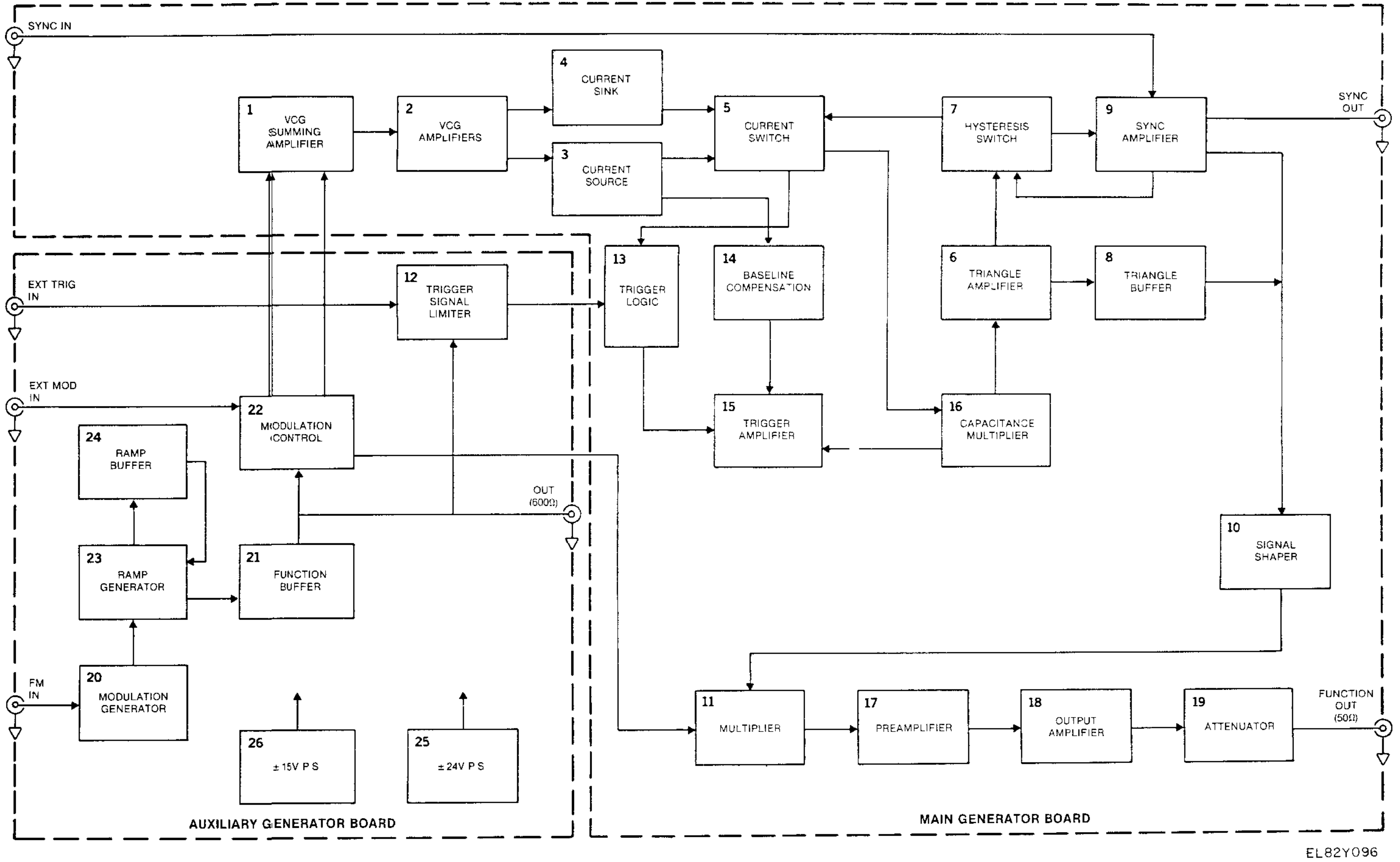
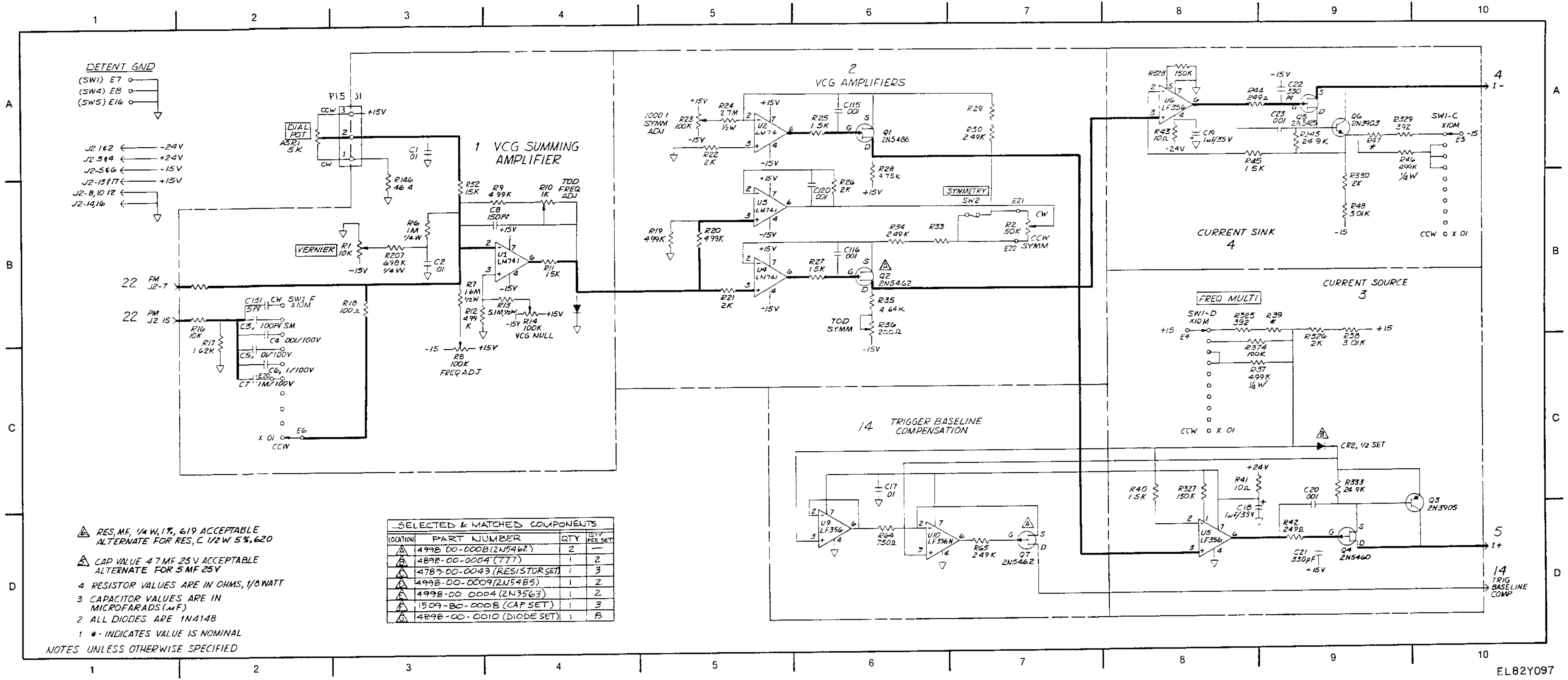


