

INSTRUCTION MANUAL

**MODEL 142 -S- 527
FUNCTION GENERATOR**

WAVETEK
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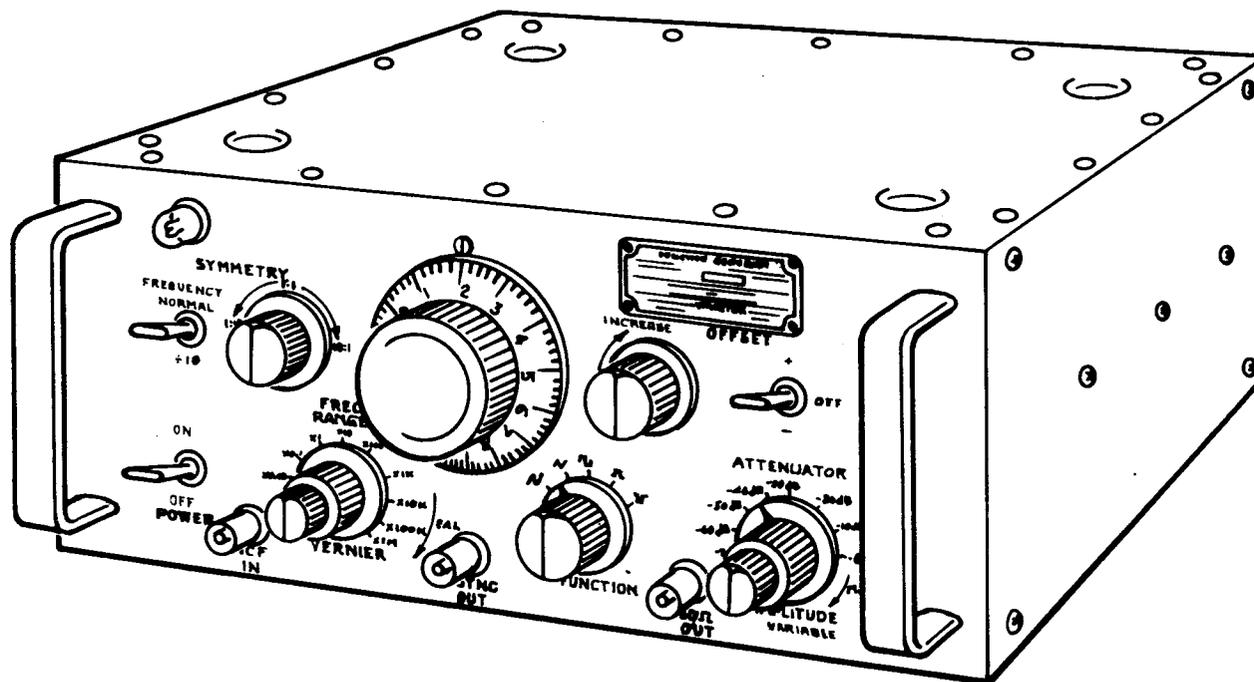


Figure 1-1. Function Generator, Model 142-S-527

CHAPTER 1
INTRODUCTION

1-1. PURPOSE AND FUNCTION

1-2. The Model 142-S-527 Function Generator, FSN 6625-01-005-7236, manufactured by WAVETEK, San Diego, CA, illustrated in figure 1-1, herein called the instrument, provides sine, square, triangle, positive pulse, and negative pulse outputs (with a separate sync output) over a 0.0005 Hz to 10 MHz frequency range. With this instrument it is possible to simultaneously sweep the output frequency, select the output symmetry desired, and manually vary the offset. This capability, coupled with the variety of waveforms available and precision output amplitude control, makes the instrument an extremely versatile piece of test equipment for engineering, manufacturing, and laboratory applications.

1-3. GENERAL PHYSICAL DESCRIPTION.

1-4. Weighing approximately 11.34 kg (25 pounds) the instrument is 48.26 cm (19 inches) wide, 30.48 cm (12 inches) high, and 45.72 cm (18 inches) deep. The instrument is housed in a compact ruggedized, portable case. A copy of this manual is shipped with the instrument.

1-5. SPECIFICATIONS.

1-6. The following specifications establish the performance, design, development and test requirements for the Model 142-S-527 Function Generator.

1-7. Versatility. The instrument has the capability of producing selectable sine , square , triangle , positive pulse , and negative pulse , output waveforms. The symmetry of all outputs are continuously adjustable from 1:10 to 10:1. Varying the 1:1  triangle symmetry provides a sawtooth (ramp) signal of 1:10 , or 10:1  for the output.

1-8. Frequency. The operating frequency range of 0.0005 Hz to 10 MHz is selectable as listed in table 1-1.

NOTE

When symmetry control is used, indicated frequency is divided by a factor of approximately 10.

Table 1-1. Operating Frequency Range

SELECTION	RANGES
X.001	0.0005 Hz to .01 Hz
X.01	0.005 Hz to .1 Hz
X.1	0.05 Hz to 1 Hz
X1	0.1 Hz to 10 Hz
X10	0.1 Hz to 100 Hz
X100	1 Hz to 1 kHz
X1K	10 Hz to 10 kHz
X10K	100 Hz to 100 kHz
X100K	1 kHz to 1 MHz
X1M	10 kHz to 10 MHz

The dial accuracy is \pm (1% of dial setting + 1% of full scale) for settings of 0.001 Hz to 1 MHz and \pm (2% of dial setting + 2% of full scale) for 0.0005 to 10 MHz settings. The frequency stability is \pm 0.1% for 10 minutes and \pm 0.5% for 24 hours.

1-9. SYNC OUTPUT. The sync output square wave signal has an amplitude of greater than or equal to 2 volts peak-to-peak into a 50 ohm load. The output frequency and stability of the sync signal is the same as that of the output signal. The rise time is less than or equal to 20 nanoseconds and the fall time is less than or equal to 30 nanoseconds. The output impedance of the sync output is 50 ohms (\pm 3%).

1-10. OFFSET. The control for offset provides a positive and negative offset which is continuously variable from 0 to \pm 15 volts into an open circuit (greater than or equal to 1 megohm) and 0 to \pm 7.5 volts into a 50 ohm (\pm 3%) load. The -70 dB attenuator proportionately attenuates both the offset and the waveform. The continuously variable control is enabled

only when the OFFSET switch is in either the + or the - position. The stability of the offset is $\pm 0.1\%$ of max Vdc for 10 minutes and $\pm 0.5\%$ of max Vdc for 24 hours.

1-11. DUTY CYCLE. The control for symmetry is separated into two controls, the $\div 10$ /FREQUENCY NORMAL switch and the 1:10/1:1/10:1 variable control to select the amount of symmetry desired. This control is continuously adjustable from 1:10 to 10:1 whenever the SYMMETRY switch is in the $\div 10$ position.

1-12. VCF CONTROL RANGE. The Voltage Controlled Frequency (VCF) is capable of controlling the frequency up to 1000:1 with the application of an external voltage input of 0 to ± 5 volts of change. The slew rate for the change is 2% of the frequency range per microsecond or 0.5 volts per microsecond for input voltage control. The bandwidth of the input is 100 kHz and the maximum voltage limit of the input without damage is ± 15 volts. The upper frequency is limited to maximum of the selected range; the bottom frequency is limited to the minimum possible for the range selected. Input impedance for the VCF connector is 5,000 ohms.

1-13. AMPLITUDE. The instrument supplies a variable output voltage from 0 to 30 volts peak-to-peak into an open circuit (greater than or equal to 1 megohm) and 0 to 15 volts peak-to-peak into a 50 ohm ($\pm 3\%$) load. The change in amplitude with frequency changes is less than:

0.1 dB . . . 0.0005 Hz to 100 kHz
 0.2 dB 100 kHz to 1 MHz
 2.0 dB 1 MHz to 10 MHz

1-14. ATTENUATOR. The attenuator is capable of providing calibrated attenuation in 10 dB increments from 0 dB to 70 dB. Another 10 dB of attenuation is available with the AMPLITUDE VARIABLE control. The calibrated attenuator accuracy is 0.025 dB per dB.

1-15. AMPLITUDE STABILITY. The short term amplitude stability is within 0.1% of maximum peak-to-peak for 10 minutes. The long term amplitude stability is within 0.5% of maximum peak-to-peak amplitude for 24 hours.

1-16. WAVEFORMS. The following waveforms (except pulse) are symmetrical about ground within $\pm 1\%$ of maximum peak-to-peak amplitude with OFFSET in the OFF position.

a. The sine wave generated by the instrument has a flat frequency response with a harmonic distortion of not greater than 0.5% from 0.001 Hz to 100 kHz, 1.0% from 100 kHz to 1 MHz, and 3.0% from 1 MHz to 10 MHz.

b. The triangular waveform generated by the instrument has a linearity of greater than or equal to 99% from 0.0005 Hz to 100 kHz and greater than or equal to 95% from 100 kHz to 1 MHz.

c. The square wave and pulse rise and fall times are less than or equal to 20 nanoseconds when terminated into a 50 ohm ($\pm 3\%$) load. Rise time is defined as the time required for a signal pulse to rise from 10% to 90% of its maximum value. Fall time is the time required for the signal pulse to fall from 90% to 10% of its maximum value.

1-17. ABERRATIONS. The following are maximum aberrations for the instrument:

a. Hum and Noise. The hum and noise of the instrument is less than 0.05% of maximum peak-to-peak output.

b. Ringing. The ringing of the instrument is less than or equal to 5% of maximum peak-to-peak amplitude.

c. Droop. The droop for the instrument is less than or equal to 5% at the maximum pulse width.

d. Overshoot and Undershoot. The overshoot and undershoot of the instrument is less than or equal to 5% of the maximum peak-to-peak amplitude.

e. Jitter. The cycle-to-cycle jitter instability of the instrument is less than $\pm 0.02\%$.

WARNING

This instrument is connected for 115 Vac operation. The attached fuses must be used when the instrument is switched to 230 Vac operation.

1-18. POWER. The instrument is capable of operating from either a 115 volt or a 230 volt, single phase 50, 60 or 400 Hz power source with a maximum power drain of 50 watts. The instrument has two different fuse types to match the voltage requirements; the 115 Vac supply requires a .5 amp fuse and the 230 Vac supply requires a .25 amp fuse. A front panel indicator (green) indicates when power is applied with the power switch ON and the instrument plugged into an active source. The source selection, a 115/230 switch on the back panel of the instrument, must be selected and the correct fuses installed prior to plugging in the instrument.

1-19. ENVIRONMENTAL. The operating temperature for the instrument is 0 to 55° C.

1-20. ACCESSORIES AND EQUIPMENT

1-21. Table 1-2 is a list of the items supplied and table 1-3 is a list of the items required but not supplied.

Table 1-2. List of Items Supplied

ITEM	DESCRIPTION
Instruction Manual	TECHNICAL MANUAL OPERATION and MAINTENANCE INSTRUCTIONS MODEL 142-S-527 FUNCTION GENERATOR

Table 1-3. List of Items Required But Not Supplied

ITEM	DESCRIPTION
Adapters	BNC tees, BNC to banana, and BNC to UHF adapters as required by ancillary equipment.
SYNC OUT Cable	Connecting cable; RG58U, or equivalent 50Ω RF Coaxial cable not greater than four foot long, with female BNC connectors.
VCF IN Cable	Connecting cable; RG58U, or equivalent 50Ω RF Coaxial cable not greater than four foot long, with female BNC connectors.
50Ω OUT Cable	Connecting cable; RG58U, or equivalent 50Ω RF Coaxial cable not greater than four foot long, with female BNC connectors.

1-22. TEST EQUIPMENT REQUIRED

1-23. Table 1-4 is a listing of the test equipment required for maintenance and alignment of the Model 142-S-527 Function Generator.

Table 1-4. Test Equipment

NOTE

The Required Characteristics column gives the principal parameters required for maintaining the instrument and may be used to assist in the selection of alternate equipment. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED EQUIPMENT
Frequency Counter	Measurement range: freq; 50 Hz to 20 MHz. Period: 0.001 Hz to 50 Hz with resolution of 0.01 millisecond. Uncertainty: $\pm 0.01\%$.	Dana Model 8015, or equivalent.
D.C. Voltage Source	Range: 0.0 to 5.0 Vdc. Uncertainty: $\pm 0.05\%$.	Cohu Model 324 or equivalent.
Oscilloscope	Sweep speed: lms/div to 20ns/div, $\pm 3\%$. Vertical sensitivity: 0.1 to 20V/div, $\pm 3\%$. DC to 50 MHz bandwidth, dual trace and comparator. Resolution: 1 mV.	Tektronix 7603, 7704A or 7904 with 7A12 or 7A26, 7B92 or 7B70 and 7A13 plug-in units, or 547, 548B, 543B, 544, 545B or 545A with 1A1 and type W plug-in units.
Digital Voltmeter (DVM)	Ranges: 0.0 to ± 20.0 Vdc, $\pm 0.1\%$; 0.0 to 300.0 Vac, $\pm 0.1\%$. Frequency: 30 Hz to 50 kHz. Resolution: 100 μ V.	Data Precision 1450 or equivalent.
Distortion Analyzer	Frequency range: 5 Hz to 600 kHz; can measure 0.1%.	H-P 332A or 334A or equivalent.
Audio Spectrum Analyzer	Frequency range: 5 Hz to 50 kHz. Dynamic range: 80 dB. Frequency response: 20 Hz to 20 kHz ± 0.3 dB, 5 Hz to 50 kHz ± 0.5 dB.	H-P 3580A or equivalent.
50 Ω Attenuator	50 Ω impedance 10x (20 dB attenuator) $\pm 2\%$ at dc, $\pm 5\%$ at 2 GHz, 2 W.	Tektronix 011-0059-02 or equivalent.
Spectrum Analyzer	Frequency range: 1 kHz to 110 MHz. Frequency response: ± 0.5 dB	H-P 141T with 8553B and 8552B or 140T with 8553L and 8552A plug-in units.

1-24. SAFETY PRECAUTIONS

1-25. This paragraph describes the hazards associated with the operation and maintenance of the instrument. Basic safety concepts and responsibilities are reviewed and precautions are described. General safety precautions applicable to both operation and maintenance are presented first, followed by safety precautions applicable to a maintenance procedure. Throughout the remainder of this document these safety precautions will be presented in the following manner:

WARNING

An operational or maintenance procedure, practice, condition, etc., which if not strictly observed, could result in serious injury to, or death of personnel.

CAUTION

An operational or maintenance procedure, practice, condition, etc., which if not strictly observed, could result in damage to, or destruction of the instrument or connected equipment.

a. The following paragraphs contain general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this document. These are recommended precautions that personnel must understand and apply during the performance of tasks involved in the operation and maintenance of the instrument.

1. Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside an equipment with the high voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power; discharge and ground a cir-

cuit before touching it.

2. Under no circumstances should any person reach into equipment for the purpose of servicing or adjusting except in the presence of someone who is capable of rendering aid.

3. Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

The following warning appears in the text in this volume, and is repeated here for emphasis.

WARNING

High voltages capable of causing death are used in this instrument. Use extreme caution when servicing either the instrument or its load components.

b. The following paragraphs present maintenance safety precautions which are not related to any specific maintenance procedure and do not appear elsewhere in this document.

1. Sudden surges of power caused by grounding of the power lines can result in FLASHBURNS and EYESIGHT damage plus serious damage to the instrument.

2. Failure to remove line power prior to the cleaning of the inside of the instrument can result in serious injury or DEATH to personnel and serious damage to equipment.

3. Some maintenance may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

4. Fuses, relays, switches and all other components must be replaced with parts having the same voltage, current, resistance, power rating and operating characteristics. Ensure power is secured prior to touching, removing or replacing components.

CHAPTER 2
PREPARATIONS FOR USE AND INSTALLATION INSTRUCTIONS

2-1. UNPACKING AND INSPECTION

2-2. No special unpacking procedures are necessary. After unpacking, visually inspect the instrument for damage to knobs, connectors, switches and fuse holders. Rotate the knobs and flip the switches to ensure freedom from binding. Any damage must be repaired prior to use.

CAUTION

To prevent damage to the instrument, check for proper match of line and instrument voltage and proper fuse type and rating.

2-3. PREPARATION FOR OPERATION

2-4. To prepare the instrument for operation, determine the voltage and frequency rating of the source of power for the function generator and set the rear panel power selector to 115 Vac or 230 Vac, as appropriate, and select the correct fuses as specified below:

SOURCE	SETTING	FUSE
103.5 to 126.5 Vac 50 to 400 Hz	115 Vac	.5 Amp
207 to 253 Vac, 50 to 400 Hz	230 Vac	.25 Amp

2-5. SIGNAL TERMINATION. Fifty ohm signal termination or loading of the 50 Ω OUT and SYNC OUT connectors is necessary for their specified operation; however, 50 Ω termination may not be necessary for satisfactory operation. The proper termination is shown in figure 2-1. Placing the 50Ω termination or 50Ω resistance in parallel with the circuit load at the receiving end of the connecting cable matches the receiving circuit input impedance to the instrument output impedance, thereby minimizing signal reflection or power loss on the line due to impedance mismatch.

dance to the instrument output impedance, thereby minimizing signal reflection or power loss on the line due to impedance mismatch.

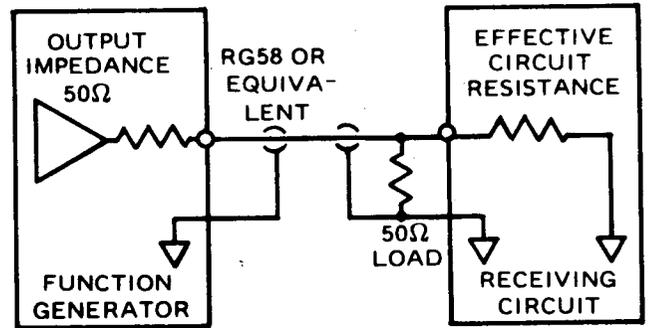


Figure 2-1. Signal Termination

2-6. MODEL 142-S-521 FUNCTION GENERATOR INITIAL OPERATION VERIFICATION

2-7. SETUP. Table 2-1 lists the steps required to check the initial operation of the instrument.

NOTE

Do not alter the alignment order or attempt to partially adjust the instrument. Subsequent steps often depend on preceding adjustments.

If the operation of the instrument is not as specified in the table, the instrument must be realigned. Alignment procedures are specified in chapter 5.

CAUTION

Ensure that the line voltage and frequency is compatible with the instrument to be adjusted.

Table 2-1. Initial Operation Verification

STEP	PROCEDURE	RESULT
1	Set the instrument as follows: FREQUENCY NORMAL/ $\div 10$ SYMMETRY Frequency Dial OFFSET (dial) OFFSET +/-OFF/- POWER FREQ RANGE Frequency VERNIER FUNCTION ATTENUATOR AMPLITUDE VARIABLE	NORMAL 10:1 Fully Counterclockwise Fully Clockwise OFF ON x100 Fully Clockwise Square Wave  -0 dB Fully Clockwise
2	Connect the 50 Ω OUT to the oscilloscope with a cable terminated into 50 Ω at the oscilloscope input.	
3.	Set the oscilloscope up as follows: Volts/Div - 5 Volts/Div Input coupling - DC Time/Div - .2 msec Triggering - Internal, Auto	Check for approximately two cycles, three divisions high of  waveform displayed.
4.	Select the  Function.	Check for approximately two cycles, three divisions high of  waveform displayed.
5.	Select the  Function.	Check for approximately two cycles, three division high of  waveform displayed.

CHAPTER 3
THEORY OF OPERATION

3-1. CIRCUIT DESCRIPTION

3-2. Refer to figure FO-1, the overall block diagram, and figure 3-1, the simplified timing diagram, when reading this description. These paragraphs describe the major circuit elements and their relationship to one another.

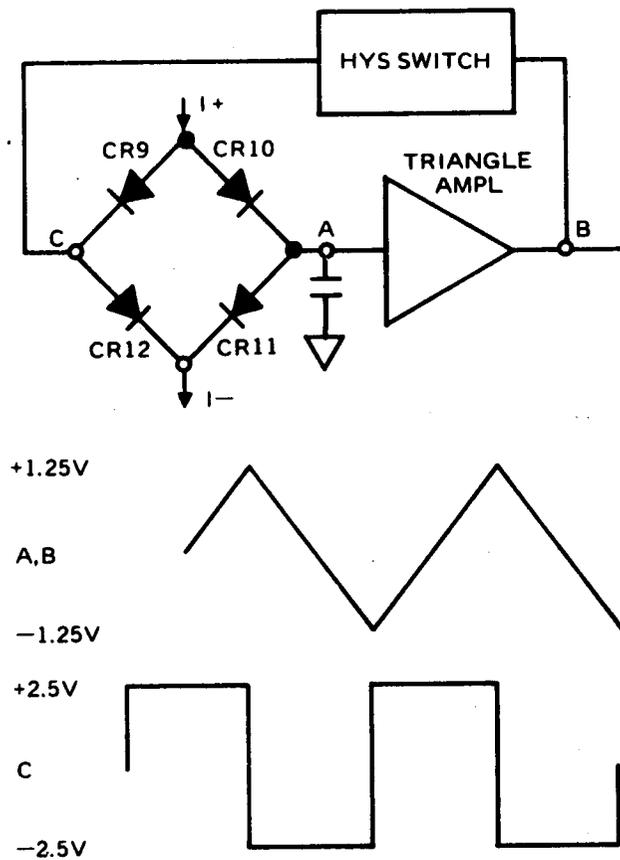


Figure 3-1. Simplified Timing Diagram

3-3. **DIAL BUFFER CIRCUIT.** The dial buffer sums the current from the frequency dial, VERNIER control and VCF IN connector. The dial buffer is an inverting amplifier; the output voltage controls the positive and negative current source. For symmetrical output waveforms, the currents from the two current sources are

equal but opposite and directly proportional to the voltage of the dial buffer output.

3-4. **DIODE GATE CIRCUIT.** The diode gate, which is controlled by the hysteresis switch, is used to switch the positive or negative current to the timing capacitor selected by the FREQ RANGE selector. If the positive current is switched into the timing capacitor, the voltage across the capacitor will rise linearly to generate the triangle rise transition. If the current is negative, the voltage across the timing capacitor will fall linearly to produce the fall transition of the triangle.

3-5. **TRIANGLE AMPLIFIER CIRCUIT.** The triangle amplifier is a unity gain amplifier whose output is fed to the hysteresis switch as well as to the triangle buffer. The hysteresis switch has two voltage limit points (+1.25 and -1.25V) at its input.

3-6. **HYSTERESIS SWITCH CIRCUIT.** During the time the output voltage of the triangle amplifier is rising, the output voltage of the hysteresis switch is positive, but when the output voltage of the triangle amplifier reaches +1.25V, it triggers the hysteresis switch, causing the hysteresis switch output to switch negative. Once the control voltage into the diode gate becomes negative, it switches the positive current out and the negative current in to the timing capacitor, so that the direction in the voltage change across the capacitor reverses, starting a linear decrease of the waveform. When the decreasing voltage reaches -1.25 V the hysteresis switch output switches back to positive, reversing the process. This action generates the triangle waveform. Since the hysteresis switch output is a square wave, the result is simultaneous generation of a square wave and a triangle wave at the same frequency in the phase relationship illustrated in figure 3-1.

3-7. VCF CURRENT SOURCE CIRCUIT. The output frequency is determined by the capacitance selected by the FREQ RANGE selector and, within a given range, the magnitude of the positive and negative current sources. Since the current sources are linearly proportional to the control voltage of the dial buffer circuit, the output frequency will also be linearly proportional to the control voltage.

3-8. SIGNAL SHAPING CIRCUIT. The complementary output of the hysteresis switch is fed to both the sync amplifier and signal shaping circuit. The signal shaping circuit consists of shaping circuitry which limits the square wave output swing to ± 1.25 volts. For negative pulse outputs, it limits the output voltage swing from -1.25 to 0 volts; and for positive pulse outputs, from 0 to $+1.25$ volts. A sine wave is formed from the triangle wave in this circuit by using nonlinear characteristics of diodes. A thermistor is used at the input of the signal shaping circuit to minimize the effect of temperature on the voltage drop across the diodes.

3-9. OUTPUT AMPLIFIER CIRCUIT. The sine, triangle, square, positive pulse, or negative pulse is fed to the output amplifier through the FUNCTION switch, preamplifier circuit and amplitude variable control. The output amplifier is an inverting amplifier with an output fed into a step attenuator and then to the 50Ω OUT connector.

3-10. OUTPUT ATTENUATOR CIRCUIT. The output attenuator consists of seven 10 dB sections. The output impedance stays at 50Ω as these sections are used. The result is a distributed attenuation in 10 dB steps from 0 to 70 dB.

3-11. BLOCK ANALYSIS

3-12. These paragraphs provide further descriptions of the functions of the basic circuits comprising the instrument. As each block circuit is described, refer to the appropriate portions of the schematic diagrams.

3-13. DIAL BUFFER. Figure FO-2 contains the schematic for the dial buffer, positive current source and negative current source. IC1 is a summing amplifier which sums the VCF IN current through R2, the current from the frequency dial R1 and the current from the VERNIER control R10. IC1 is an inverting amplifier which controls the output voltage from 0 to -5 volts under normal operating conditions. The output of IC1 is used to control both the positive and negative current sources, I+ and I-. With the SYMMETRY switch set to FREQUENCY NORMAL, the 50 kohm potentiometer R32 (symmetry control) is shorted and the amplifier IC4 is disconnected. There are two current paths; the positive current path is through R35, SW6, R20, and Q1 to IC3 and the negative current path is straight to IC6. This current is proportional to the output of IC1 due to the drop across R21 for the positive current and the combination of the drop across R36 and R37 in series for the negative current. The effect is that the output of the dial buffer IC1, as referenced to common is transferred as an equal voltage across R21 and the series combination of R36 and R37 as referenced to each power supply. Each of these voltages is again transferred by IC3 to R22, R23, and R24 for the positive current and by IC6 to R41, R42 and R43 for the negative current. This results in positive and negative currents flowing in the two outputs, I+ and I-, each proportional to the dial buffer summation. When these output currents are switched alternately to the timing capacitor, a symmetrical triangle wave is generated with frequency proportional to the sum of the dial buffer inputs. With the SYMMETRY switch in the $\div 10$ position, the 50 kohm SYMMETRY control R32 is inserted into the positive current path so the resistance is now approximately 50 kohms instead of the previous 5 kohm. This results in an output frequency of one tenth of the previous case. At the same time, the output of IC4 is connected to the arm of the potentiometer R32, forcing this point to one half of the output voltage of the dial buffer. This does not change the

sum of the positive and negative currents, but the relationship of one to the other is now determined by the SYMMETRY control. This relationship can be changed between extremes of 10:1 and 1:10, resulting in these waveform symmetries at the same frequency, one tenth of that indicated by the frequency controls. For FREQ RANGE selections of x10 through x100K, the range is selected by changing the value of the timing capacitor connected to the diode gate. Current source setting resistors R23/R24 and R42/R43 are 9 kohm in these ranges. In the x1M FREQ RANGE setting these resistors are changed to 1 kohm to boost the output frequency by a factor of 9. This, with the capacitor change, gives ten times the output frequency on the top range.

3-14. CAPACITANCE MULTIPLIER. In the FREQ RANGES of x1 through x0.001, a capacitance multiplier circuit senses the timing capacitor charging current and subtracts the appropriate amount so that the effective charging current is a fraction of that delivered by the current sources. This is accomplished by the connection of the capacitance multiplier to the timing capacitor with one input-output terminal through a section of the FREQ RANGE switch. The + terminals of IC7 and IC8 serve as potentiometric input to these amplifiers. IC7 has a fixed resistive feedback network, giving it a fixed gain. Capacitor C12 and C13 is forced to comply to the triangle voltage wave being generated, because the R49 side is driven at the potential of the input/output terminal and the other side has the same waveform with some fixed gain from IC7. Since the side driven at the input/output signal is a summing node, it is fed the necessary current by the feedback resistor(s) R50, R52, R53 and R55. This feedback resistor is selected by the FREQ RANGE selector, taking on values which give the correct amplitude to the output of IC8. This output with respect to common is the input/output waveform with a square wave superimposed; TP2 is the testpoint where this output can be picked up for signal tracing. The input/output waveform is a

triangle wave so the voltage across R57 and R58 is a square wave with the correct amplitude to subtract part of the timing capacitor charging current. Since this square wave amplitude is controlled in decades by the FREQ RANGE selector, the instrument frequency is divided in decades even though the current sources and timing capacitor remain the same.

3-15. TRIANGLE AMPLIFIER. Figure FO-3 contains the schematic for the triangle amplifier; it uses Q7, an FET source follower, to drive Q9, a bipolar emitter follower, for an open loop gain of one. It is a fast, very high input impedance circuit with output impedance low enough to drive the hysteresis switch and the triangle buffer. In series with Q7, is a duplicate FET, Q8. Q8 has the identical drain current as Q7 and therefore the same gate-to-source voltage. In series with Q9 is a duplicate emitter follower, Q11. Q11 has the identical collector current as Q9; therefore, it has the same emitter-to-base voltage. Since the gate of the dummy FET is connected to the emitter of the dummy emitter follower, the two terminals have the same voltage. Therefore, within the tolerances of the part parameters and some unaccounted error for base current, the active emitter follower output voltage will be at the value of the input gate. The remaining transistor, Q10, is a second emitter follower for driving the dynamic lead networks at the input of the hysteresis switch. In this role it needs no dc integrity, as the output is not direct coupled.

3-16. HYSTERESIS SWITCH. Figure FO-3 contains the schematic for the hysteresis switch; it consists mainly of IC9, a double input comparator, and Q12/Q13, an output flip-flop. Each differential pair of IC9 compares an input voltage to common. The input network provides a positive bias to one and a negative bias to the other; therefore, when the input terminal (output of the triangle amplifier) is at ± 1.25 V, the flip-flop changes state. The flip-flop selects which input comparator of the hysteresis

switch will be activated in preparation for the next change of state. When the timing capacitor is integrating positively, the positive biased comparator is activated. When the timing capacitor voltage reaches +1.25 V, the flip-flop changes state, the negative comparator is activated and the direction of integration is reversed, so that when the timing capacitor signal reaches -1.25 V, the flip-flop switches back and the cycle starts over. In addition to the positive and negative biases at the comparator inputs, there is a dynamic lead network on each one. These lead networks are driven by Q10, a separate emitter follower, from the triangle amplifier. They provide the necessary lead to compensate for the inherent delays of the hysteresis switch, thereby keeping the higher frequency nonlinearity and sine distortion to a minimum.

3-17. DIODE GATE AND TIMING CAPACITOR. Figure FO-3 contains the schematic for the diode gate and the timing capacitor circuits. The current sources are switched to the timing capacitor by the hysteresis switch via a diode bridge arrangement called the diode gate. Actually, the hysteresis switch is linked to the bridge network by two emitter followers, Q20 and Q21, with independent outputs biased to be at the same voltage. The simplified timing diagram illustrated in figure 3-1 shows these points as one terminal at C. When the hysteresis switch output is positive, CR12 is forward biased, so that the negative current source is drawn from the drive circuit and is ineffective. CR9 and CR11 are reverse biased, providing isolation between the I- drive circuit and the timing capacitor. This leaves CR10 forward biased and free to conduct the positive current source output to the timing capacitor. When the timing capacitor voltage rises to the hysteresis switch point (+1.25 V), the hysteresis switch output switches low, forward biasing CR9 this back biases CR10 and CR12 and allows the I+ to be isolated and I to change the timing capacitor voltage in a negative direction through CR11. This state con-

tinues until the negative switch point is reached and reverts to the previous state.

3-18. SYNC AMPLIFIER. Figure FO-3 contains the schematic for the sync amplifier. The complementary output signal from the hysteresis switch which goes to the FUNCTION selection switch and the signal shaping circuit is also connected to a simple buffer stage called the sync amplifier. The four transistors, Q22, Q23, Q24 and Q25 provide an open loop gain of one and allow this signal to drive a 50 Ω load at the sync output.

3-19. TRIANGLE BUFFER. Figure FO-3 contains the schematic for the triangle buffer; it is a wide band dc amplifier providing a closed loop gain of one in potentiometric connection. The input differential, Q17, is a monolithic pair. The emitter long tail is fed from a current source at the negative supply Q45. The active collector load Q15 is also a current source providing greater open loop gain than a resistive load. Following this is an emitter follower, Q16, a zener diode level shifter, CR8, and another emitter follower, Q18, for the output stage. The gain is set to one by the 100% feedback to the input pair feedback side.

3-20. SIGNAL SHAPER. Figure FO-4 contains the schematic for the signal shaper circuit. This circuit is uniquely set up for each different waveform by four wafers of the FUNCTION selector switch. The ± 15 volt power is switched off in the triangle wave mode and there is virtually no effect on the triangle wave fed to the circuit. In the positive pulse mode, the square wave rather than the triangle wave is fed to the circuit and the -15 volt power is switched off. As a result, the negative swing of the input square wave is clipped off. The negative pulse is formed, when selected by the FUNCTION switch, in a similar manner. When the square or sine wave is selected both plus and minus 15 volt power is applied to the circuit. The difference in circuit setup for sine and square is the resistive load at the cir-

cuit output. For the sine wave mode, the matched set of diodes soft clip the input triangle at three different levels. These signals are resistively summed to produce a sine wave current at the preamp summing node. For the square wave mode, the input square wave is symmetrically hard-clipped by the diode network presenting a square wave input current to the preamp.

3-21. OUTPUT AMPLIFIER. Figure FO-4 contains the schematic for the output amplifier. The output amplifier is comprised of a low frequency dc amplifier and a high frequency ac amplifier. The Q26, Q27 and Q28 circuit is the dc amplifier and the remaining circuitry is the ac amplifier. The ac amplifier is symmetrically arranged, top and bottom. The upper portion amplifies the positive swing of the output while the lower mirror portion amplifies the negative swing. Operation is class AB; that is, there is independent positive half and negative half amplification, with a small amount of current flow in both sides near zero swing. The amplifier schematic has been simplified in figure 3-2 for the following discussion. Assume that both the input and the output voltages are zero, the voltage at point A should also be zero. Because of the symmetrical configuration of the amplifier, the current through Q30 and Q32 will be equal and the amount will remain at zero. If the input voltage goes positive, the voltage at point A will rise by a certain amount. This will cause the base voltage of Q30 to rise closer to +26 volts and at the same time cause the base voltage of Q32 to rise further away from -26 volts. Thus, the emitter base junction of Q30 will be less forward biased, thereby reducing its emitter current, while the Q32 emitter current increases, because of the forward bias increase of its emitter base junction. The result is that the voltage at point B and the output voltage will start to go negative. Finally, when the output has moved far enough negative to pull point A back to zero, the collector currents of Q30 and Q32 will again be equal and the voltage

at point B will stabilize. The amount of negative voltage at the output required to pull point A back to zero is controlled by the ratio of R_{fb} and R_{in} , and this ratio is the closed loop gain of the output amplifier. The circuit containing Q26/27/28 is a high gain low frequency amplifier used to bias the high frequency amplifier and to increase the low frequency open loop gain. The high frequency amplifier is dc isolated from the input by capacitance coupling to the bases of Q29 and Q31, as illustrated in figure FO4. It then employs the low frequency amplifier to bias the emitters of Q30 to obtain the required dc stability and high open loop gain. Emitter followers Q29 and Q31 increase the driving power to the bases of Q30 and Q32. Q34 and Q37 are a harnessed pair sharing the load through R176, R180 and R181 during the positive signal swing. Q34 and Q37 are driven by the collector of Q30. Q33 is a current limiter forming a protection circuit in case of an overload at the output. If the R176 voltage drop becomes too large, Q33 turns on, limiting the output of Q34. CR17 through CR20 compensate for the emitter-base junction voltage drops of Q34, Q36 through Q38 to control idling current, reduce crossover distortion and prevent thermal runaway.

The two resistor-capacitor networks, R158/C78 and R171/C79 are emitter bypass circuits to maintain the high frequency amplifier gain during the transition time prior to the dc amplifier taking effect. This improves the rise time since the dc amplifier requires a few microseconds to respond and stabilize. Another compensation is C77 which bypasses R166 to give the signal a low impedance path during the signal transition allowing faster and more symmetrical rise and fall times. C76 is used to calibrate the overshoot of the square wave output. Potentiometer R147 provides continuous adjustment of the output level. This is in addition to the attenuation provided by the output step attenuator. Calibration potentiometer R143 is used to zero the offset of the output amplifier, and R142 is the front panel OFFSET potentiometer.