Figure FO-1. Overall Functional Block Diagram



NOTES UNLESS OTHERWISE SPECIFIED

1 ✱ - INDICATES VALUE IS NOMINAL

2 ALL DIODES ARE 1N4148

3 CAPACITOR VALUES ARE IN MICROFARADS (μF)

4 RESISTOR VALUES ARE IN OHMS, 1/8 WATT

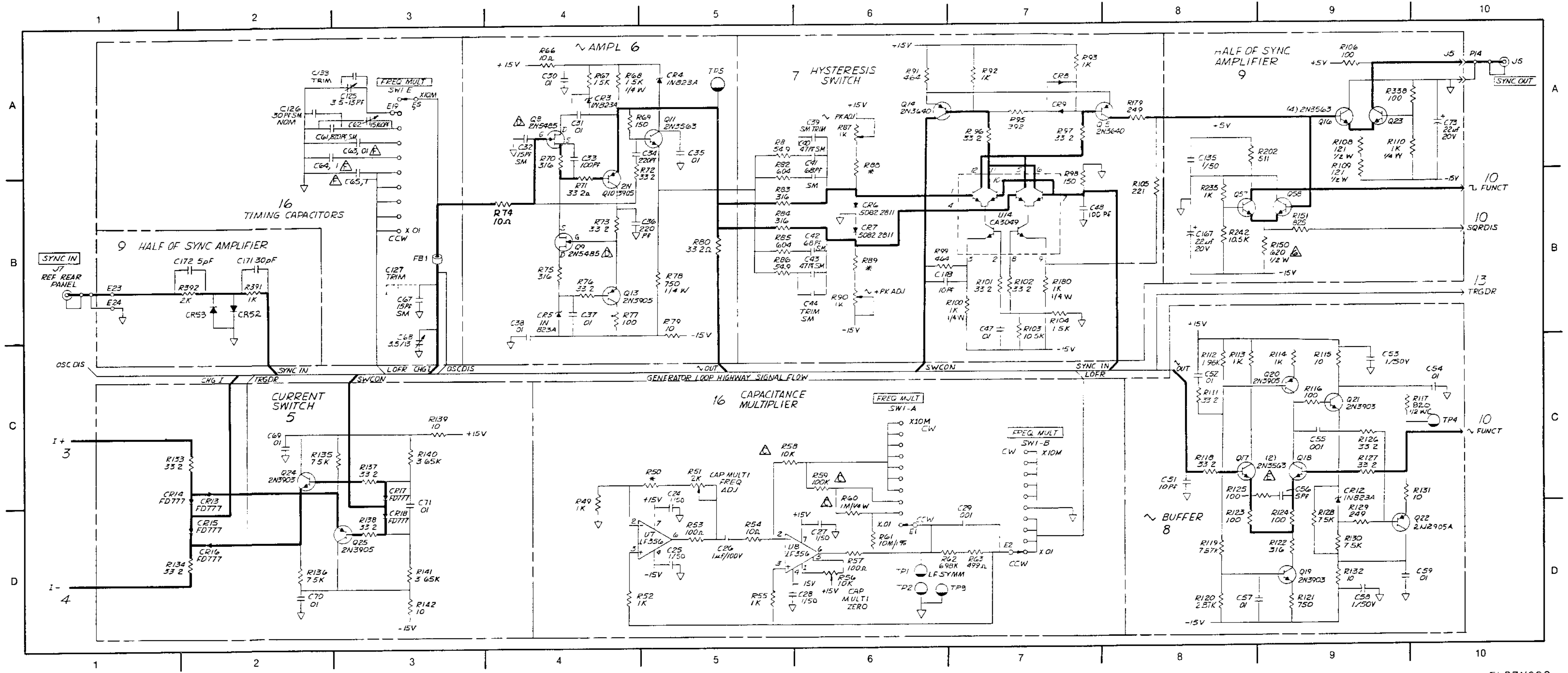
5 CAP VALUE 4 7 MF 25 V ACCEPTABLE ALTERNATE FOR 5 MF 25V

6 RES, MF, 1/4 W, 1%, 619 ACCEPTABLE ALTERNATE FOR RES, C 1/2 W 5%, 620

SELECTED & MATCHED COMPONENTS

LOCATION	PART NUMBER	QTY	QTY PER SET
A	4998 00-0008 (2N5462)	2	—
B	4898-00-0004 (777)	1	2
C	4789-00-0043 (RESISTOR SET)	1	3
D	4998-00-0009 (2N5485)	1	2
E	4998-00 0004 (2N3563)	1	2
F	1509-80-0008 (CAP SET)	1	3
G	4898-00-0010 (DIODE SET)	1	8

FIGURE FO-2. MAIN BOARD SCHEMATIC (SHEET 1 OF 4)



EL8ZY098

FIGURE FO-2. MAIN BOARD SCHEMATIC (SHEET 2 OF 4)