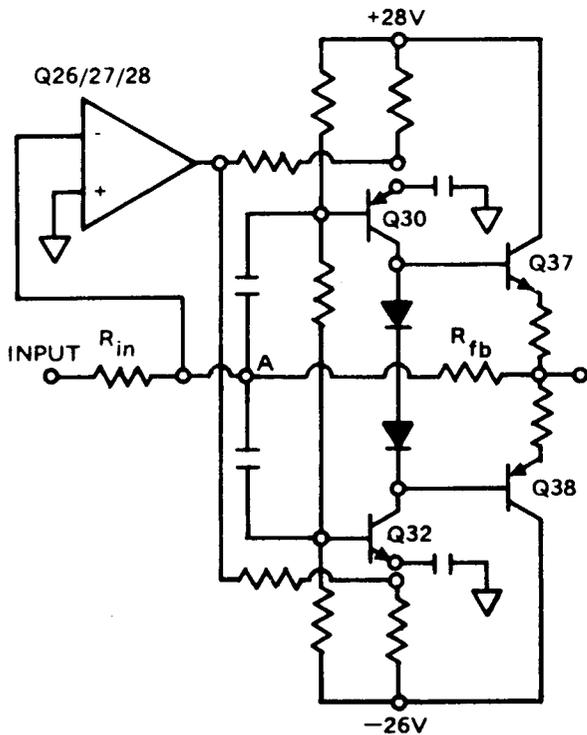


Figure 3-2. Simplified Output Amplifier

3-22. PREAMPLIFIER. Figure FO-4 contains the schematic for the preamplifier. The preamplifier, like the output amplifier, is comprised of a high frequency ac amplifier combined with a low frequency dc amplifier. The Q39/40/41 circuit is the dc amplifier and the remaining circuitry is the high frequency amplifier. Again, like the output amplifier, the ac amplifier is symmetrically arranged from the R242/R245/R246 summing node to R251 and Q44 at the output leg of the preamplifier. If the input voltage goes positive, the voltage at the summing node will rise by a certain amount. By capacitive coupling via C88 and C89, the base voltage of Q42 rises closer to +15 volts and the base voltage of Q43 rises further away from -15 volts. Thus, the emitter base junction of Q42 will be less forward biased, thereby reducing the emitter current, while the Q43 emitter current increases. The result is that the voltage at the Q44 base decreases, increasing the emitter base junction forward bias and causing a decrease in out-

put voltage due to an increase in Q44 current. The feedback path through R245/R246 to the summing node tends to cancel the rise in voltage there, causing the output voltage to stabilize. The amount of negative voltage at the output required to pull the summing node back to zero is controlled by the ratio of R245/R246 to R242. This ratio is the gain of the preamplifier.

3-23. POWER SUPPLY. Figure FO-5 contains the schematic for the power supply. The ac voltage is coupled from the transformer secondary to the bridge rectifiers CR1 through CR8. Filtering is provided by C1, C2, C10 and C12. Zener CR13 is a reference for the +15 V supply. IC1 is a differential amplifier whose output is used to drive transistor amplifier Q4; this output at the collector is used to drive a Darlington connected pair consisting of Q1 and Q2. The Darlington connected pair provides added current gain. The base voltage of Q3 is biased by voltage divider R5 and R7 to be slightly below +15 volts. Therefore, for normal operation, Q3 is off and no current flows through its collector. However, when the output current from the +15 volts is overloaded and exceeds a certain limit, the voltage drop across R12 will increase to a point exceeding the total voltage across R5 plus the base emitter voltage of Q3, forward biasing Q3. The current driving the base of Q2 will be diverted to the collector of Q3 causing the power supply voltage to drop below normal operating voltage. As the power supply voltage drops, voltage divider R5 and R7 has more effect on the base of Q2, eventually turning it off almost completely. When the overload condition is removed, the normal condition will be restored. Diode CR9 across the input terminals of IC1 prevents latch-up. Potentiometer R21 is used to calibrate the +15 volt supply. The -15 volt and +26 volt supplies have similar circuitry. The -15 volt supply is referenced to the +15 volt supply. The -26 volt supply is referenced to the -15 volts and the +26 volts are referenced to the +15 volt supply.

CHAPTER 4
OPERATING INSTRUCTIONS

4-1. OPERATING CONTROLS

4-2. The operating controls and indicators for the instrument are listed in table 4-1 which is keyed as illustrated in figure 4-1.

4-3. TURN ON PROCEDURE

WARNING

To preclude injury or death due to shock, the third wire earth ground must be continuous to the facility power outlet.

4-4. Connect the instrument to the facility power source and connect the 50 Ω OUT to the receiving circuit. If synchronization is required, connect the SYNC OUT to the receiving circuit trigger input. Select the function, amplitude, offset, frequency and symmetry desired. Refer to paragraph 4-1 for descriptions of the controls. Where a parameter is critical, use an oscilloscope, counter, voltmeter, etc., to ensure the output is correct. Place the POWER switch to ON.

4-5. NORMAL OPERATION

4-6. No preparation for operation is required beyond completion of the initial installation checks given in paragraph 2-3 and the verification checks in paragraph 2-6. After completing the turn on procedure in paragraph 4-3, it is recommended that a one half hour warmup period be allowed for the associated equipment to reach a stabilized operating temperature, and for the instrument to attain stated accuracies.

4-7. FUNCTION GENERATOR OPERATION. Terminate the 50 Ω OUT connector as desired, either load or no load. Select desired output waveform using the FUNCTION selector switch. Set FREQ RANGE switch to desired multiplier. Set frequency dial to desired setting by align-

ing with index. Set AMPLITUDE VARIABLE control and ATTENUATOR switch for desired output level and amplitude. For reference, table 4-2 gives the approximate output amplitude levels at attenuator settings. The output levels of the positive and negative pulse waveforms are one-half of these levels. With OFFSET switch set to OFF and FREQUENCY switch set to NORMAL, the output waveform should be a symmetrical waveform oscillating around a zero dc reference point. (Except when FUNCTION switch is in a positive or negative pulse position.) Select the polarity of offset desired using the OFFSET switch, and set the amount of offset using the OFFSET INCREASE control. If an excessive amount of offset is used, waveform clipping may be observed. The sum of peak waveform voltage and the offset cannot exceed the maximum rated output of the generator. The maximum output is 15 V peak-to-peak or 7.5 V peak above and below zero volts when 50 Ω OUT is terminated into a 50 Ω load. If terminated without a load, the waveform amplitude is doubled, and offset plus peak voltage cannot exceed 15 V. See figure 4-5. Set SYMMETRY switch/control for desired symmetry. The SYMMETRY control can be used to develop ramp waveforms with variable rise/fall ratios and pulse trains with variable duty cycle. By using the sine wave with ± 10 selected, controllable sine distortion can be developed. Figures 4-2, 4-3 and 4-4 show the effect of this control on output waveforms.

4-8. VCF OPERATION. VCF operation uses both ac and dc voltage to control the frequency of the output waveforms. The instrument should be set up for normal operation, as specified in paragraph 4-5. Set the frequency controls to a reference from which the frequency is to be voltage controlled. This will be the frequency output with 0 volt input at the VCF IN

Table 4-1. Controls and Indicators

INDEX NO.	CONTROL/INDICATOR	POSITION	FUNCTION
1.	Power (Indicator)	Illuminated (green) Extinguished	Indicates power is applied. Indicates power is off.
2.	SYMMETRY FREQUENCY (2 position switch)	NORMAL $\div 10$	Disables the SYMMETRY control. Enables the SYMMETRY control, divides frequency by 10.
3.	SYMMETRY (control)	1:10 1:1 10:1	When the SYMMETRY FREQUENCY switch is in the $\div 10$ position, the control is enabled to set the normally 1:1 waveform horizontal symmetry to 1:10 as shown in figure 4-2. Normal waveform 1:1 as shown in figure 4-3. Asymmetrical waveform 10:1 as shown in figure 4-4.
4.	Frequency Dial (control)	.1 to 10	Settings under the dial index mark multiplied by the FREQ RANGE setting determine the output signal frequency. NOTE For specified dial accuracy, the frequency VERNIER, SYMMETRY switch and VCF IN connector must be at CAL, NORMAL and 0 volts respectively.
5.	OFFSET INCREASE (control)	Variable	Controls the amount of waveform offset up to 15 Vdc. The direction of offset (positive or negative) is selected by the OFFSET switch. Figure 4-5 illustrates offset control waveforms.
6.	OFFSET +, OFF, - (3 position switch)	+ OFF -	Selects positive offset of waveform. Disables OFFSET INCREASE control. Selects negative offset of waveform. NOTE Waveform clipping will occur when waveform plus offset amplitude exceeds ± 7.5 volts peak. Offset as well as waveform amplitude is affected by the attenuation control.

Table 4-1. Controls and Indicators (Contd)

INDEX NO.	CONTROL/INDICATOR	POSITION	FUNCTION
7.	ATTENUATOR (8 position switch)	70dB thru 0	Selects one of eight steps of waveform and offset amplitude from 0 to -70 dB in 10 dB steps.
8.	AMPLITUDE VARIABLE (control)	Variable	Varies the waveform amplitude from 0 to -10 dB continuously. This control does not affect waveform offset.
9.	50Ω OUT (connector)		The main output of the instrument; this 50 ohm impedance output is the source of the function selected by the frequency, amplitude and offset selected.
10.	FUNCTION (5 position switch)		Triangle waveform selected
			Sine waveform selected
			Square waveform selected
			Positive pulse waveform selected
			Negative pulse waveform selected
11.	SYNC OUT (connector)		Outputs a 2 volt peak-to-peak (into 50Ω) square wave at generator frequency for oscilloscope or other synchronization. Output impedance is 50Ω.
12.	FREQ RANGE (10 position switch)	X.001 thru X1M	Selects one of ten frequency multipliers for the frequency dial setting.
13.	VERNIER (control)	Variable	Varies the frequency setting up to approximately 1%. Full CW setting, CAL, ensures frequency dial calibration.
14.	VCF IN (connector)		Accepts 0 to 5 Vac or Vdc to vary the frequency up to 1000:1. (Frequency is limited to top and bottom of the range setting.)
15.	POWER (2 position switch)	ON	Applies power to instrument.
		OFF	Removes power from instrument.

Table 4-2. Output Amplitude Levels

ATTENUATOR POSITION	PEAK-TO-PEAK OUTPUT INTO 50Ω LOAD	
	AMPLITUDE VARIABLE	
	MAXIMUM (CW)	MINIMUM (CCW)
0 dB	15 volts	1.5 V
-10 dB	5 volts	500 mV
-20 dB	1.5 volts	150 mV
-30 dB	500 mV	50 mV
-40 dB	150mV	15 mV
-50 dB	50 mV	5 mV
-60 dB	15 mV	1.5 mV
-70 dB	5 mV	.5 mV

connector. A voltage excursion from 0 to +5 volts will be the equivalent of turning the dial from 0.1 to 10. A voltage excursion from 0 to -5 volts will be the equivalent of turning the dial from 10 to 0.1. For frequency control with positive dc inputs at VCF IN, set the dial for a lower frequency; for frequency control with negative dc inputs at VCF IN, set the dial for an upper frequency, and for modulation with an ac input at VCF IN, set the dial at the desired center frequency. In example 1 of the frequency nomograph, figure 4-6, the frequency dial is set at 5 and 0 volts VCF input voltage is applied. Extend a straight line from 5 (dial setting) through 0 volts (VCF voltage). The result is an output frequency of 5 (multiplied by the FREQ RANGE setting). In example 2, the dial is again set at 5 and a VCF voltage of +2.5 volts is applied. By extending a straight line through this position it can be seen that the frequency will shift to 10 (multiplied by the FREQ RANGE set-

ting). In example 3, the dial is again set at 5 and a VCF voltage of -1 volts is applied. By extending a straight line through this position it can be seen that the frequency will shift to 3 (multiplied by the FREQ RANGE setting). A variation from 0 to +5 volts VCF input with a .01 dial setting will cause the frequency to increase from .01 to 10 (multiplied by the FREQ RANGE setting), an increase of 1000:1.

NOTE

The frequency VERNIER must be rotated fully ccw for 1000:1 frequency change with 0 to ±5 volts at VCF IN.

CAUTION

Damage to the VCF circuit may result if greater than 15 volts is applied to the VCF IN connector.

Connect a voltage source to the VCF IN connector. Monitor the instrument output with a frequency counter or an oscilloscope to ensure desired operation.

NOTE

For linear operation, do not force the instrument to exceed the limits of the dial range.

4-9. TURN OFF PROCEDURE

4-10. Place the POWER switch to OFF, disconnect the SYNC OUT and 50Ω OUT cables from the receiving circuit and the instrument and unplug the instrument from facility power.

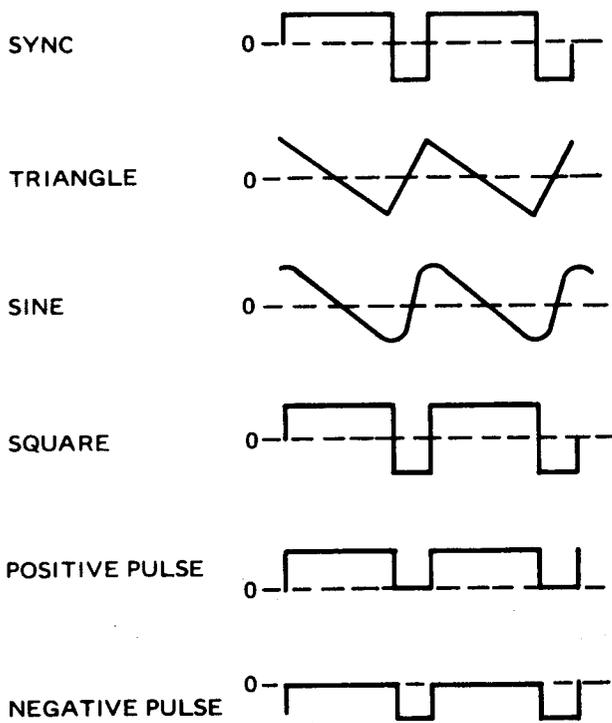


Figure 4-2. Symmetry Controls at ÷10 and CCW

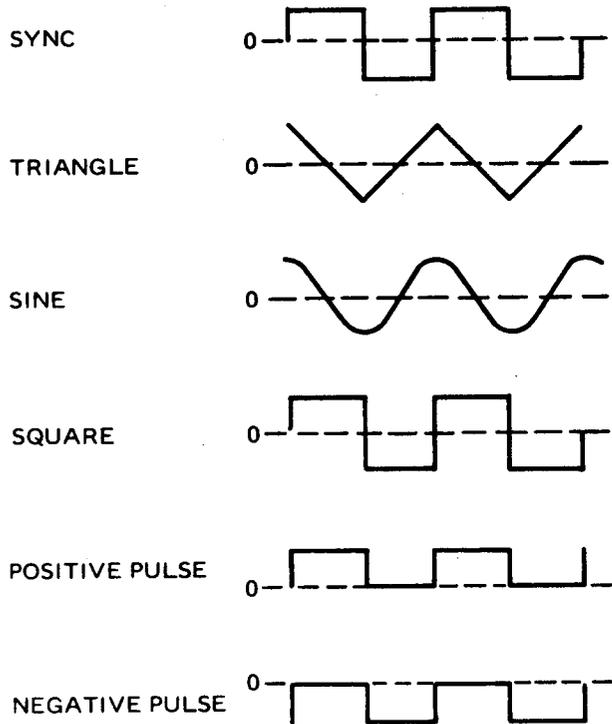


Figure 4-3. Symmetry Control at Normal

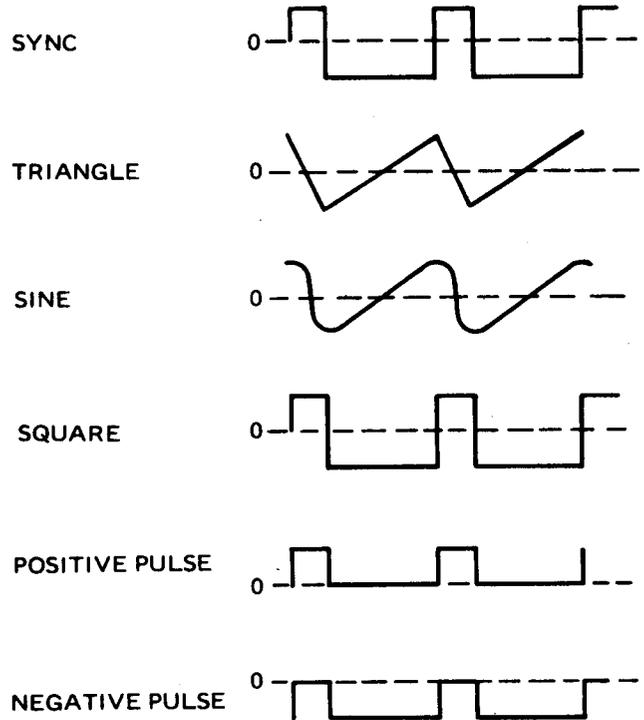


Figure 4-4. Symmetry Controls at ÷10 and CW

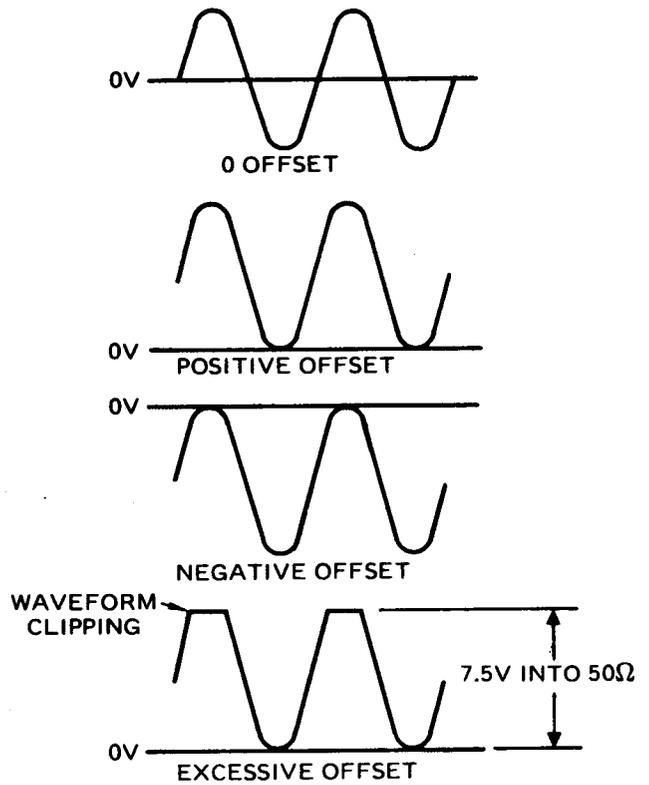


Figure 4-5. Offset Control

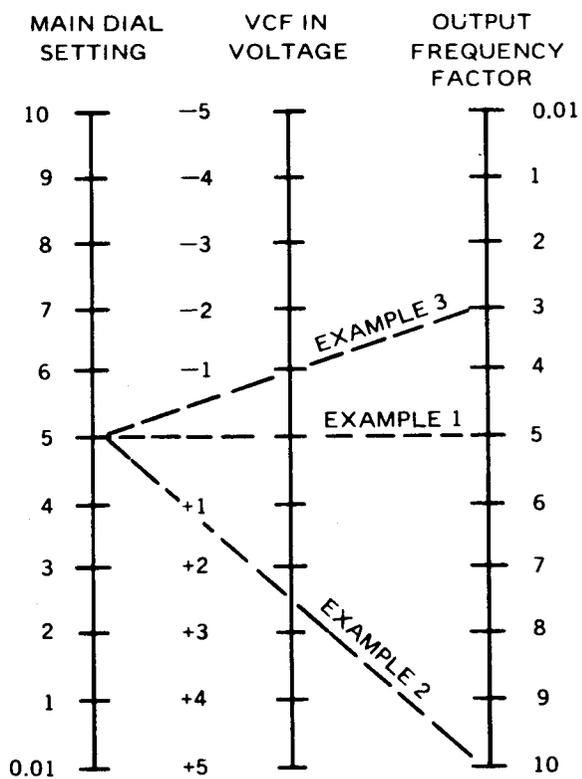


Figure 4-6. VCF Voltage-To-Frequency Nomograph

CHAPTER 5
MAINTENANCE

5-1. SCHEDULED MAINTENANCE

5-2. The purpose of scheduled maintenance is to implement preventive maintenance checks and performance tests on a regular basis. Scheduled maintenance consists of periodic performance of these checks and tests to ensure the proper operation of the instrument. The checks and tests on the instrument are to be performed in accordance with the instructions provided in paragraphs 5-3 and 5-4. No special tools are required for preventive maintenance checks; test equipment required but not supplied for the performance tests are listed in table 1-4.

5-3. PREVENTIVE MAINTENANCE CHECKS. The instrument is normally operated in an environment where the humidity, temperature, dust and dirt are reasonably well controlled. Under these conditions the instrument does not require extensive cleaning and a simple wipedown with a damp lint-free cloth prior to each use will normally suffice. Each time the instrument is used the control knobs should be checked for cracks and looseness, the indicator lamp should be inspected for illumination and the power cord should be inspected for cracks in the insulating material and separation of the plug from the cord.

5-4. PERFORMANCE TESTS. The instrument is constructed with solid state devices which have high reliability under normal operating conditions. The performance tests called out in table 5-1 are recommended on a semi-annual basis to ensure the instrument is operating within the prescribed parameters.

NOTE

If inadequate performance is detected in the tests, attempt to align the instrument (paragraph 5-9) and if that fails proceed to troubleshooting (paragraph 5-8).

5-5. CORRECTIVE MAINTENANCE

5-6. The following paragraphs contain instructions for locating the malfunction, removing and replacing the faulty component or defective part and returning the equipment to aligned operating status.

5-7. DISASSEMBLY, REPAIR, REPLACEMENT AND REASSEMBLY. FO-6 illustrates the wiring diagram for the instrument; and FO-7 and FO-8 illustrate the position of the parts. To gain access to the components in the instrument, the following procedure should be adhered to:

a. Unplug the power cord from the facility power supply (FO-7 item 1).

b. Turn the instrument upside down on the bench and remove the 18 screws (FO-7 item 7) from the bottom cover (FO-7 item 6). Remove the cover.

c. Set the instrument right side up on the bench and remove the 18 screws (FO-7 item 3) from the top cover (FO-7 item 4). Remove the cover.

d. Disconnect the MOLEX connector (FO-7 item 8) on the power supply board.

e. Turn instrument on its side, disconnect the MOLEX connector (FO-7 item 9) on the generator board (FO-8 item 3).

f. Turn instrument right side up on the bench, remove the two 6-32 x $\frac{1}{4}$ " pan head screws (FO-8 item 6) that hold the back of the power supply board (FO-8 item 4) in place.

g. Remove the two 4-40 x $\frac{1}{2}$ " pan head screws (FO-8 item 8) that hold the front of the power supply board in place.

h. Remove the power supply board.

5-8. TROUBLESHOOTING. A troubleshooting index, table 5-2 covers the mode of operation where the malfunction was discovered and informs the technician which chart and schematic to use. The troubleshooting charts are illustrated in

Table 5-1. Performance Tests

STEP	PROCEDURE	RESULT
1.	<p>INITIAL SETUP</p> <p>a. Set the front panel controls of the instrument as follows:</p> <p>ATTENUATOR - - - - - 0 dB SYMMETRY - - - - - FREQUENCY NORMAL OFFSET - - - - - OFF FUNCTION - - - - - Sine Wave \sim FREQ RANGE - - - - - x100 Frequency Dial - - - - 10 AMPLITUDE VARIABLE - - Fully CW Frequency VERNIER- - - Fully CW</p> <p>b. Connect the instrument 50Ω OUT to the oscilloscope channel 1 input using a 50Ω load.</p> <p>c. Arrange controls on the oscilloscope as follows:</p> <p>Vertical Sensitivity - 5 V/Div dc. Horizontal Sweep - - - .2 ms/Div Trig Gen Mode- - - - - AUTO Coupling - - - - - ac Source - - - - - INT Display Mode - - - - - CHAN 1 Trigger Source - - - - CHAN 1</p> <p>d. Set power source ON/OFF switch to ON</p> <p>e. Set instrument POWER switch to ON</p> <p style="text-align: center;">NOTE</p> <p style="text-align: center;">Use trigger level control on oscilloscope to stabilize trigger as required.</p>	<p>Green power indicator lamp illuminates. Two sine wave cycles on oscilloscope.</p>
2.	<p>FUNCTION OUTPUT TEST</p> <p>a. Set the FUNCTION switch to triangle \triangle</p> <p>b. Set the FUNCTION switch to squarewave \square</p>	<p>Two triangle waves on the oscilloscope</p> <p>Two square waves on the oscilloscope</p>

Table 5-1. Performance Tests (Contd)

STEP	PROCEDURE	RESULT
n.	Set the frequency dial to 1.	.78 MHz to 1.22 MHz
o.	Set the FREQ RANGE to x10, the frequency dial to 10, and the frequency counter function switch to period.	9.8 ms to 10.2 ms
p.	Set the frequency dial to 1.	98.9 ms to 101.1 ms
q.	Set the FREQ RANGE to x1 and the frequency dial to 10.	98.9 ms to 101.1 ms
r.	Set the frequency dial to 1.	901 ms to 1120 ms
s.	Set the FREQ RANGE to x.1 and the frequency dial to 10.	989 ms to 1011 ms
t.	Set the frequency dial to 1.	9.01 s to 11.20 s
u.	Set the FREQ RANGE to x.01 and the frequency dial to 10	9.89 s to 10.11 s
v.	Set the frequency dial to 1.	90.1 s to 112 s
w.	Set the FREQ RANGE to x.001 and the frequency dial to 10.	98.9 s to 101.1 s
x.	Set the frequency dial to 1 and the FUNCTION to triangle(\wedge).	Instrument is oscillating
4.	SINE WAVE DISTORTION TEST	
a.	Connect the instrument 50 Ω OUT to the distortion analyzer (H-P 334) using a 50 Ω load.	
b.	Set the instrument controls as shown in step 1a, except rotate the frequency dial to 1 and FREQ RANGE x10.	
c.	Set the distortion analyzer controls as follows: Power- - - - - ON Input- - - - - Normal Function - - - - - Set Level Meter Range- - - - - Set Level Mode - - - - - Manual Frequency Range- - - - x10 Balance- - - - - Up Frequency Dial - - - - 10	

Table 5-1. Performance Tests (Contd)

STEP	PROCEDURE	RESULT
	<p>High Pass Filter - - - Out Sensitivity/Coarse - - Rotate to position and Vernier meter pointer over "1" on the 0 - 1 scale.</p> <p>d. Set the distortion analyzer function control to distortion.</p> <p>e. Achieve the best null of meter pointer near the 0 end of the scale with the use of the frequency dial and the red coarse balance control.</p> <p>f. Switch mode level to automatic (if applicable).</p> <p>g. Select a meter range with the meter range switch that will provide the greatest resolution without pegging the meter. Note the meter reading, using the percentage scale indicated by the meter range switch.</p> <p>h. Return the meter range switch to "0".</p> <p>i. Set the instrument FREQ RANGE to x1K and the frequency dial to 10.</p> <p>j. Rotate the distortion analyzer frequency range switch to x1K and the mode switch to manual.</p> <p>k. Repeat steps e through h.</p> <p>l. Set the instrument FREQ RANGE to x10K.</p> <p>m. Rotate the distortion analyzer frequency range switch to x10K and the mode switch to manual.</p> <p>n. Repeat steps e through h.</p> <p>o. Connect the instrument 50Ω OUT to the spectrum analyzer (H-P 141T) using a 50Ω 20 dB attenuator.</p>	<p>0.5% maximum</p> <p>0.5% maximum</p> <p>0.5% maximum</p>

Table 5-1. Performance Tests (Contd)

STEP	PROCEDURE	RESULT
c.	Set the Spectrum Analyzer (HP 3580A) controls as follows: POWER- - - - - ON (ac) AMPLITUDE MODE - - - - 10 dB AMPLITUDE REF LEVEL- - Normal dBm/LIN - dBm 600- - - dBm/LIN INPUT SENSITIVITY- - - +10 FREQUENCY- - - - - 00.0 START-CTR switch - - - START RESOLUTION BANDWIDTH - 3 FREQ SPAN/DIV- - - - - .2 SWEEP TIME/DIV - - - - 10 SWEEP MODE - - - - - MANUAL	
d.	Adjust Spectrum Analyzer sweep mode manual vernier for maximum fundamental peak and then adjust the input sensitivity vernier to position the fundamental peak on the 0 dB line.	
e.	Rotate sweep mode manual vernier counterclockwise and adjust frequency zero cal for maximum peak on 0 vertical line.	
f.	Rotate FREQ SPAN/DIV switch to 50. Rotate SWEEP MODE switch to REP. Depress clear write pushbutton.	
g.	After one sweep, record the level below 0 dB of the highest peak displayed on the CRT excluding the 0 Hz peak.	At least 66 dB down
6.	JITTER TEST	
a.	To test the jitter of the instrument, connect it to the oscilloscope using a 50Ω load.	
b.	Set the instrument controls as shown in step 1a, except set FUNCTION to square wave, FREQ RANGE to x10K and the frequency dial to 1.	

Table 5-1. Performance Tests (Contd)

STEP	PROCEDURE	RESULT
c.	Set the oscilloscope controls as follows: Volts/Div- - - - - 2 Vdc Time/Div - - - - - 10 μ s Trigger Mode - - - - - Auto Trigger Coupling - - - ac Trigger Source - - - - Int Delayed Trig Level - - Push in (if applicable)	
d.	Expand the waveform by horizontal sweep magnification of x100, center leading edge of the second cycle of the amplified waveform and note horizontal jitter.	Less than 0.02% or less than one minor horizontal division.
7.	OVERSHOOT, UNDERSHOOT, RINGING AND DROOP TEST	
a.	To test the instrument for overshoot, undershoot, ringing and droop, connect it to the oscilloscope using a 50 Ω load.	
b.	Set the instrument controls as shown in step 1a, except set FUNCTION to square wave and the FREQ RANGE to x100K.	
c.	Set the oscilloscope controls as follows: Time/Div - - - - - .1 μ s Trigger Mode - - - - - Auto Trigger Coupling - - - ac Trigger Source - - - - Int Volts/Div- - - - - 2 Vdc	
d.	Rotate the volts/div switch to 1 Vdc and position the waveform as necessary to make measurements. Each small vertical graduation equals 200 mV.	Overshoot less than 750 mV Undershoot less than 750 mV Ringing less than 750 mV Droop less than 750 mV
8.	VCF TEST	
a.	To test the VCF function of the instrument, connect it to the Frequency Counter (Dana 8015) through 50 Ω load.	

Table 5-1. Performance Tests (Contd)

STEP	PROCEDURE	RESULT
b.	Set the instrument controls as specified in step 1a, except set FUNCTION to square wave and FREQ RANGE to x 10K.	
c.	Set the Frequency Counter as follows and note the counter reading. POWER- - - - - ON FUNCTION - - - - - FREQ A INPUT CONTROLS - - - - PRESET, 10, +dc TIME BASE- - - - - 1s	100 kHz approximately
d.	Connect the dc voltage source to the VCF IN connector and apply -5 Vdc.	Frequency no greater than step 8c reading divided by 1000.
e.	Remove the -5 Vdc, set the instrument frequency VERNIER fully CCW and frequency dial to 0.1. Note the counter reading.	100 Hz or less
f.	Apply +5 Vdc to VCF IN.	Frequency no less than step 8e reading times 1000.

Table 5-2. Troubleshooting Index

MALFUNCTION	CHART (FIGURE #)	SCHEMATIC
Waveform bad or missing	5-1 Initial checks	FO-2, 3, 4
Dial good, VCF bad	5-6 Input/Output checks	FO-3
Incorrect Frequency	5-4 VCF checks	FO-2, 3
Incorrect Symmetry	5-4 VCF checks	FO-2
Incorrect Offset	5-3 Generator Output checks	FO-4
No Power to Generator board	5-5 Power Supply checks	FO-5
No Sync Out	5-6 Input/Output checks	FO-3

figures 5-1 through 5-6 to aid the technician in isolating the malfunction to a defective circuit, or replaceable part such as a transistor, diode, capacitor, etc. These charts do not cover every possible malfunction, but will be an aid in systematically isolating faulty components.

a. Troubleshooting individual components is accomplished by following the procedures listed below.

1. A transistor is defective if more than one volt is measured across its base emitter junction in the forward direction.

NOTE

A transistor when used as a switch may have a few volts reverse bias voltage base to emitter.

2. A transistor is defective if the collector and emitter voltages are the same, but the base emitter voltage is less than 500 mV forward voltage (or reversed bias).

3. A transistor is defective if its base current is larger than 10% of its emitter current (calculate currents from voltage across the base and emitter series resistors).

4. In a transistor differential pair (common emitter stages), the base voltages are the same in normal operating condition, or the one with less forward voltage across its base emitter junction should be off (no collector current); otherwise one of the transistors is defective.

5. A diode is defective if there is greater than one volt (typically 0.7 volts) forward voltage across it (except a zener).

6. An operational amplifier is defective when there is greater than 15 mV difference between the "+" and "-" inputs during normal operating conditions.

7. An operational amplifier is defective if when the output voltage stays at maximum positive its "+" input is less positive than its "-" input or when the output voltage stays at maximum negative its "-" input voltage is less negative than its "+" input.

8. A capacitor may be shorted when it has zero volts dc across its terminals.

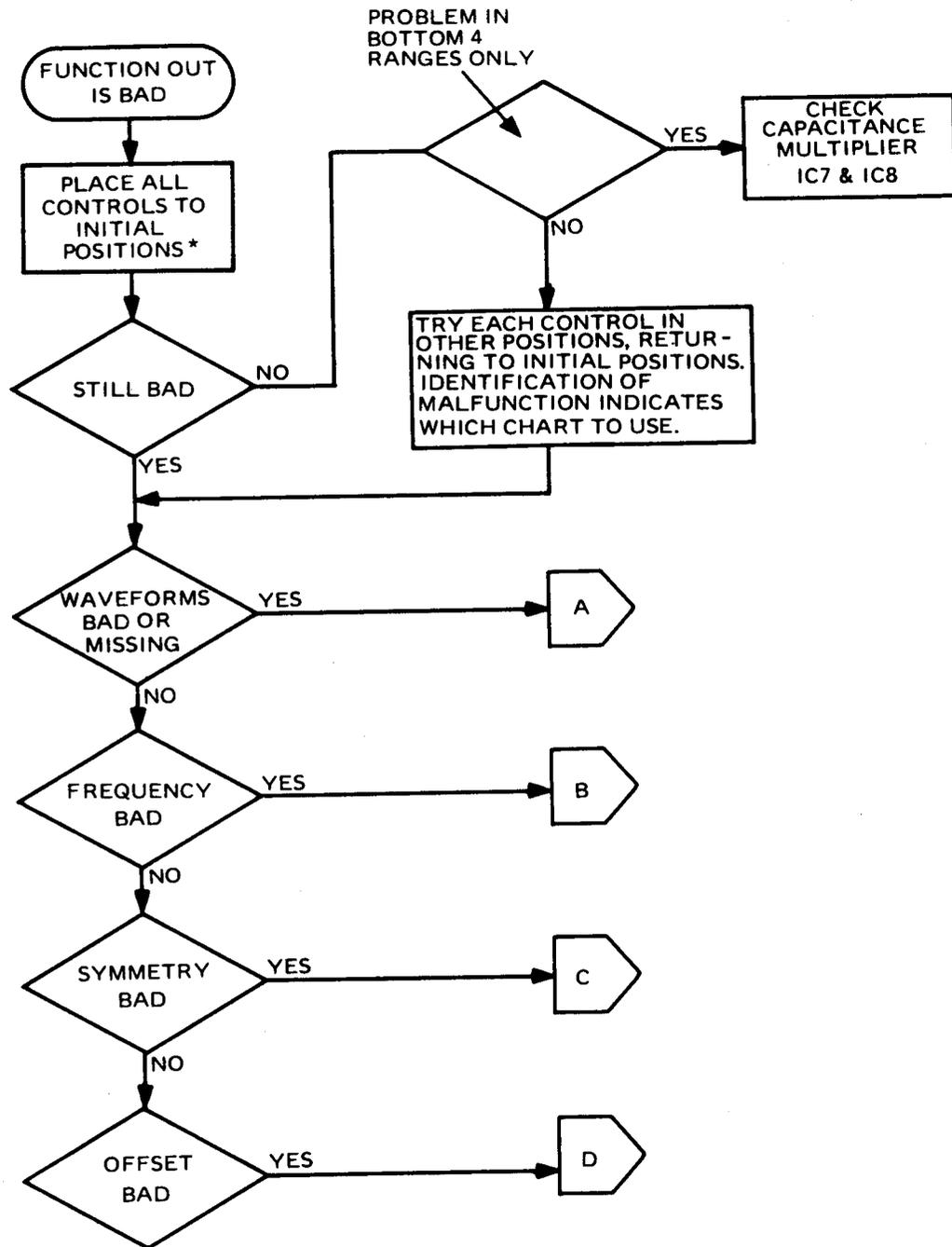
9. An open capacitor may be located (but not always) by using a good capacitor connected in parallel with the capacitor under test and observing that correct operation occurs.

10. An FET is defective if current is drawn by the gate in normal back-biased condition.

5-9. ALIGNMENT PROCEDURE. Upon completion of repair and/or replacement of components and prior to reinstalling covers, the instrument must be recalibrated (or aligned). The initial settings for the front panel controls are called out in table 2-1. Table 5-3 details the alignment procedure for the instrument.

NOTE

Warm up the instrument and other test equipment for a minimum of 30 minutes prior to attempting alignment. Read the complete alignment procedure prior to actual adjustment of the instrument. Do not alter alignment order or attempt to partially adjust the instrument. Subsequent steps often depend on preceding steps.