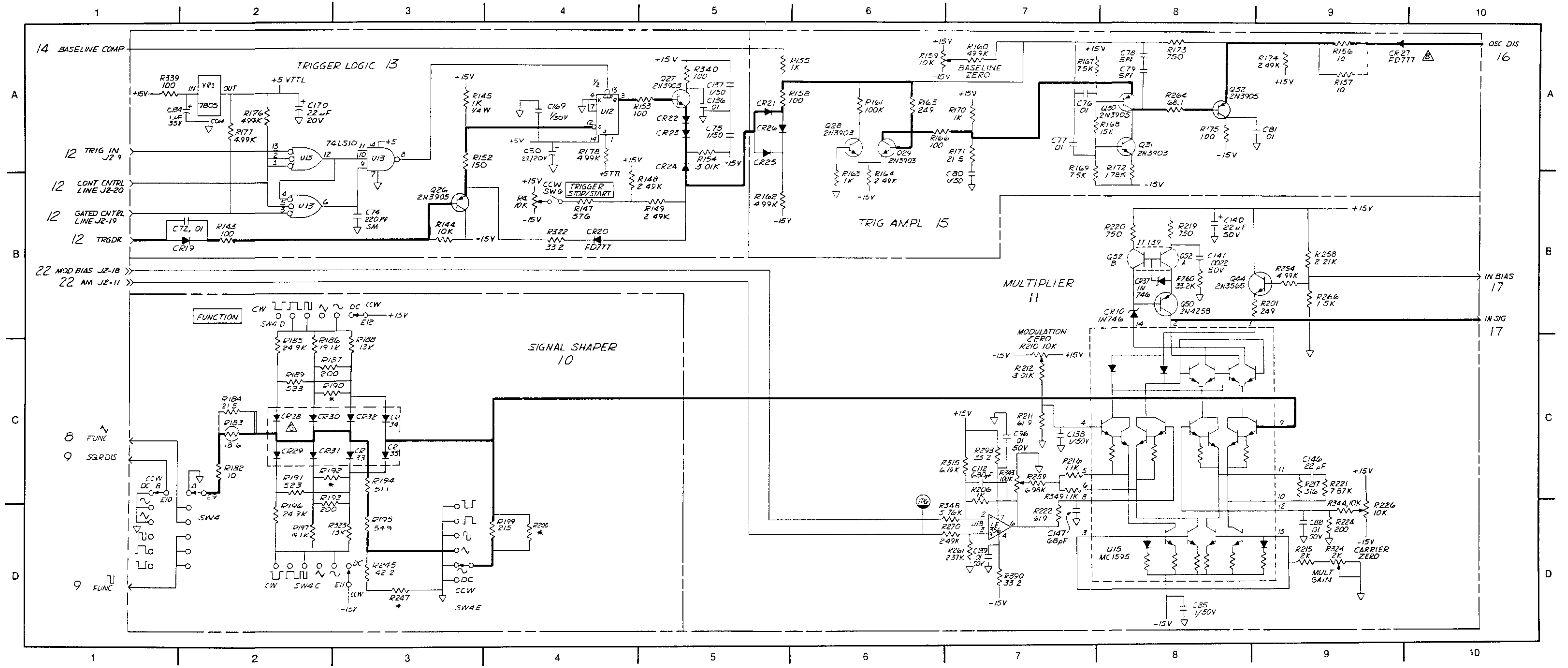


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FIGURE FO-2. MAIN BOARD SCHEMATIC (SHEET 3 OF 4)