* SYMMETRY NORMAL, OFFSET OFF, AMPLITUDE VARIABLE TO MAX, FREQUENCY VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK

Figure 5-1. Initial Checks, Generator Board (Sheet 1 of 2)

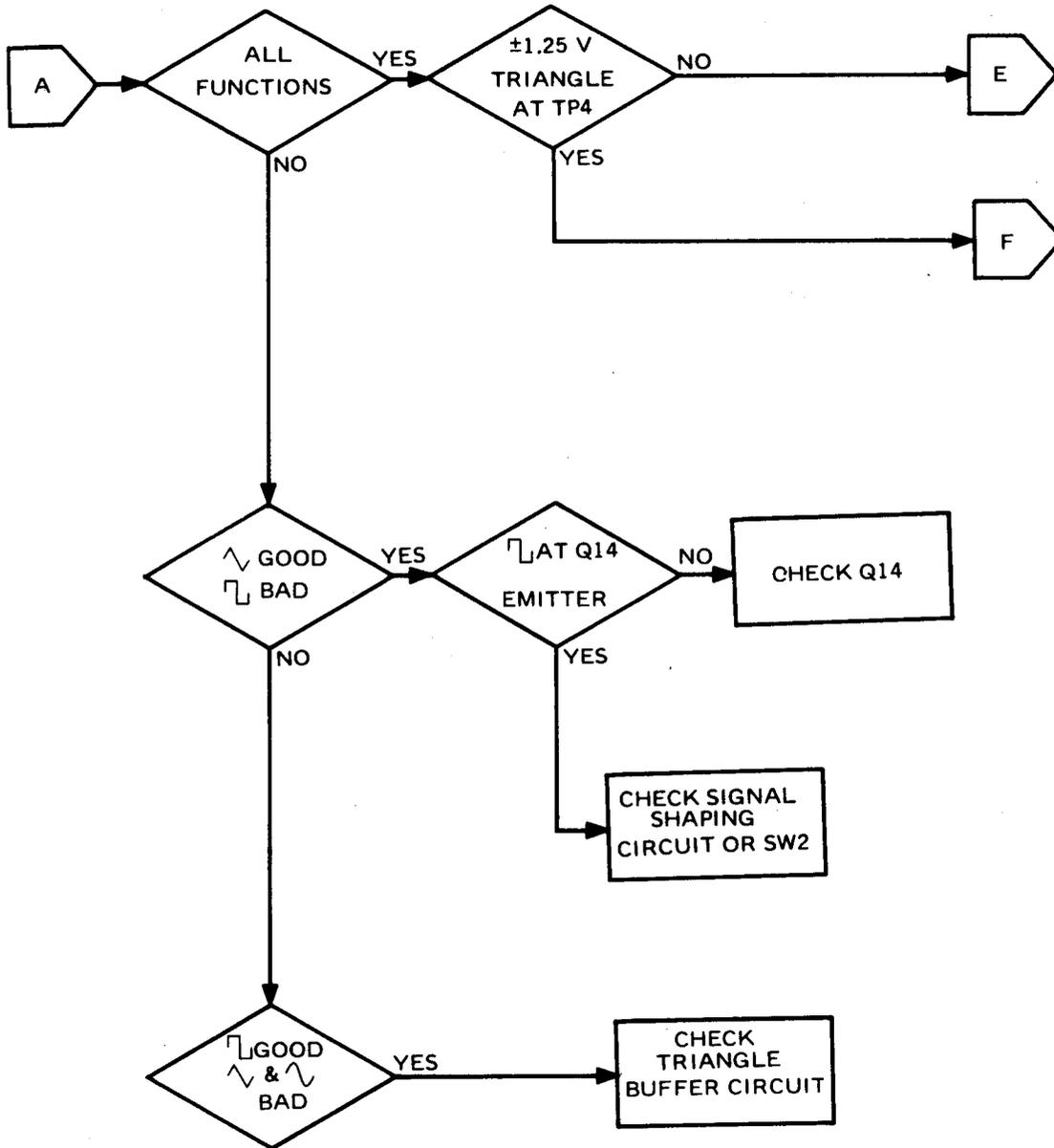
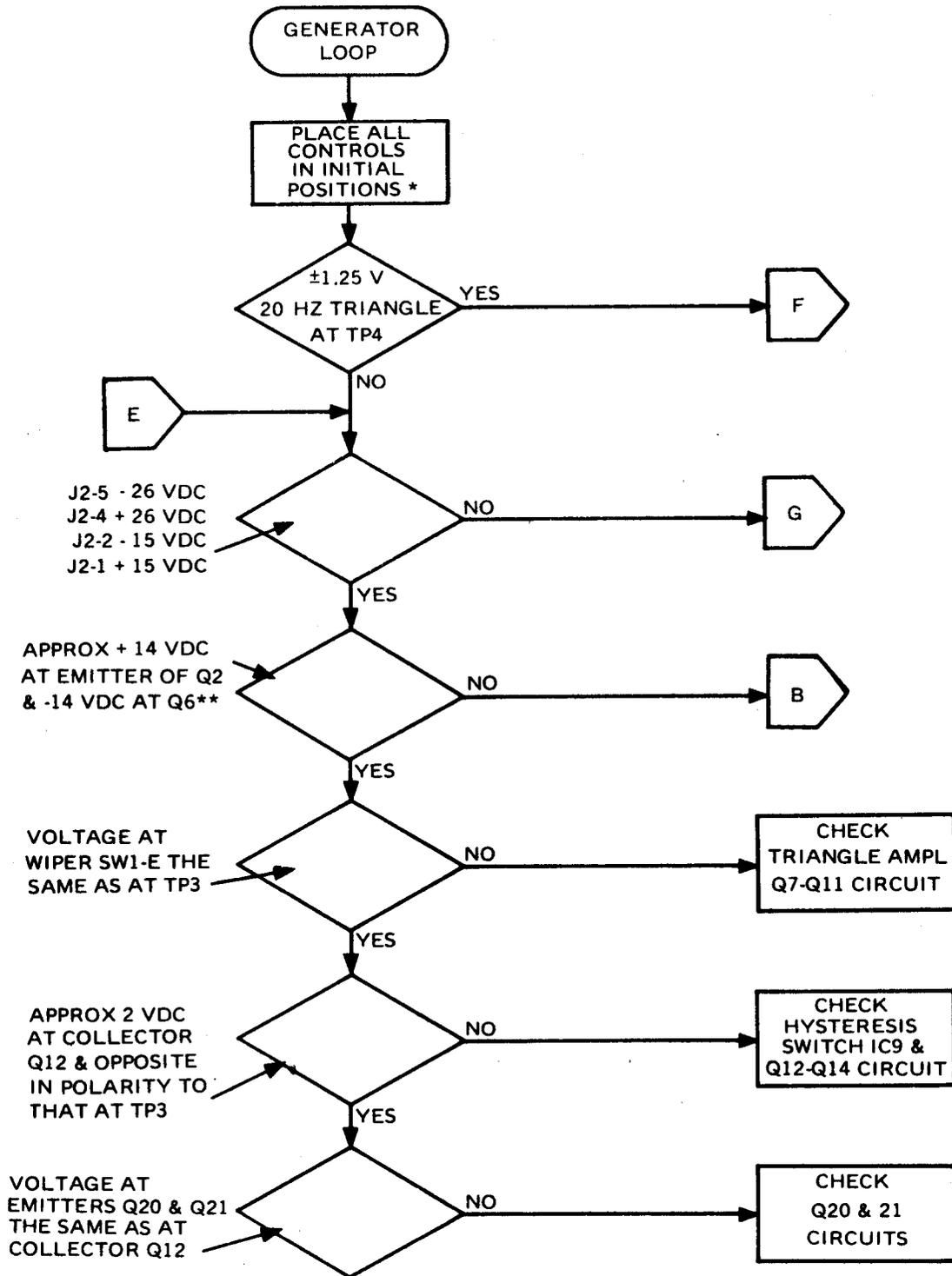


Figure 5-1. Initial Checks, Generator Board (Sheet 2 of 2)



*SEE FIGURE 5-1 (SHEET 1 OF 2)
 **USE SCOPE AND HIGH IMPEDANCE PROBE

Figure 5-2. Generator Loop Checks, Generator Board

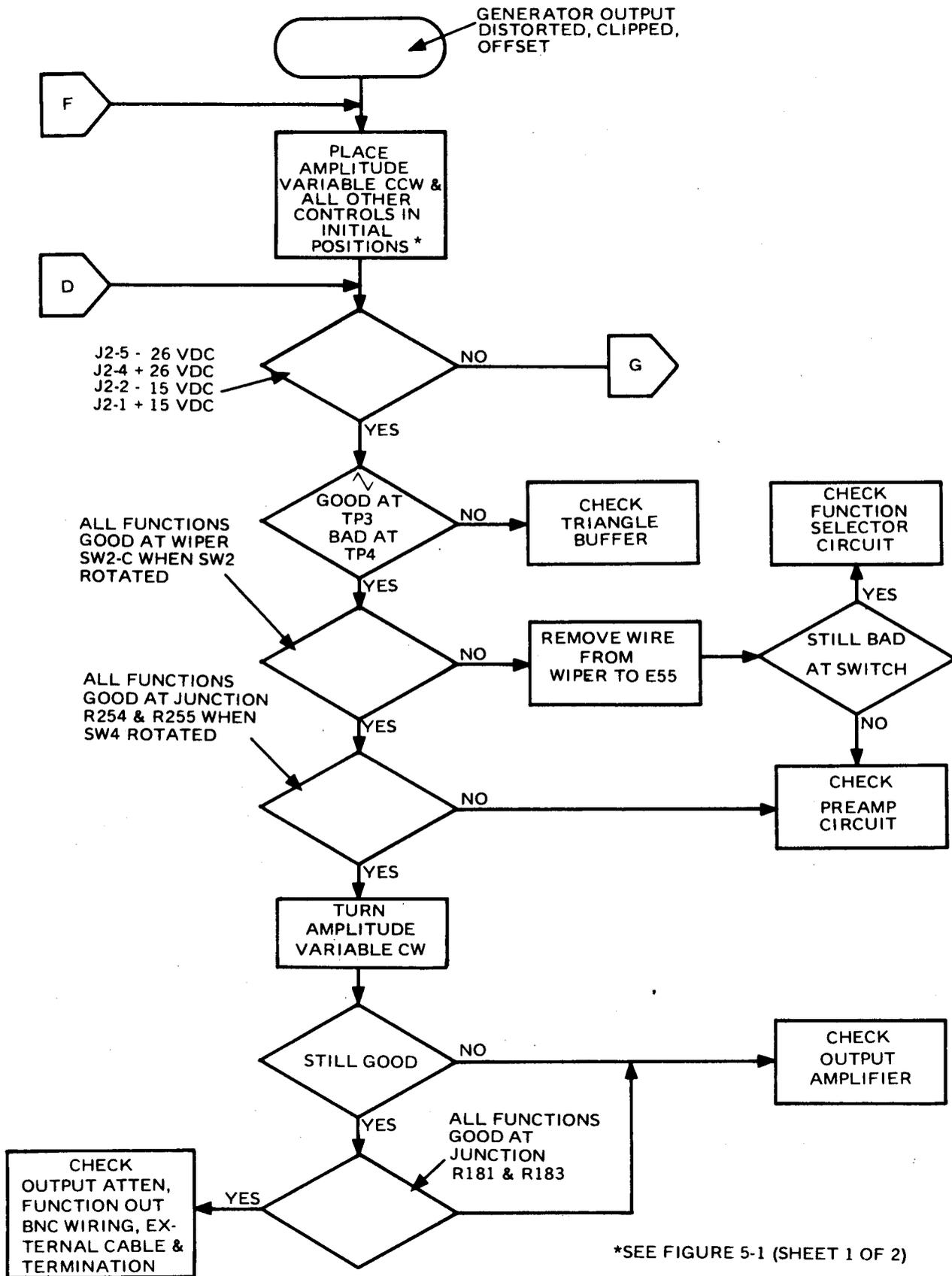


Figure 5-3. Generator Output Checks

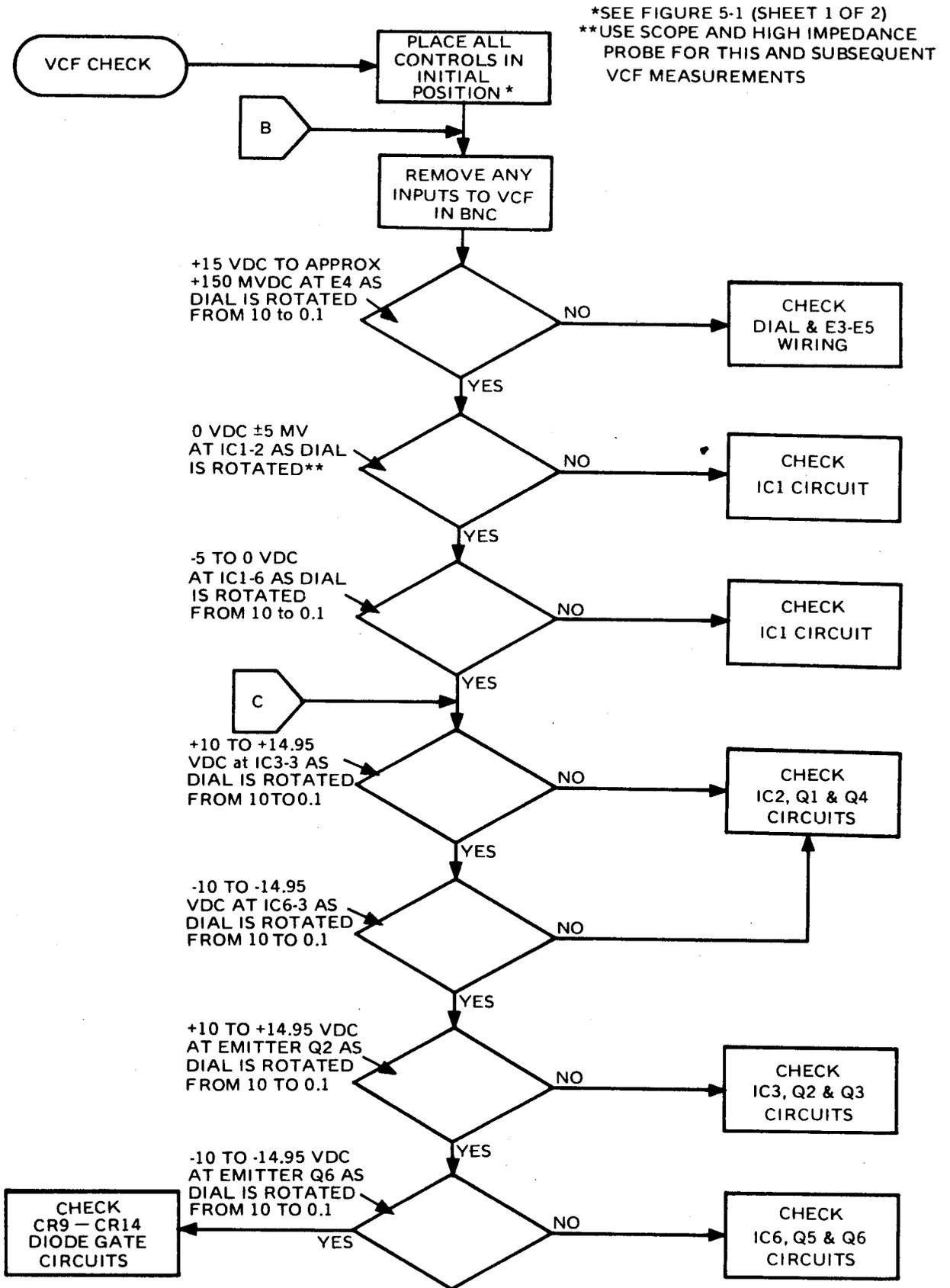


Figure 5-4. VCF Checks

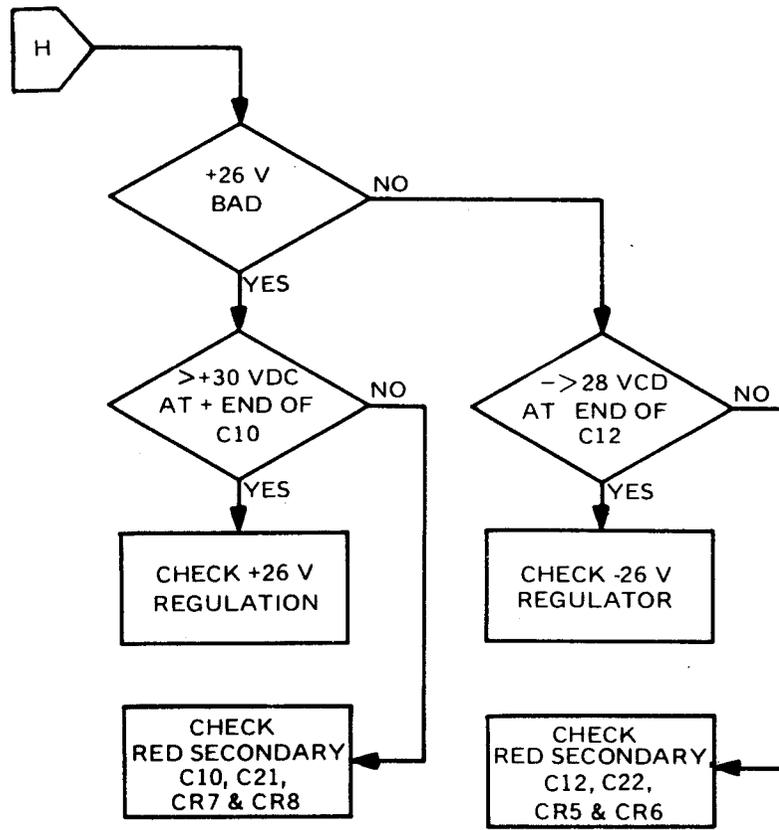


Figure 5-5. Power Supply Checks (Sheet 2 of 2)

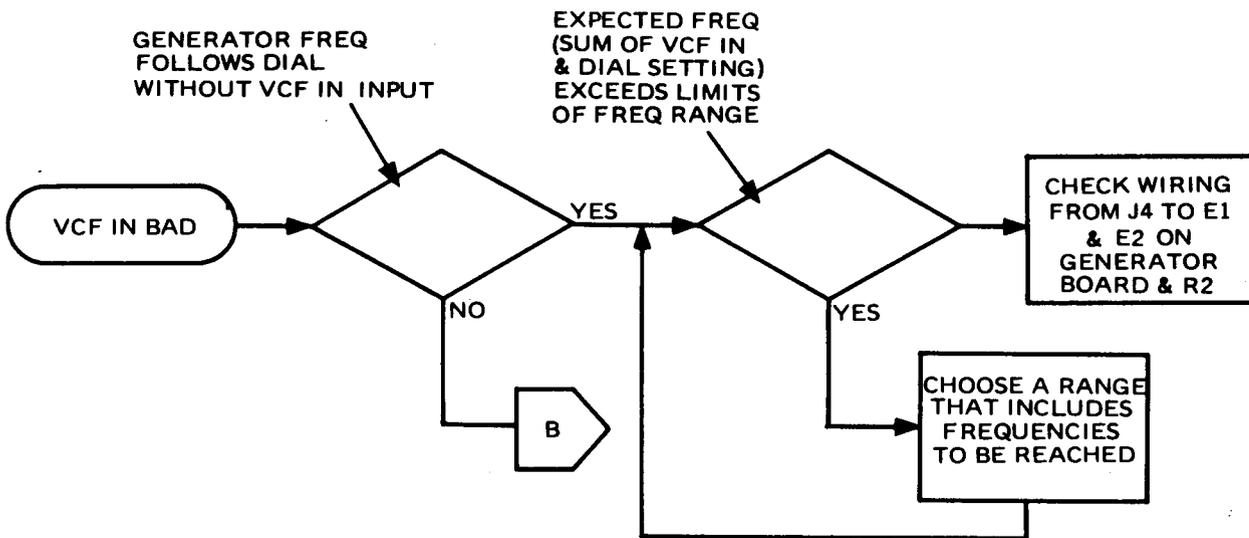
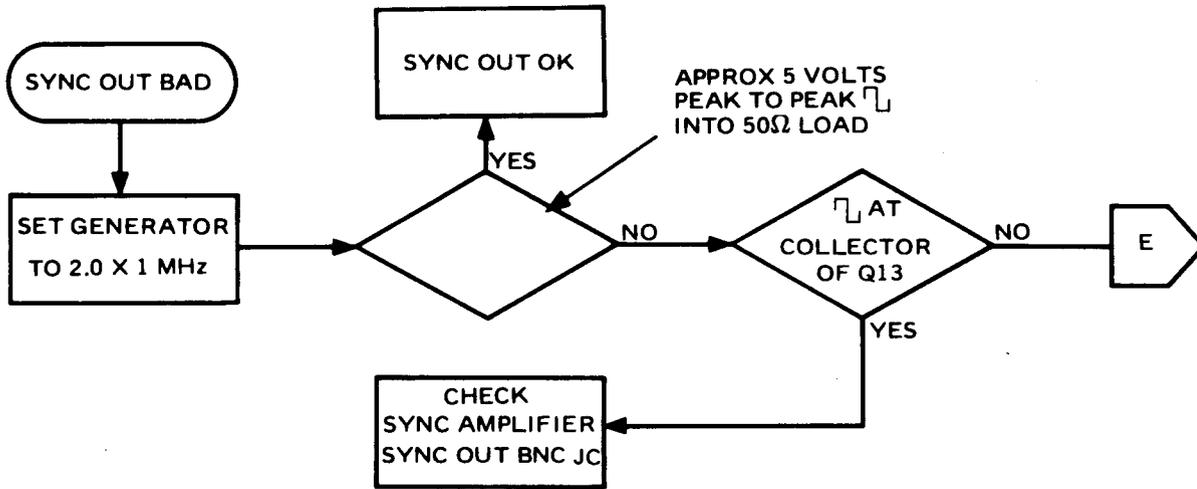


Figure 5-6. Generator Input and Output Checks

Table 5-3. Functional Generator Alignment Procedure

STEP	PROCEDURE	ADJUSTMENT/RESULT
1.	Perform the verification procedure specified in table 2-1.	Correct Waveforms
2.	Perform Power Supply Board alignment as detailed below: a. Connect the DVM (dc volts, 100 volt range) common to 1A2TP1 b. Connect the DVM Hi to 1A2TP2. c. Connect the DVM Hi to 1A2TP3. d. Connect the DVM Hi to 1A2TP4. e. Connect the DVM Hi to 1A2TP5.	Adjust 1A2R21 for +15 Vdc ± 20 mV Verify -15 Vdc ± 100 mV Verify +26 Vdc ± 200 mV Verify -26 Vdc ± 200 mV
3.	Perform the Generator Board Alignment as detailed below: a. Turn the instrument upside-down on the bench to gain access to the component side of the generator board. b. Temporarily connect a jumper between 1A1TP1 and the wiper lug 1A1SW4-c. (the green/white wire on the FUNCTION switch assembly). c. Set the front panel control as specified in table 2-1 step 1, and connect DVM common to 1A1TP1 and DVM Hi to 1A1TP2. d. Disconnect the DVM, connect the 50 Ω OUT by cable to the oscilloscope input, terminated into 50 Ω at the oscilloscope, and turn AMPLITUDE VARIABLE control fully CCW. e. Turn the AMPLITUDE VARIABLE control fully CW. f. Repeat steps 3d and 3 until both steps yield 0 Vdc ± 10 mV without further adjustment. g. Remove the jumper installed in step b, set up the instrument as specified in table 2-1 except set the frequency dial fully clockwise and the FREQ RANGE to x10K. h. Momentarily short and open the VCF IN connector, set the oscilloscope to .1 msec/div.	Adjust 1A1R54 for 0 Vdc ± 5 mV Adjust 1A1R143 for 0 Vdc ± 10 mV Adjust 1A1R234 for 0 Vdc ± 10 mV Adjust 1A1R13 for minimum frequency shift.

Table 5-3. Functional Generator Alignment Procedure (Contd)

STEP	PROCEDURE	ADJUSTMENT/RESULT
i.	Set frequency VERNIER fully CCW, set oscilloscope to 1 msec/div.	Adjust 1A1R12 for slightly less than one cycle
j.	Same connections and settings.	Adjust 1A1R17 for time symmetry error of less than 0.1%, use x10 sweep magnification on oscilloscope.
k.	Return frequency VERNIER to fully CW, set frequency dial to 10, FREQ RANGE to x100, set the oscilloscope to .1 msec/div with x10 magnification.	Adjust 1A1R37 for time symmetry error of less than 0.1%.
l.	Repeat steps 3i, 3j and 3k for proper operation without further adjustment.	
m.	Set the front panel controls as specified in table 2-1 step 1 except set the FUNCTION switch to \sim . Connect the 50 Ω OUT cable to the distortion analyzer and terminated into a 50 Ω at the distortion analyzer.	Adjust 1A1R78 and 1A1R83 for less than 0.5% sine distortion.
n.	Connect the 50 Ω OUT cable to the frequency counter, terminated into 50 Ω at the frequency counter. Set FUNCTION to \square and frequency dial to 10.	Adjust 1A1R5 for 1000 Hz ± 20 Hz
o.	Set FREQ RANGE to x1.	Adjust 1A1R47 for 100 msec ± 2 msec
p.	Set FREQ RANGE to x1M.	Adjust 1A1C66 for 10 MHz ± 400 kHz
q.	Set FREQ RANGE to x100K.	Adjust 1A1C60 for 1 MHz ± 20 kHz
r.	Repeat steps 3p and 3q until proper frequencies are achieved.	
s.	Connect the 50 Ω OUT cable, terminated into 50 Ω to the oscilloscope, set the oscilloscope to 0.1 μ sec time/div. Set FREQ RANGE to x100K.	Adjust 1A1C76 for no overshoot with minimum rise and fall time.

CHAPTER 6
PREPARATION FOR RESHIPMENT

6-1. REPACKING

6-2. When shipped, the instrument should be protected by method II-B of MIL-P-116C. As illustrated in figure 6-1, this method uses two containers and a moisture barrier. Figure 6-1 illustrates the packing, procedure, and table 6-1 provides details on the size and type of materials required for each step.

6-3. REPACKING PROCEDURE. The following procedure should be adhered to when re-

packing the instrument for reshipment:

a. Wrap the enclosure in the polyethylene material and secure the material with adhesive tape.

b. Place the wrapped enclosure in the urethane container and seal the container with adhesive tape.

c. Tape the desiccant bags and the moisture indicator card to the urethane container.

d. Enclose the urethane container in the scrim bag and seal the bag with heat.

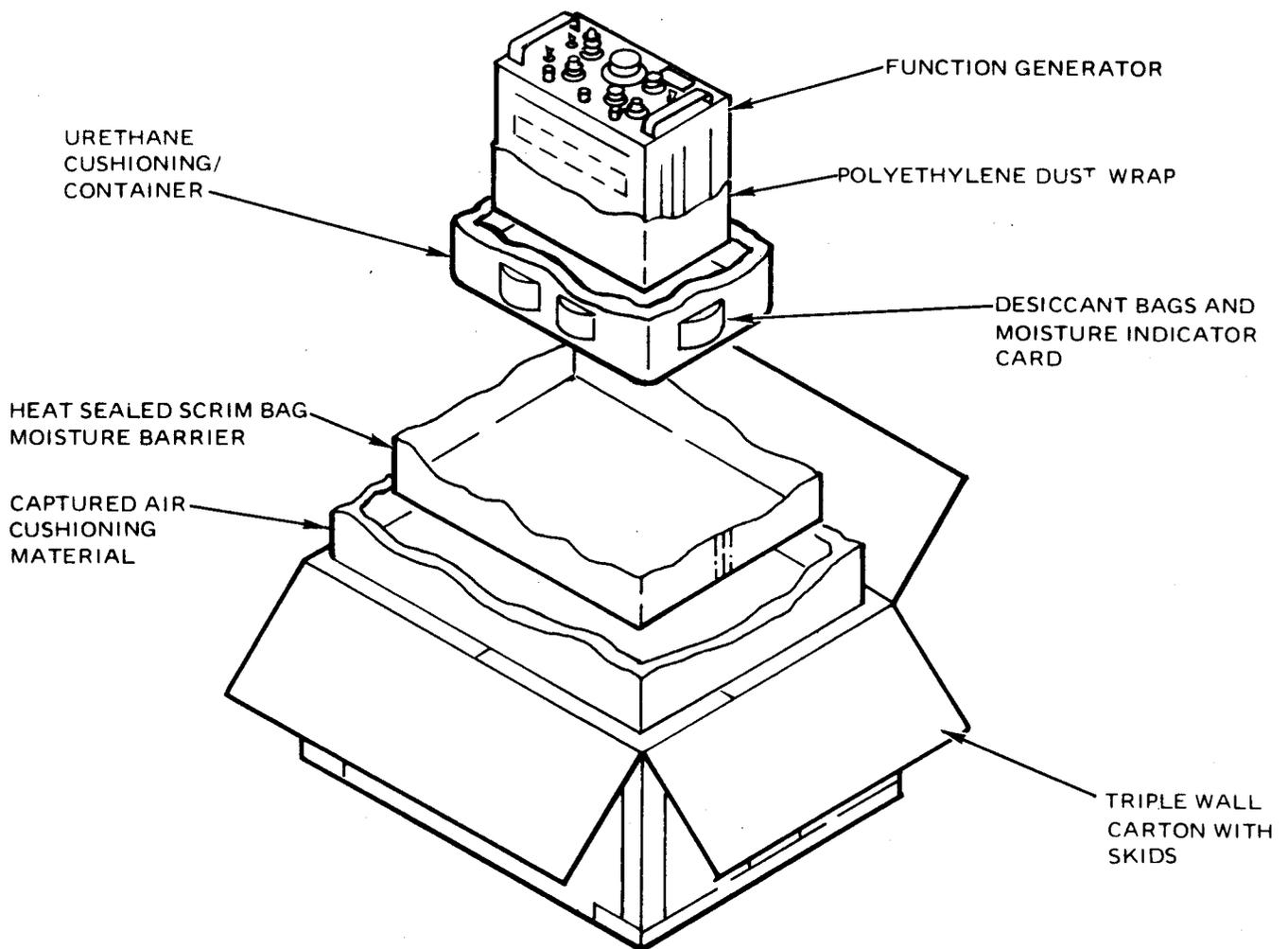


Figure 6-1. Enclosure Packing Method

e. Identify the packaged item on the scrim bag by marking method II of MIL-STD-129.

f. Surround the package with the captured-air material and place it in the triple-wall carton.

g. Secure the carton cover flaps with

the heavy staples, and seal the carton using the seven-strip tape method.

h. Label the carton in accordance with MIL-STD-129 and UU-P-534. Indicate the center of load and upward direction. Mark as fragile equipment. Labels must include the shipping address and package identification number.

Table 6-1. Packaging Materials

DESCRIPTION	MATERIAL SPEC NO.	QTY	SIZE (INCHES) (L x W x D)
Unit Protection			
Polyethylene dust wrap	L-P-378	1	33 x 33 x 0.004
Urethane foam cushioning/container	MIL-P-26514	1	20 x 13 x 19
Desiccant bag	MIL-D-3464D	11	34 x 23-1/4 x 32-1/2
Moisture indicator card	MS-20003-2	1	3 x 2
Waterproof adhesive tape	PPP-T-60	2	95 x 1
Intermediate Protection			
Moisture barrier bag (scrim)	MIL-B-131E	1	63 x 50 x 0.004
Identification label	MIL-STD-129	1	
Captured-air cushioning	PPP- C-795	1	117 x 24 x 1/4
		1	96 x 34 x 1/4
Exterior Protection			
Triple-wall carton with skids	PPP-B-636	1	36 x 24 x 36
Heavy staples	FF-N-105a	8	1-1/8 x 5/8 x 0.02
Waterproof adhesive tape	PPP-T-76	2	38 x 3
		4	28 x 3
Labels	MIL-STD-129		
Stencils	UU-P-534		

CHAPTER 7
STORAGE7-1. SHORT TERM STORAGE

7-2. Short term storage of the instrument requires that it be wrapped in a sheet of polyethylene material for protection from dust and dirt, and stored in a clean dry environment where there will be minimal handling.

7-3. LONG TERM STORAGE

7-4. Long term storage requires that the repacking procedures listed in paragraph 6-3 a thru d be followed to protect the instrument from the atmospheric conditions, moisture and dirt. Storage of the instrument must be in an environment with temperature extremes of less than 50° C and more than 0° C.

CHAPTER 8
ILLUSTRATED PARTS BREAKDOWN

SECTION A
INTRODUCTION

8-1. GENERAL

8-2. This Illustrated Parts Breakdown lists, describes and illustrates the items necessary for the support of the Function Generator, Model 142-S-527, FSN 6625-01-005-7236. This section is intended for use by maintenance personnel for parts identification.

8-3. The assemblies and parts installed at the time the end item was manufactured are listed and identified in this manual. Interchangeable and substitute assemblies and parts, subsequently authorized by the Government, are not listed in this manual; such items are identified by information available through the Interchangeable and Substitute (I and S) Data Systems. Refer to TO 00-25-184.

8-4. This Illustrated Parts Breakdown is divided into four parts, as follows:

Section A - Introduction

Section B - Maintenance Parts List

Section C - Numerical Index

Section D - Reference Designation Index

8-5. MAINTENANCE PARTS LIST

8-6. This section contains the complete maintenance parts list, separated into figures by assemblies and keyed to associated illustrations by figure and index numbers. The breakdown is listed in end item, assemblies, subassemblies, and detail parts order. The relationship of each part to its next higher assembly (NHA) is shown by indentation (para 8-8) or by figure cross reference (para 8-9).

8-7. Abbreviations. Abbreviations used in the Maintenance Parts List are in compliance with MIL-STD-12.

8-8. Indention. Parts listed in the Maintenance Parts List are indented to indicate item relationship or NHA. The

nomenclature of each assembly is followed in the list (except for attaching parts) by the nomenclature of its components indented one column to the right. This indention indicates the relationship of the component to the assembly. To determine the NHA of a part or assembly, note the column in which the first word of the nomenclature appears. The first item directly above, which appears one column to the left (except for attaching parts) is the NHA.

8-9. Figure Cross-reference Phrases. The continuity of parts lists figures and their relationship to the end item is maintained by a figure cross-reference phrase following the nomenclature of the item being referenced, as follows:

a. (See figure - for details) indicates the complete detailed breakdown for the item is located in the referenced figure.

b. (See figure - for NHA) indicates the item is listed in the referenced figure with its quantity requirements and relationship to its NHA indicated by column indention.

8-10. Attaching Parts. Nuts, bolts, screws, etc, which serve as attaching parts for frequently detached items are listed immediately following and with the same indention as the item they attach. The nomenclature of attaching parts is followed by the annotation (AP). When attaching parts are not exploded one index number serves to identify the set of attaching parts.

8-11. Federal Supply Codes for Manufacturers (FSCMs). All FSCMs listed are in accordance with Federal Supply Code for Manufacturers, Cataloging Handbook H4-1 and H4-2. When no FSCM is available the manufacturers' name is listed following the nomenclature of the item. The

FSCMs used in this publication are shown in the following list, with the name and address of the manufacturer, followed by a list of those manufacturers for whom no FSCM is available.

8-12. Units per Assembly. The Units per Assy column reflects the quantity required per one NHA.

8-13. Usable on Code. Since all parts listed in this breakdown have unlimited use, no "Usable on Code" is used.

8-14. NUMERICAL INDEX

8-15. This section contains an alpha-numerical listing of all drawings/part numbers listed in the Maintenance Parts List.

8-16. When a part has not been assigned an index number the figure and index number of the preceding part number in the parts list is used with a prefix of "F" meaning "follows." Thus, F3-2 means the listing will be found following the listing at 3-2.

8-17. Alpha-numerical arrangement. Part numbers are arranged in alpha-numerical sequence, beginning at the extreme left and progressing from left to right, one position at a time. The order of precedence for the first position of the part number is as follows:

a. Letters A through N and P through Z. (Alphabetic O's are considered numeric zeros.)

b. Numerals 0 through 9.

For the second and succeeding characters of the part number the precedence is as follows:

a. Diagonal

b. Period

c. Dash

d. Letters A through N and P through Z.

e. Numerals 0 through 9.

8-18. REFERENCE DESIGNATION INDEX

8-19. The reference designation index contains all the applicable reference designations shown on schematic diagrams and those cited in the manual. They are arranged in alphanumeric sequence.