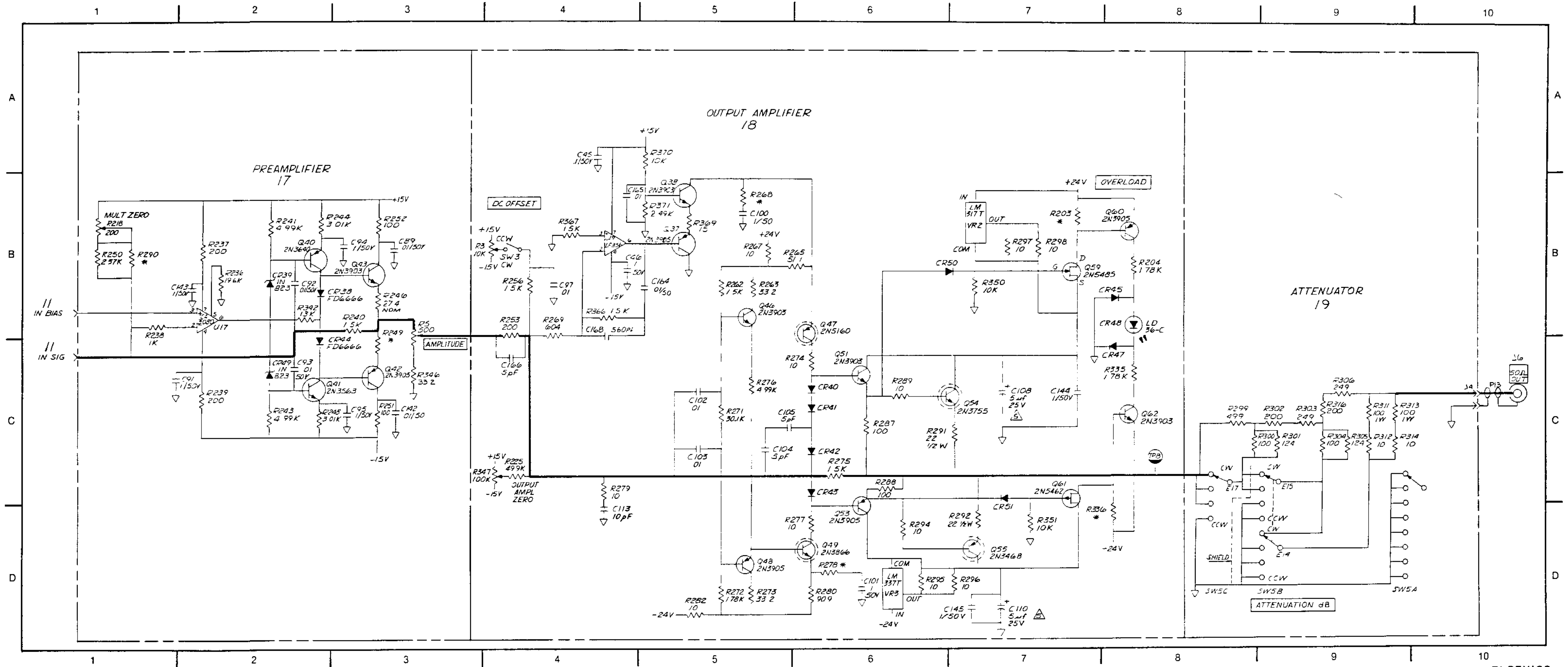

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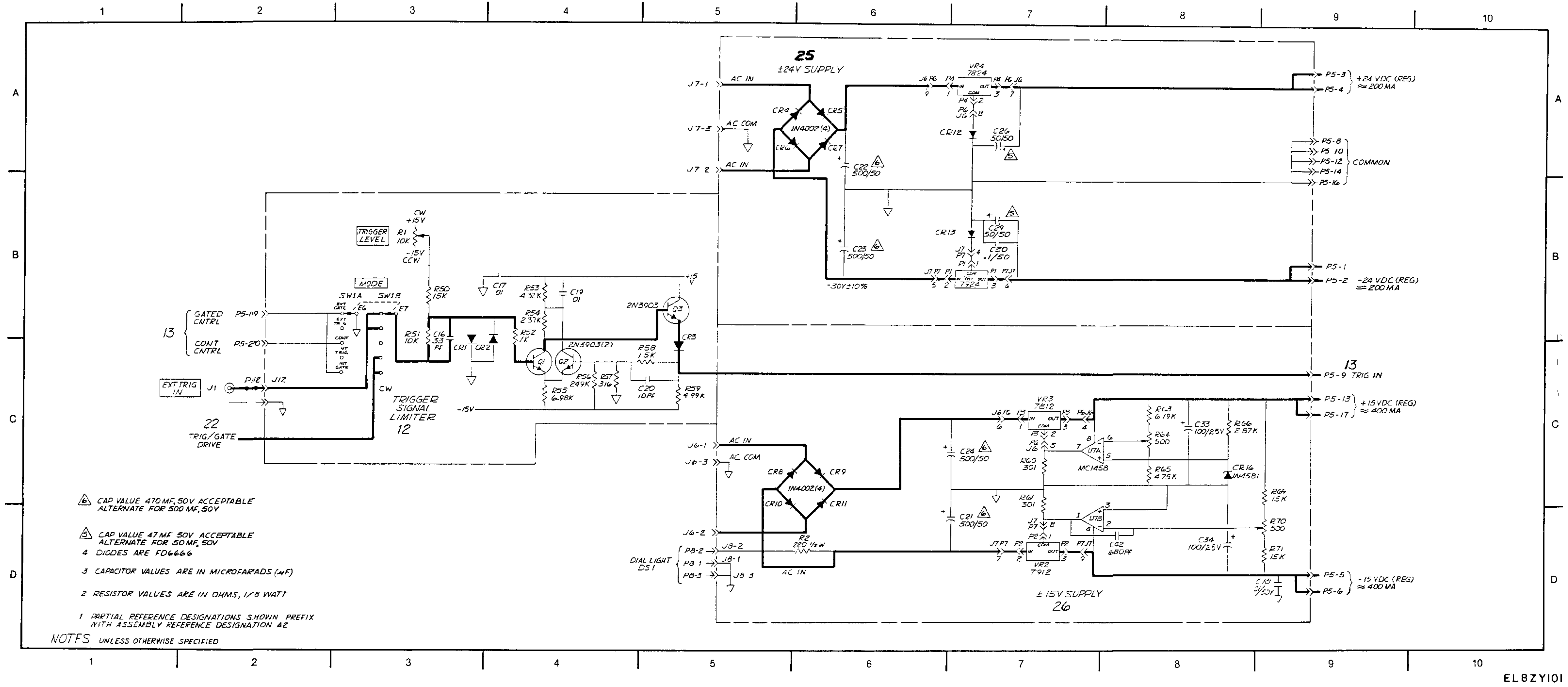
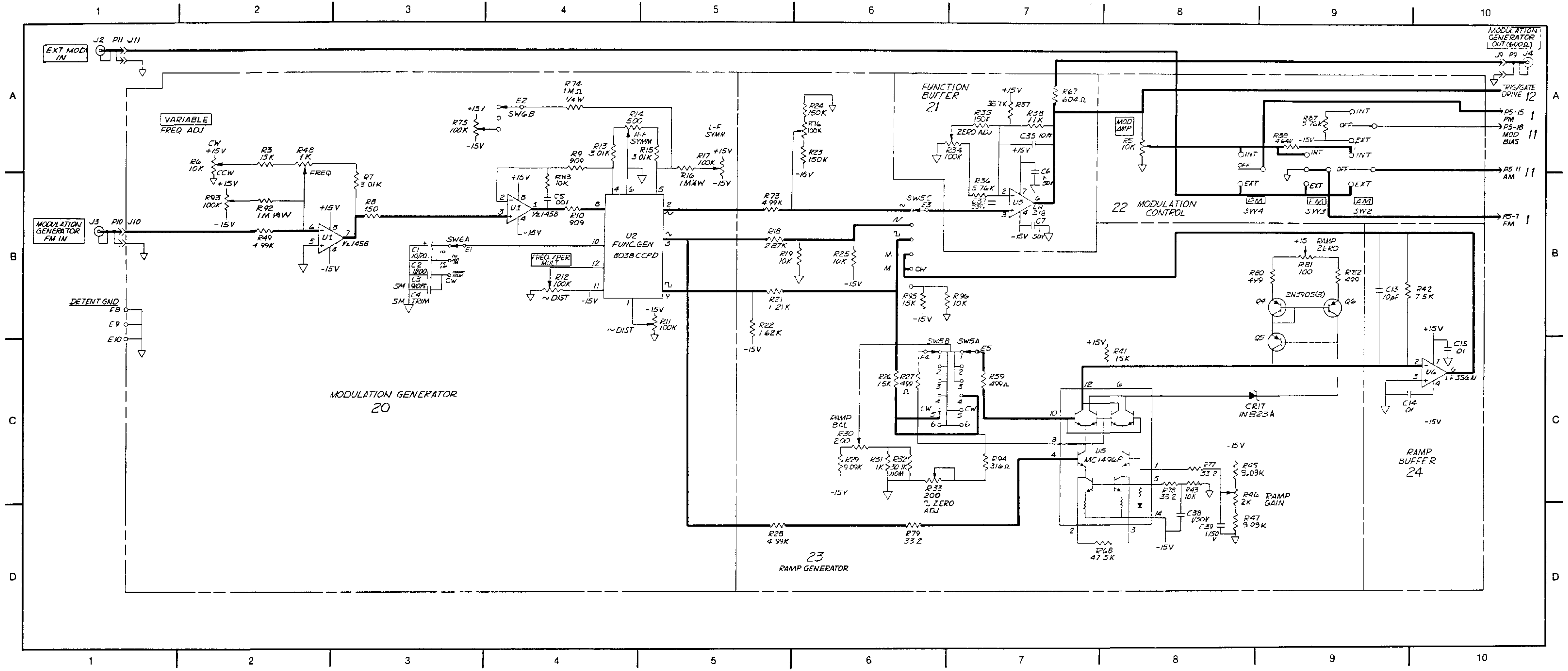
FIGURE FO-2. MAIN BOARD SCHEMATIC (SHEET 4 OF 4)



EL8ZY101

FIGURE FO-3. AUXILIARY BOARD SCHEMATIC (SHEET 1 OF 2)



EL8ZY102

FIGURE FO-3. AUXILLARY BOARD SCHEMATIC (SH 2 OF 2)

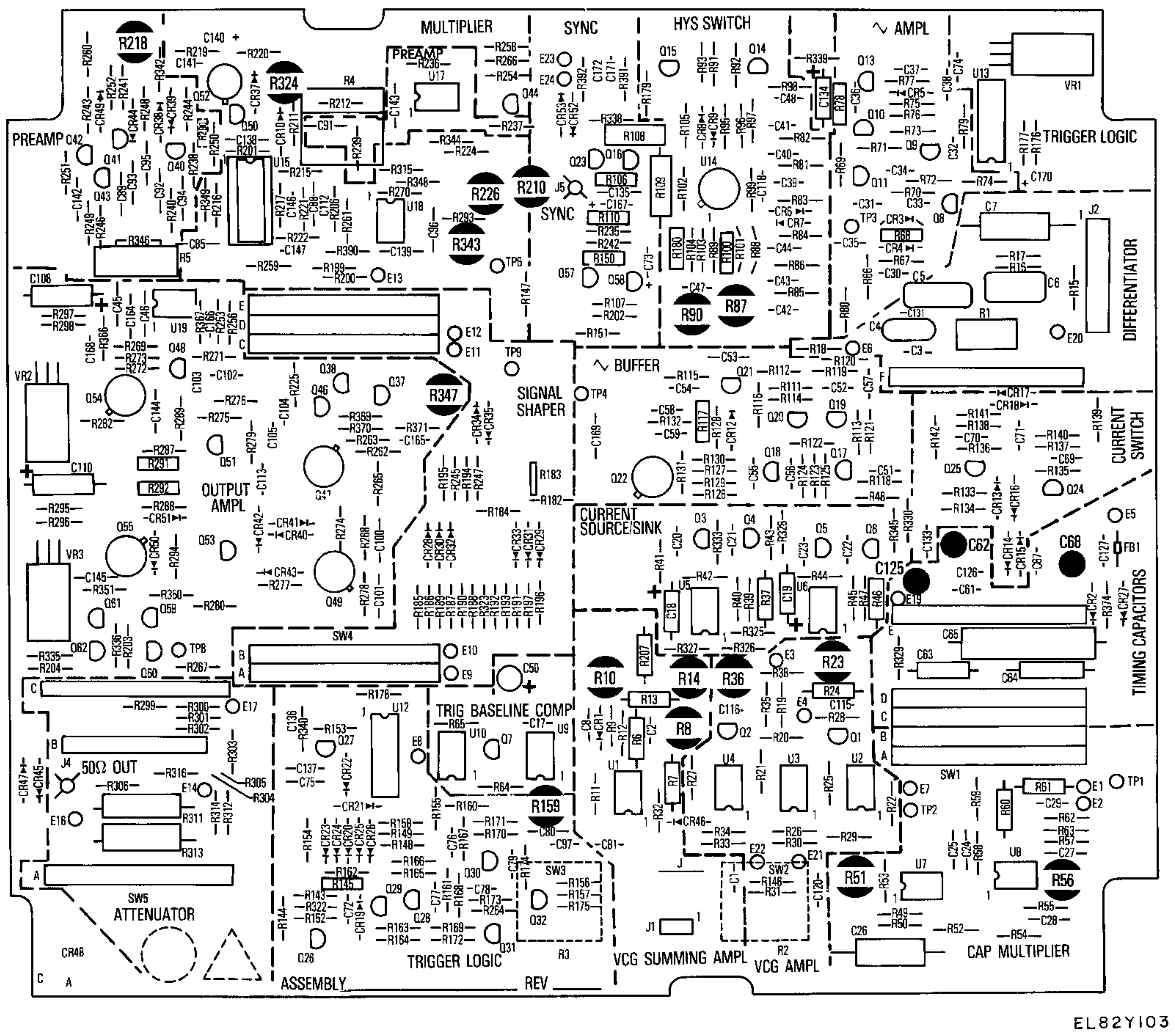
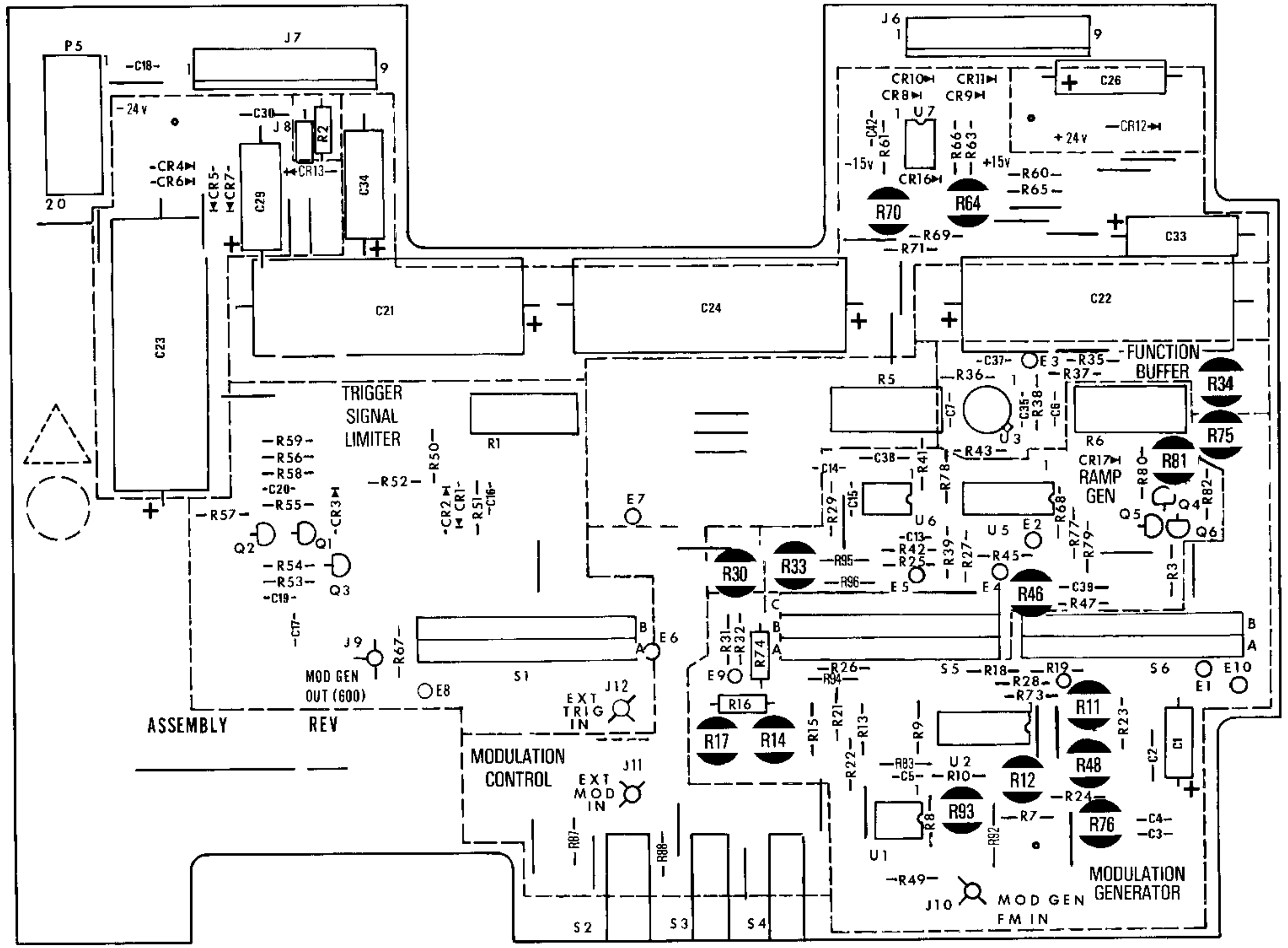