List of Manufacturers

CODE	MANUFACTURER
00779	AMP, INC. P.O. Box 3608 Harrisburg, PA 17105
03554	AMPHENOL CANADA, LTD. A Division of the BUNKER RAMO CORP. 44 Metropolitan Rd. Scarborough, Ontario, Canada
04729	UNICORP MRF. 534 Mitchel St. Orange, NJ 07050
05394	PEM MACHINE TOOL CO., INC. 39A Myrtle St. Cranford, NJ 07016
05791	LYN-TRON, INC. 3625 W. Pacific Ave. Burbank, CA 91505
05820	WAKEFIELD ENGINEERING, INC. Audubon Rd. Wakefield, MA 01880
06383	PANDUIT CORP. 17301 Ridgeland Tinley Park, IL 60477
06540	AMATRON ELECTRONIC HARDWARE CO. Division of Mite Corp. 446 Lake St. New Haven, CT 06515
07047	MILTON ROSS CO. 511 2nd St. Pike Southampton, PA 18966
08808	GENERAL ELECTRIC 24400 Highland Rd. Richmond Heights, OH 44143
09353	C&K COMPONENTS, INC. 103 Morse St. Watertown, MA 02172

List of Manufacturers (Contd)

CODE	MANUFACTURER
11426	PACKARD INSTRUMENT CO., INC. 2200 Warrenville Rd. Downer Grove, IL 60515
14099	SEMTECH CORP. 652 Mitchell Rd. Newbury Park, CA 91320
15801	FENWAL ELECTRONICS, INC. 63 Fountain St. Framingham, MA 01701
15849	LITTON PRECISION PRODUCTS, INC. USECO Div., Litton Industries Van Nuys, CA
19647	CADDOCK ELECTRONICS 3127 Chicago Ave. Riverside, CA 92507
19738	AVDEL CORP. 10 Henry St. Teterboro, NJ 07608
22753	UID ELECTRONICS, DIV. AMF, INC. 4105 Pembroke Rd. Hollywood, FL 33021
23338	WAVETEK 9045 Balboa Ave. San Diego, CA 92123
24011	BURLINGTON OPERATIONS Div. of Electronized Chemicals Corp. S. Bedford St. Burlington, MA 01803
24355	ANALOG DEVICES, INC. P.O. Box 280, Route 1 Industrial Park Norwood, MA 02062
27014	NATIONAL SEMICONDUCTOR CORP. 2900 San Ysidro Dr. Santa Clara, CA 95051
27264	MOLEX PRODUCTS CO. 5224 Katrine Ave. Downers Grove, IL 60515

List of Manufacturers (Contd)

CODE	MANUFACTURER
27556	IMB ELECTRONIC PRODUCTS, INC. 15401 E. Carminita Rd. Santa Fe Springs, CA 90670
28145	SELECTIVE EQUIPMENT 5405 S. Broadway Los Angeles, CA 90012
28480	HEWLETT-PACKARD CO., INC. 1501 Page Mill Rd. Palo Alto, CA 94304
32997	BOURNS, INC. 1200 Columbia Ave. Riverside, CA 92507
33809	TEXAS INSTRUMENTS, INC. P.O. Box 5012 Dallas, TX 75222
33888	FAIRCHILD SEMICONDUCTOR, San Diego Facility 8865 Balboa Ave. San Diego, CA 92123
34206	FERRAFLUX, CORP. 1612 S. Lyon St. Santa Ana, CA 92705
49956	RAYTHEON CO. 141 Spring St. Lexington, MA 02173
51249	O.W. HEYMAN CO., INC. P.O. Box 30190 7560 Skylark Dr. Cleveland, OH 44130
56289	SPRAGUE ELECTRIC CO. North Adams, MA 01247
60703	TRICO PRODUCTS CORP. 817 Washington St. Buffalo, NY 14203
75915	LITTELFUSE, INC. 800 E. Northwest Hwy. Des Plaines, IL 60016

List of Manufacturers (Contd)

CODE	MANUFACTURER
81349	MILITARY SPECIFICATIONS Promulgated by Military Departments/Agencies under authority of Defense Standard- ization Manual 4120 3-M
83330	HERMAN H. SMITH, INC. 812 Snediker Ave. Brooklyn, NY 11027
84171	ARCO/LDP A Division of Loral Corp. Community Dr. Great Neck, LI, NY 11022
86654	NORTH AMERICAN SMELTING CO. Marine Terminal Wilmington, DE 19899
86684	RCA, Electronics Components 415 S. 5th St. Harrison, NJ 97029

List of Manufacturers (Contd)

CODE	MANUFACTURER
91836	KINGS ELECTRONICS CO., INC. 40 Marbledale Rd. Tuckahoe, NY 10707
96881	THOMPSON INDUSTRIES, INC. 1029 Plandome Rd. Manhasset, NY 11030
98388	ROYAL INDUSTRIES, ACCURATE PRODUCTS DIV. 4370 Jutland Dr. San Diego, CA 92117
99942	CENTERLAB SEMICONDUCTORS, Centerlab Electronics Div. of Glove-Union, Inc. 4501 N. Arden Dr. El Monte, CA 91734
99949	DEARBORN MFG. CO., INC. 12317 Woodbine Detroit, MI 48239
	SAN DIEGO BAG AND SUPPLY CO. 6550 Federal Blvd. San Diego, CA 92045

SECTION B. MAINTENANCE PARTS LIST

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description							Units Per Assy	Usable on Code	SMR Code
8-1-	1000-00-0112	23338	FUNCTION GENERATOR, Model 142-S-527							1		
1	1100-00-0608	23338	. GENERATOR BOARD ASSY . . (Drawing No. 0101- 00-0608) (See figure 8-2 for detail breakdown)							1		
2	1100-00-0607	23338	. POWER SUPPLY ASSY. . . . (Drawing No. 0101-00-0607) (See figure 8-3 for detail breakdown)							1		
	1101-00-0609	23338	. CHASSIS ASSY (Drawing. . . No. 0102-00-0609)							1		
3	3000-00-0020	23338	. . TAG, Caution							1		
4	312.250	75915	. . FUSE, 230V, 1/4A							2		
5	3x4x.004	NONE	. . BAG (San Diego Bag . . and Supply Co., 6550 Federal Blvd., San Diego, CA 92045)							1		
6	1400-00-7460	23338	. . TAG, ID.							1		
7	1400-00-7750	23338	. . TAG, Fuse.							1		
8	1131-0306	19738	. . RIVET, 3/32 x 3/16L. . (AP)							4		
9	2197W	98388	. . FOOT, Rubber							4		
10	COML	NONE	. . SCREW, Phillips. . . . head, 6-32 x 5/8L (AP)							4		
11	COML	NONE	. . LOCKWASHER, Internal . teeth, No. 6 (AP)							4		
12	S632-2	05394	. . NUT, Press (AP).							4		
13	1400-00-7472	23338	. . COVER, Bottom.							1		
14	COML	NONE	. . SCREW, Phillips, flat head, 4-40 x 5/16L (AP)							18		
15	1400-00-7482	23338	. . COVER, Top							1		
16	COML	NONE	. . SCREW, Phillips, flat head, 4-40 x 5/16L (AP)							18		
17	D2655-4	04729	. . HANDLE							2		
18	COML	NONE	. . SCREW, Pan head, 10-24 x 3/8L (AP)							4		
19	COML	NONE	. . LOCKWASHER, Internal . teeth, No. 10 (AP)							4		
20	70-3BL2G	49956	. . KNOB							3		
21	50-1WD1G	49956	. . KNOB							2		
22	70-3CB2G	49956	. . KNOB							2		
	1201-00-0606	23338	. . DIAL ASSY.							1		

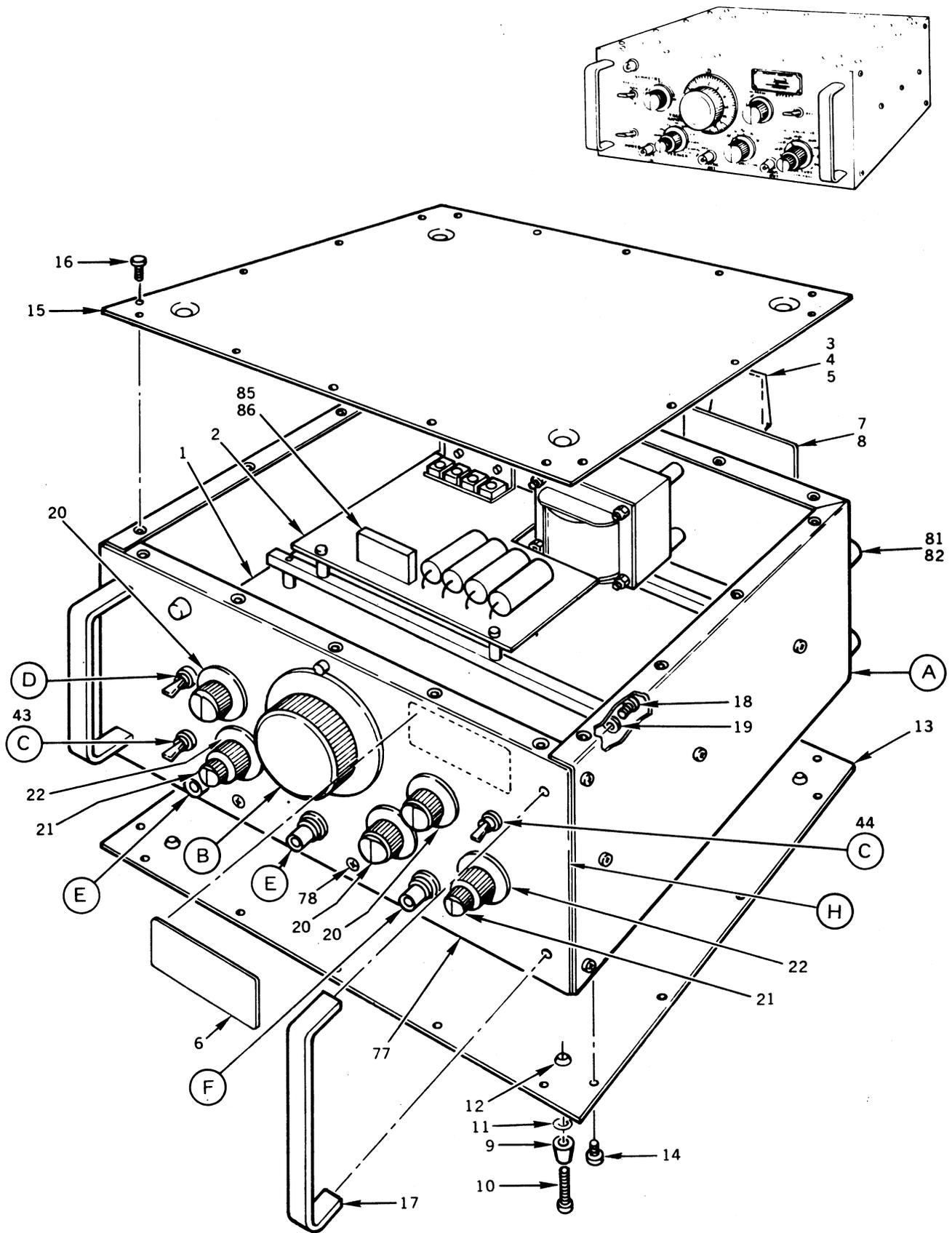


Figure 8-1. Function Generator, Model 142-S-527 (Sheet 1 of 3)

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-1-23	COML	NONE	. . NUT, 3/8 x 32 (AP) . .	1		
24	COML	NONE	. . LOCKWASHER, Internal . teeth, 3/8 (AP)	1		
25	4600-05-0200	23338	. . . POTENTIOMETER, 5K. .	1		
26	1400-00-1193	23338	. . . KNOB	1		
27	COML	NONE	. . . SCREW, Set, 6-32 x 1/4L (AP)	1		
28	COML	NONE	. . . SCREW, 4-40 x 1/46 (AP)	3		
29	COML	NONE	. . . WASHER, Flat, No. 4 (AP)	3		
30	1400-00-7569	23338	. . . DIAL (Alt from 1400-00-1321)	1		
	1400-00-1321	23338 DIAL	1		
31	1400-00-0183	23338	. . INDICATOR, Dial.	1		
32	COML	NONE	. . NUT, 6-32 (AP)	1		
33	COML	NONE	. . LOCKWASHER, Internal . teeth, No. 6 (AP)	1		
34	COML	NONE	. . SCREW, Fillister head, 4-40 x 3/8L	1		
35	LC12GT2	81349	. . CAP, Lens.	1		
36	387	08808	. . LAMP	1		
37	LH73/1	81349	. . LAMP Holder.	1		
38	7201P3DZQN	09353	. . SWITCH	1		
39	7099	09353	. . NUT, 1/4 x 40 (AP) . .	1		
40	2259N253	06540	. . WASHER, Nylon, flat (AP)	1		
41	2664	83330	. . WASHER, Shoulder (AP). .	1		
42	1410-14	83330	. . LUG.	1		
43	7201P3DZQN	09353	. . SWITCH	1		
44	7203P3DZQN	09353	. . SWITCH	1		
45	7099	09353	. . NUT, 1/4 x 40.	2		
46	2259N253	06540	. . WASHER, Nylon, flat. .	2		
47	7007	09353	. . RING, Locking.	2		
48	COML	NONE	. . NUT.	2		
49	SSTIM	06383	. . TY-WRAP.	4		
50	ABMS-A-C	06383	. . MOUNT, Adhesive.	4		
51	KC19-152	91836	. . CONNECTOR, BNC	2		
52	COML	NONE	. . RETAINER, Coax	2		
53	COML	NONE	. . NUT.	2		
54	COML	NONE	. . LOCKWASHER, Internal . teeth	2		
55	2668	83330	. . WASHER, Shoulder	1		
56	2264N385	06540	. . WASHER, Nylon, flat. .	1		
57	KC19-152	91836	. . CONNECTOR, BNC	1		
58	COML	NONE	. . RETAINER, Coax (AP). .	1		
59	COML	NONE	. . NUT (AP)	1		

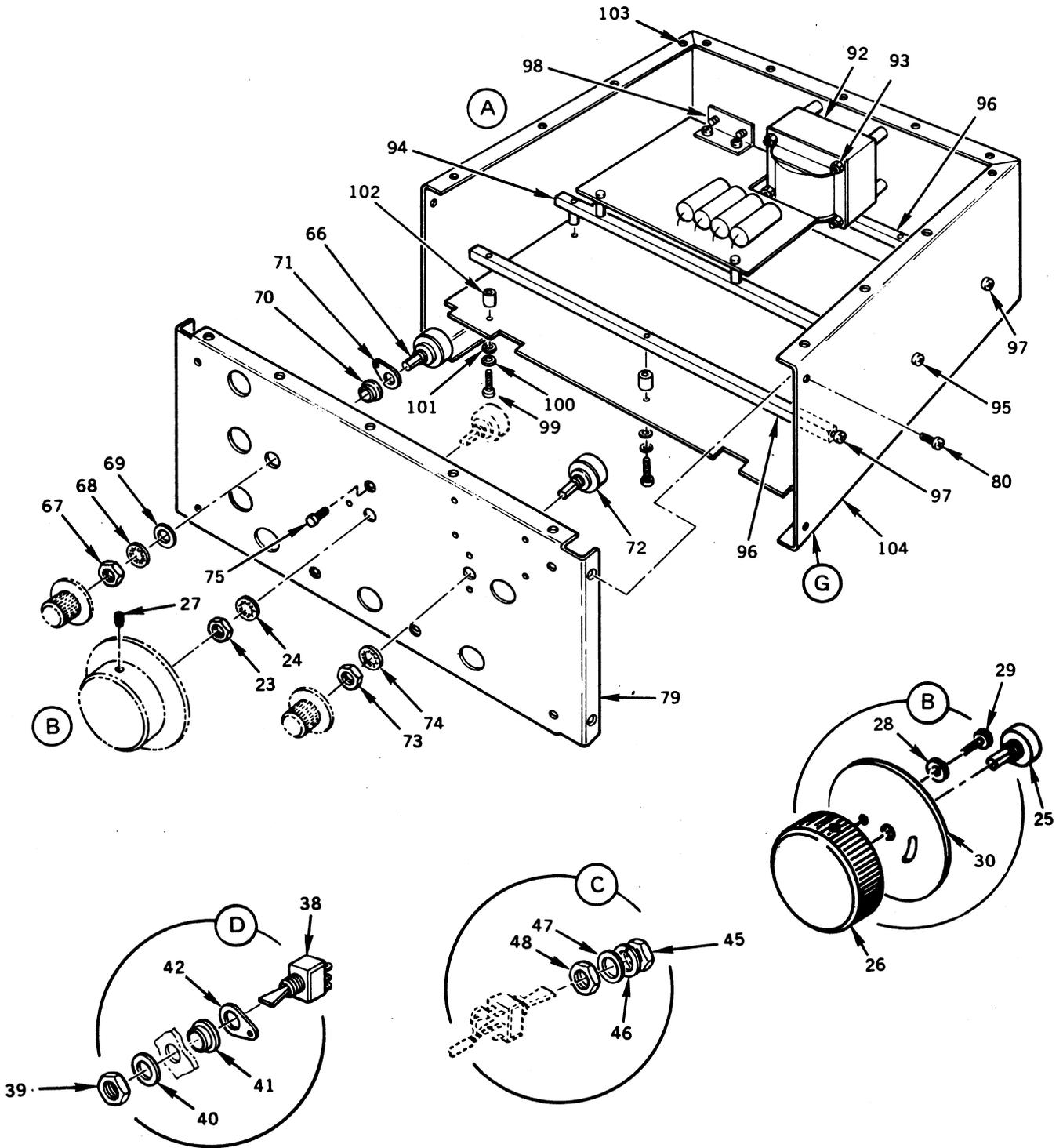


Figure 8-1. Function Generator, Model 142-S-527 (Sheet 2 of 3)

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description							Units Per Assy	Usable on Code	SMR Code
8-1-60	1497	83330	. .	LUG.						1		
61	2267N385	06540	. .	WASHER, Nylon (AP) . .						1		
62	2668	83330	. .	WASHER, Shoulder (AP).						1		
63	2264N385	06540	. .	WASHER, Nylon, flat. .						1		
64	GAP103	99942	. .	CAPACITOR, Ceramic, . .						1		
				0.01 μ F, 1.5KV								
65	1414-10	83330	. .	TERMINAL, Lock lug . .						1		
66	82A1A-B28H18	80294	. .	POTENTIOMETER, 50K . .						1		
67	COML	NONE	. .	NUT, 3/8 (AP).						1		
68	COML	NONE	. .	LOCKWASHER, Internal .						1		
				teeth (AP)								
69	2264N385	06540	. .	WASHER, Nylon,						1		
				flat (AP)								
70	2668	83330	. .	WASHER, Shoulder (AP).						1		
71	1497	83330	. .	LUG.						1		
72	4600-01-0304	23338	. .	POTENTIOMETER, 10K . .						1		
73	COML	NONE	. .	NUT, Hex, 3/8 (AP) . .						1		
74	COML	NONE	. .	LOCKWASHER,						1		
				Internal teeth,								
				3/8 (AP)								
75	COML	NONE	. .	SCREW, Fillister						1		
				head, 4-40 x 3/8L								
76	4L2FF	96881	. .	BUSHING, Nyliner						3		
77	1400-00-7510	23338	. .	PANEL, Front						1		
78	COML	NONE	. .	SCREW, 4-40 x 5/16L. .						2		
				(AP)								
79	1400-00-7491	23338	. .	PANEL.						1		
80	COML	NONE	. .	SCREW, Flat head,						4		
				4-40 x 5/16L (AP)								
81	2098W	98388	. .	BUMPER, Rubber						4		
82	COML	NONE	. .	SCREW, 8-32 x 3/4L . .						4		
				(AP)								
	S832-2	05394	. .	NUT, Press (AP).						4		
83	01-167-0001	22753	. .	SWITCH ASSY, Slide . .						1		
84	1125-0406	19738	. .	RIVET, 1/8 x 3/16L . .						2		
				(AP)								
85	08-50-0105	27264	. .	PIN, Connector						8		
86	09-50-7091	27264	. .	CONNECTOR.						1		
87	313.500	75915	. .	FUSE, 115V, 1/2A						2		
88	345001	75915	. .	HOLDER, Fuse						2		
89	FP301-3/4	24011	. .	SLEEVING, 3/4.						2		
90	6001-80-0004	23338	. .	POWER CORD						1		
91	SR6W1	51249	. .	BUSHING, Strain.						1		
				relief								
92	1204-00-0624	23338	. .	TRANSFORMFR.						1		