Figure FO-4. **Main Board Assembly**



EL8ZY104

Figure FO-5. Auxiliary Board Assembly

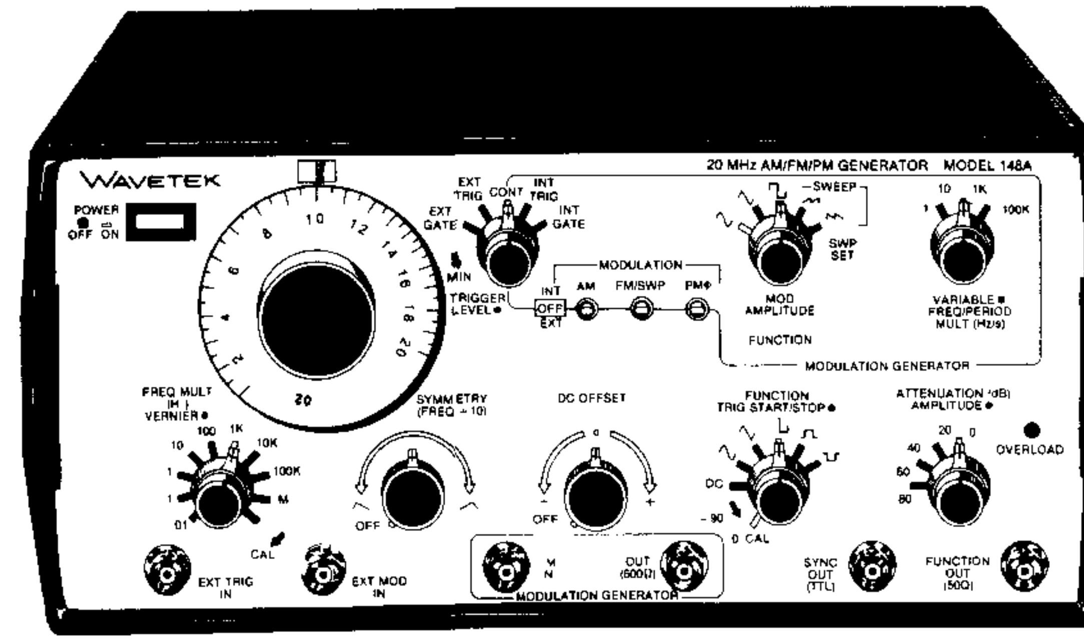


Figure FO-6 **Front Panel (Outside View)**

EL8ZY105

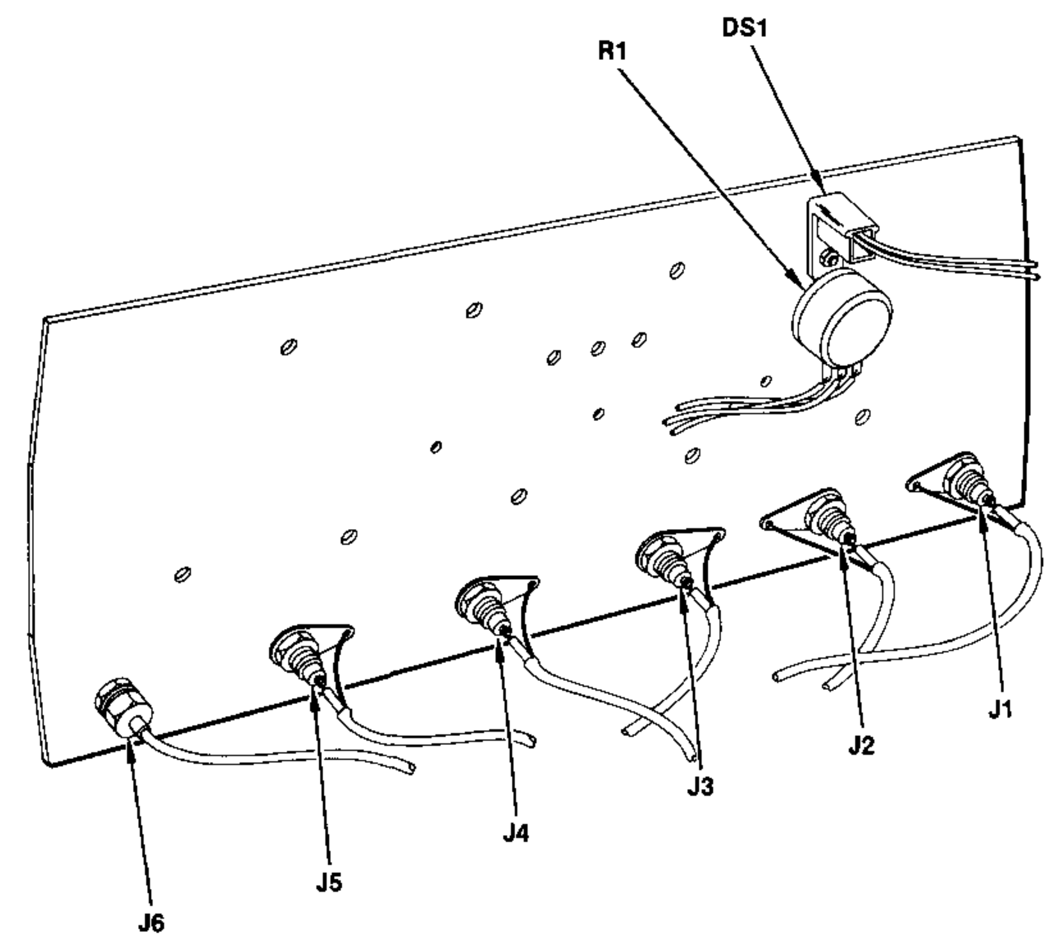


Figure FO-7 **Front Panel (Inside View)**

EL82Y106

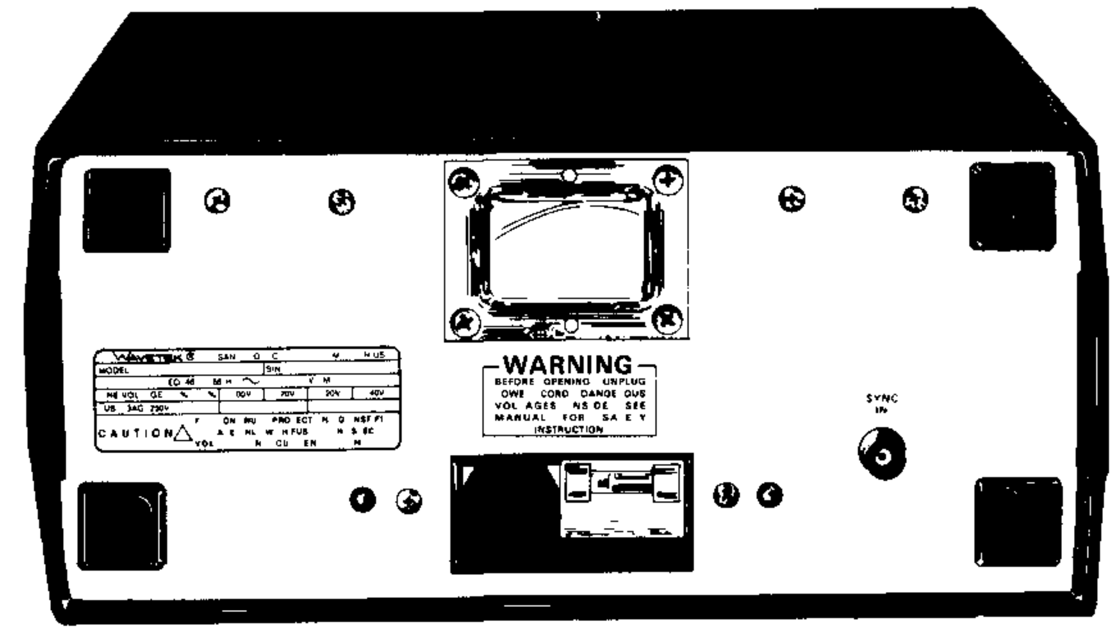


Figure FO-8. **Rear Panel (Outside View)** EL8ZY107

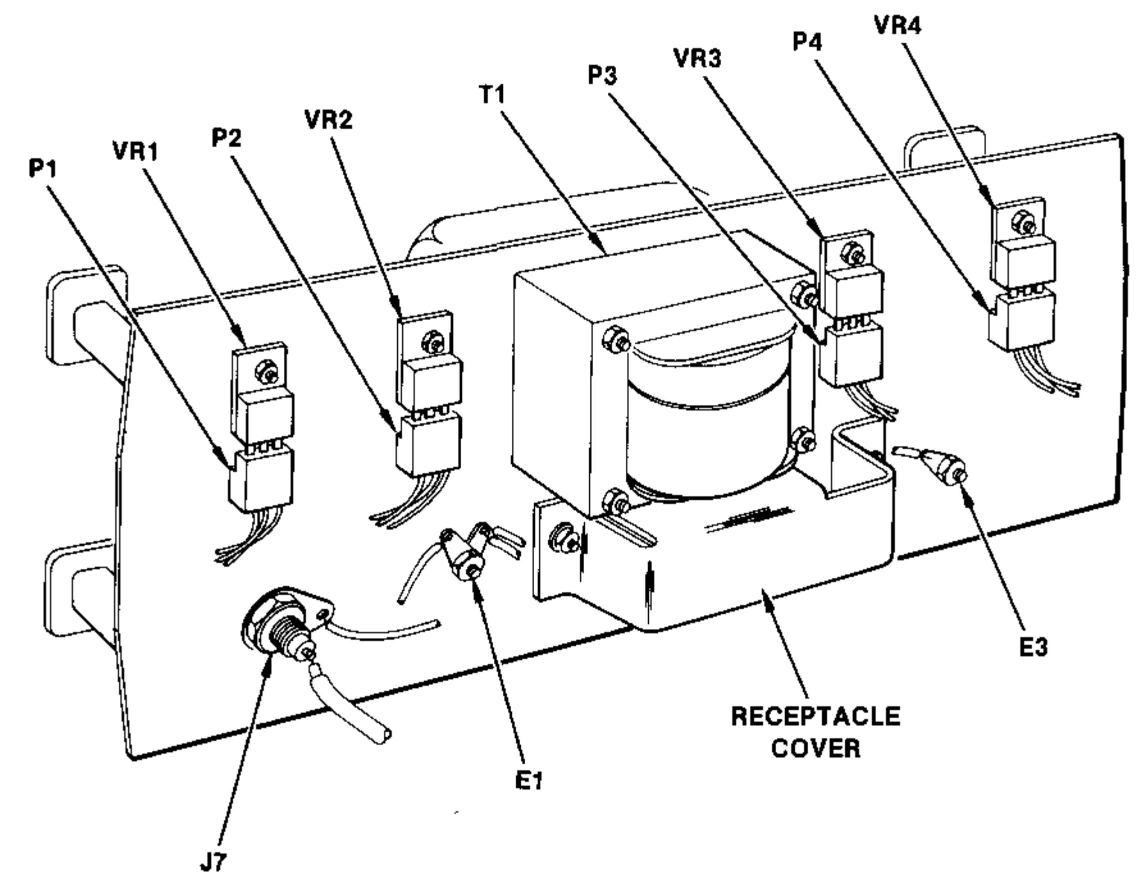
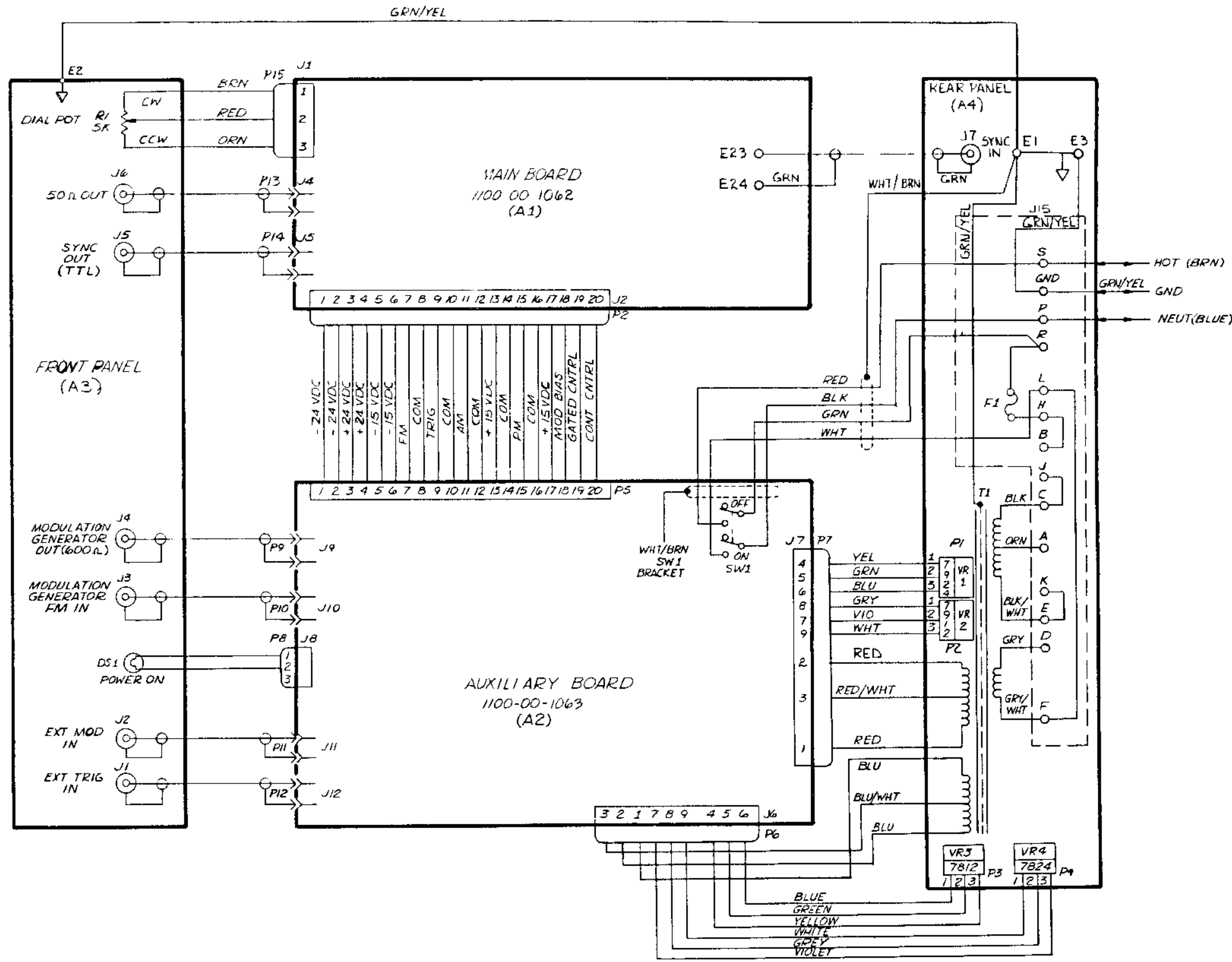


Figure FO-9. **Rear Panel (Inside View)** EL8ZY108



EL8ZY109

FO-10 NSTRUMENT SCHEMATIC (INTERCONNECTING DIAGRAM)

SUBJECT INDEX

SUBJECT INDEX (CONT)

SUBJECT INDEX (CONT)

SUBJECT INDEX (CONT)

SUBJECT INDEX (CONT)

Subject | Paragraph, Figure or Table

R (Cont)

SUBJECT INDEX (CONT)

SUBJECT INDEX (CONT)

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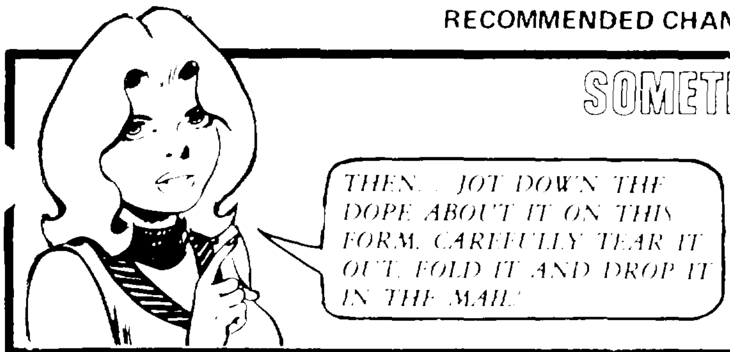

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Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703-5007

DATE SENT
10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
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.
		F03		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.

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

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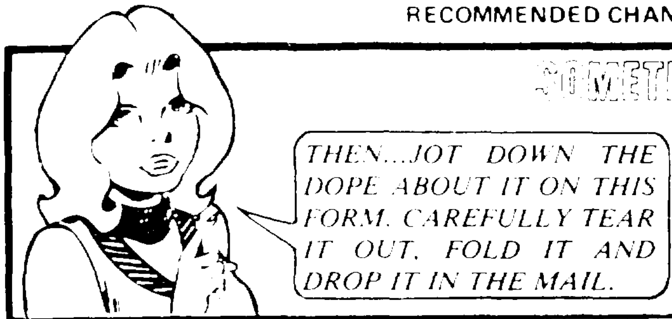

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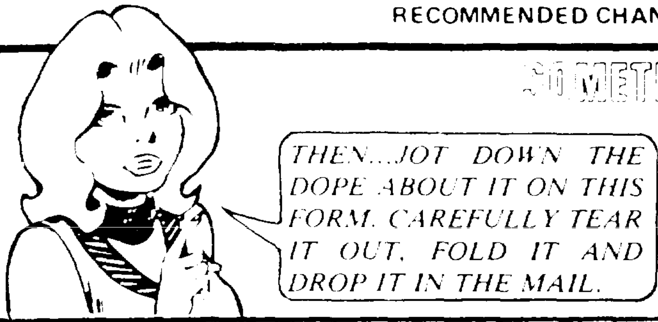

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