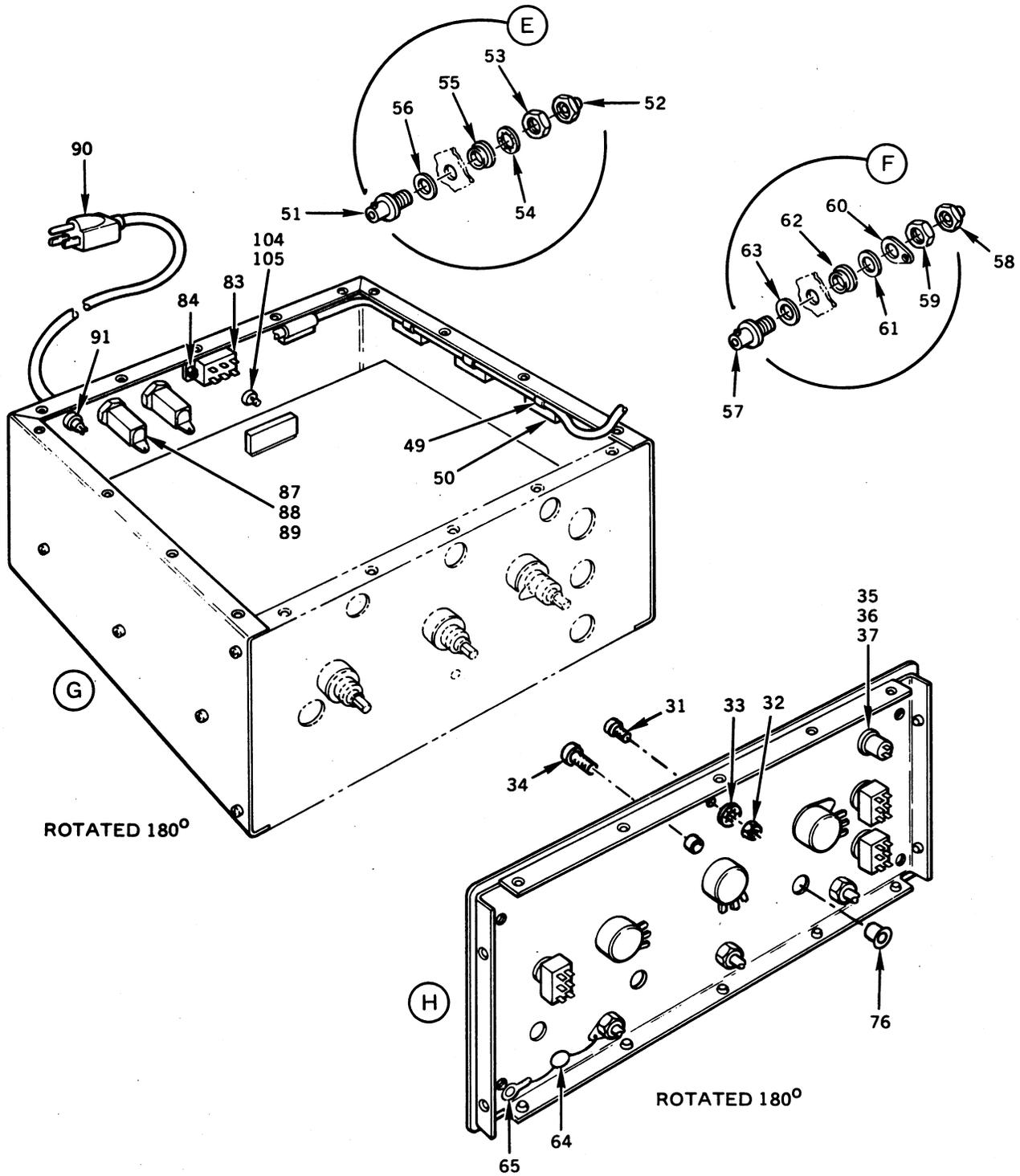


Figure 8-1. Function Generator, Model 142-S-527 (Sheet 3 of 3)

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-1-93	COML	NONE	. . NUT, No. 4 (AP). . . .	4		
	COML	NONE	. . LOCKWASHER, No. 4. . . (AP)	4		
	COML	NONE	. . SPACER, 1/2L (AP). . .	4		
	COML	NONE	. . SCREW, Pan head, . . . 6-32 x 2L (AP)	4		
94	1400-00-7613	23338	. . BAR, Support	1		
95	COML	NONE	. . SCREW, Phillips, . . . 4-40 x 5/16L (AP)	2		
96	1400-00-7553	23338	. . BAR, Support	2		
97	COML	NONE	. . SCREW, Phillips, . . . 4-40 x 5/16L (AP)	4		
98	COML	NONE	. . SCREW, Pan head, . . . 6-32 x 1/4L	2		
99	COML	NONE	. . SCREW, Pan head, . . . 4-40 x 1/2L	11		
100	COML	NONE	. . LOCKWASHER, Internal . teeth, No. 4	11		
101	COML	NONE	. . WASHER, Flat, No. 4. .	11		
102	6310-4-2C	05791	. . STANDOFF	11		
103	S440-2	05394	. . NUT, Press	43		
104	208-	83330	. . POST, Binding.	1		
105	COML	NONE	. . NUT, 6-32 (AP)	1		
	COML	NONE	. . LOCKWASHER, Internal . Teeth, No. 6 (AP)	1		
	106	1400-00-7502	23338	. . CHASSIS.	1	

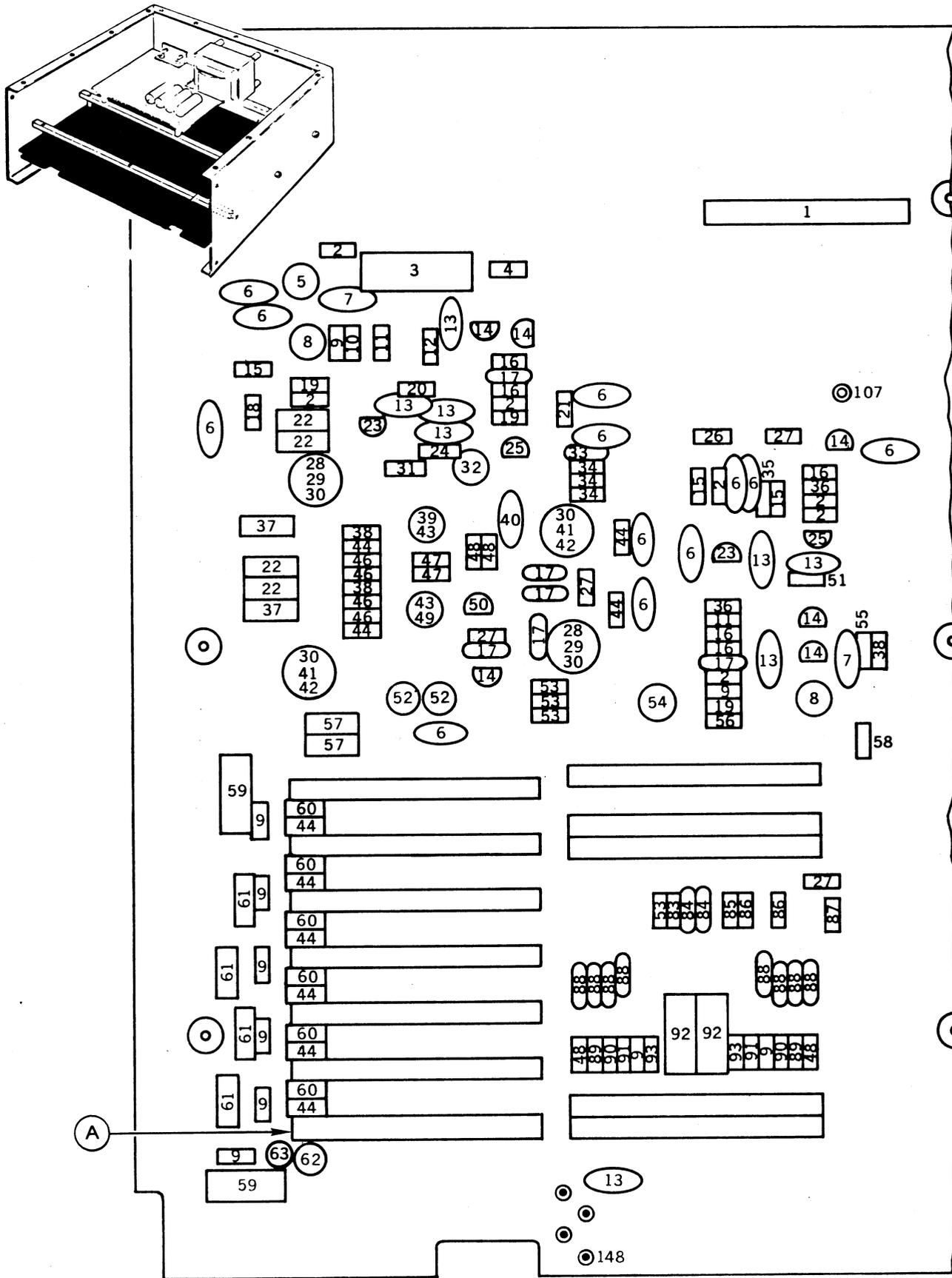


Figure 8-2. Generator Board Assembly (Sheet 1 of 3)

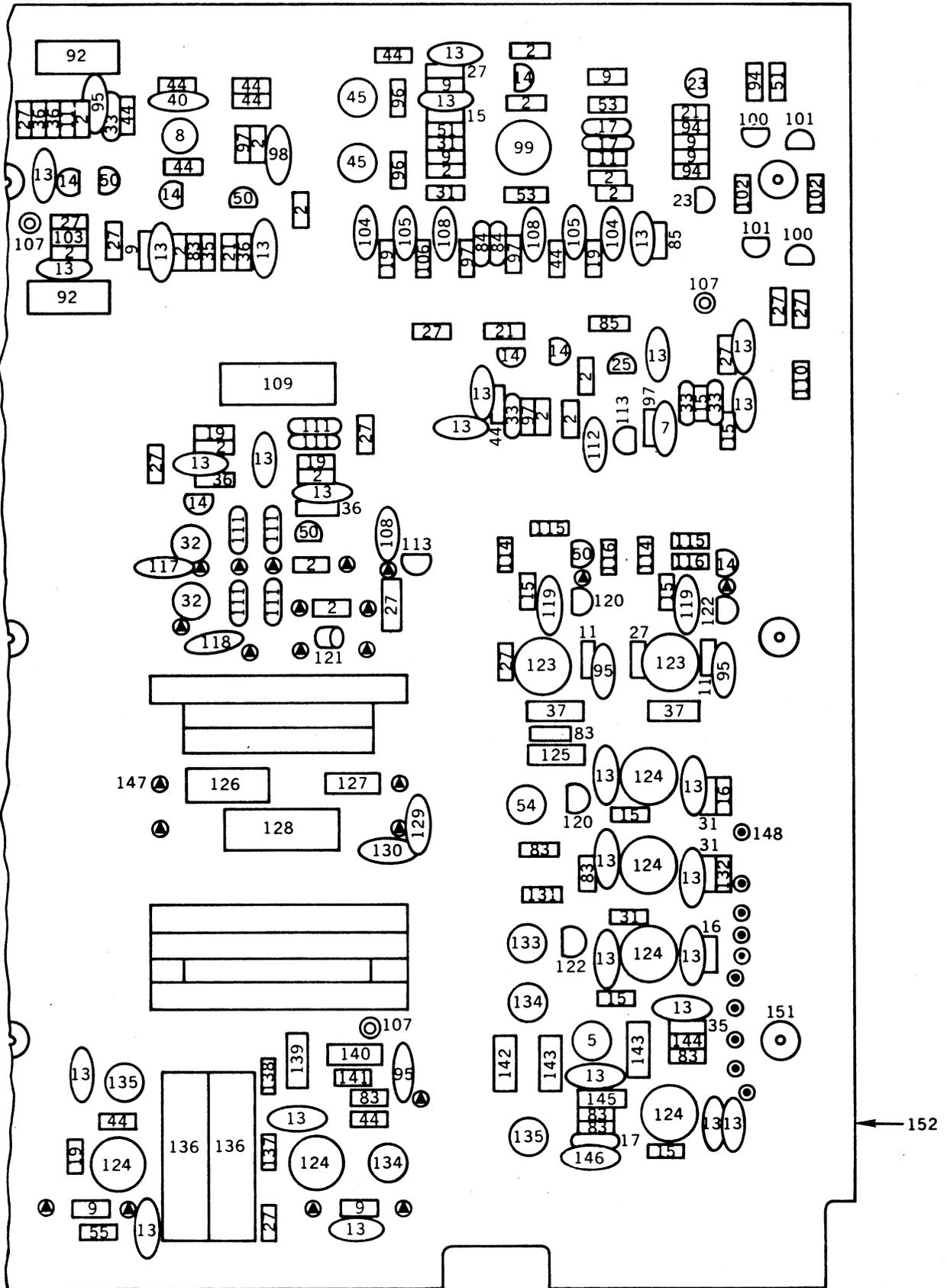


Figure 8-2. Generator Board Assembly (Sheet 2 of 3)

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-2-	1101-00-0608	23338	GENERATOR BOARD ASSY . . . (Drawing No. 0101-00-0608) (See figure 8-1-1 for NHA)	REF		
1	09-60-1091	27264	. CONNECTOR	1		
2	RN55D33R2F	81349	. RESISTOR, 33.2, 1/8W, . . . 1%	24		
3	4609-75-0102	23338	. POTENTIOMETER (Alt . . . from 4600-05-0105)	1		
	4600-05-0105	23338	. . POTENTIOMETER, 500, . . . 20%	1		
4	RN55D90R9F	81349	. RESISTOR	1		
5	3329P1-104	80294	. POTENTIOMETER, 100K. . .	2		
6	CK104	99942	. CAPACITOR, Ceramic, . . . 1 μ F, 50V	12		
7	CM05CD101J03	84171	. CAPACITOR, Mica, 100pF, 500V	3		
8	AD812	24355	. INTEGRATED CIRCUIT . . .	3		
9	RN55D1001F	81349	. RESISTOR	18		
10	RN55D1503F	81349	. RESISTOR	1		
11	RN55D2490F	81349	. RESISTOR	6		
12	RN55D1961F	81349	. RESISTOR	1		
13	CK103	99942	. CAPACITOR, Ceramic, . . . 0.01 μ F, 50V	37		
14	2N3905	81349	. TRANSISTOR	13		
15	RN55D1501F	81349	. RESISTOR	11		
16	RN55D2491F	81349	. RESISTOR	7		
17	FDH666	33888	. DIODE.	9		
18	RN55D4021F	81349	. RESISTOR	1		
19	RN55D3651F	81349	. RESISTOR	8		
20	RN55D4642F	81349	. RESISTOR	1		
21	RN55D7500F	81349	. RESISTOR	4		
22	RN60D75R0F	81349	. RESISTOR	4		
23	2N3640	81349	. TRANSISTOR	4		
24	RN55D3011F	81349	. RESISTOR	1		
25	2N3563	81349	. TRANSISTOR	3		
26	RN55D6810F	81349	. RESISTOR	1		
27	RN55D10R0F	81349	. RESISTOR	18		
28	209	05820	. HEATSINK	2		
29	2N4047	81349	. TRANSISTOR	2		
30	10160	07047	. TRANSIPAD.	4		
31	RN55D2001F	81349	. RESISTOR	6		
32	7S-TRIK002-3-5- 13PF	60703	. CAPACITOR, Variable, . . . 3.5/13pF, 250V	3		
33	1N4581	81349	. DIODE.	5		
34	RN55D3920F	81349	. RESISTOR	3		
35	RN55D1502F	81349	. RESISTOR	3		

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-2-36	RN55D7501F	81349	. RESISTOR	7		
37	150D105X9035A2	56289	. CAPACITOR, Tantalum, . . 1 μ F, 35V .	4		
38	RN55D61R9F	81349	. RESISTOR	3		
39	2N2219A	81349	. TRANSISTOR	1		
40	DD050	99949	. CAPACITOR, Ceramic, 5pF, 1KV	2		
41	207	05820	. HEATSINK	2		
42	2N5160	81349	. TRANSISTOR	2		
43	10123N	07047	. TRANSIPAD.	2		
44	RN55D1000F	81349	. RESISTOR	20		
45	3339P1-501	80294	. POTENTIOMETER, 500	2		
46	RN55D15R0F	81349	. RESISTOR	4		
47	RN55D1101F	81349	. RESISTOR	2		
48	RN55D2492F	81349	. RESISTOR	4		
49	2N2905A	81349	. TRANSISTOR	1		
50	2N3903	81349	. TRANSISTOR	5		
51	RN55D1002F	81349	. RESISTOR	3		
52	196D276X0035TE4	56289	. CAPACITOR, Tantalum, 27 μ F, 35V	2		
53	RN55D4640F	81349	. RESISTOR	6		
54	3339P1-104	80294	. POTENTIOMETER, 100K. . . .	2		
55	RN55D4990F	81349	. RESISTOR	2		
56	RN55D3013F	81349	. RESISTOR	1		
57	RN60D3160F	81349	. RESISTOR	2		
58	RN55D5004F	81349	. RESISTOR, Select from. . . .	1		
	RN55D2004F	81349	. RESISTOR, Select from. . . .	1		
	RN55D1004F	81349	. RESISTOR, Select from. . . .	1		
59	RN65D1210F	81349	. RESISTOR	2		
60	RN55D2740F	81349	. RESISTOR	6		
61	RN60D1210F	81349	. RESISTOR	4		
62	RN70D1000F	81349	. RESISTOR	1		
63	RN65D2740F	81349	. RESISTOR	1		
64	COML	NONE	. NUT, Radio, 4-40	8		
65	COML	NONE	. LOCKWASHER, Internal teeth, No. 4	8		
66	COML	NONE	. SCREW, Pan head, 4-40 x 3/8 L	1		
67	COML	NONE	. SCREW, Round head, 4-40 x 3 1/16 L	1		
68	COML	NONE	. SCREW, Pan head, 4-40 x 7/8 L	1		
69	COML	NONE	. SCREW, Pan head, 4-40 x 1/2 L	2		
70	COML	NONE	. SCREW, Pan head, 4-40 x 2 1/2 L	1		
71	COML	NONE	. SCREW, Pan head, 4-40 x 1 L	1		

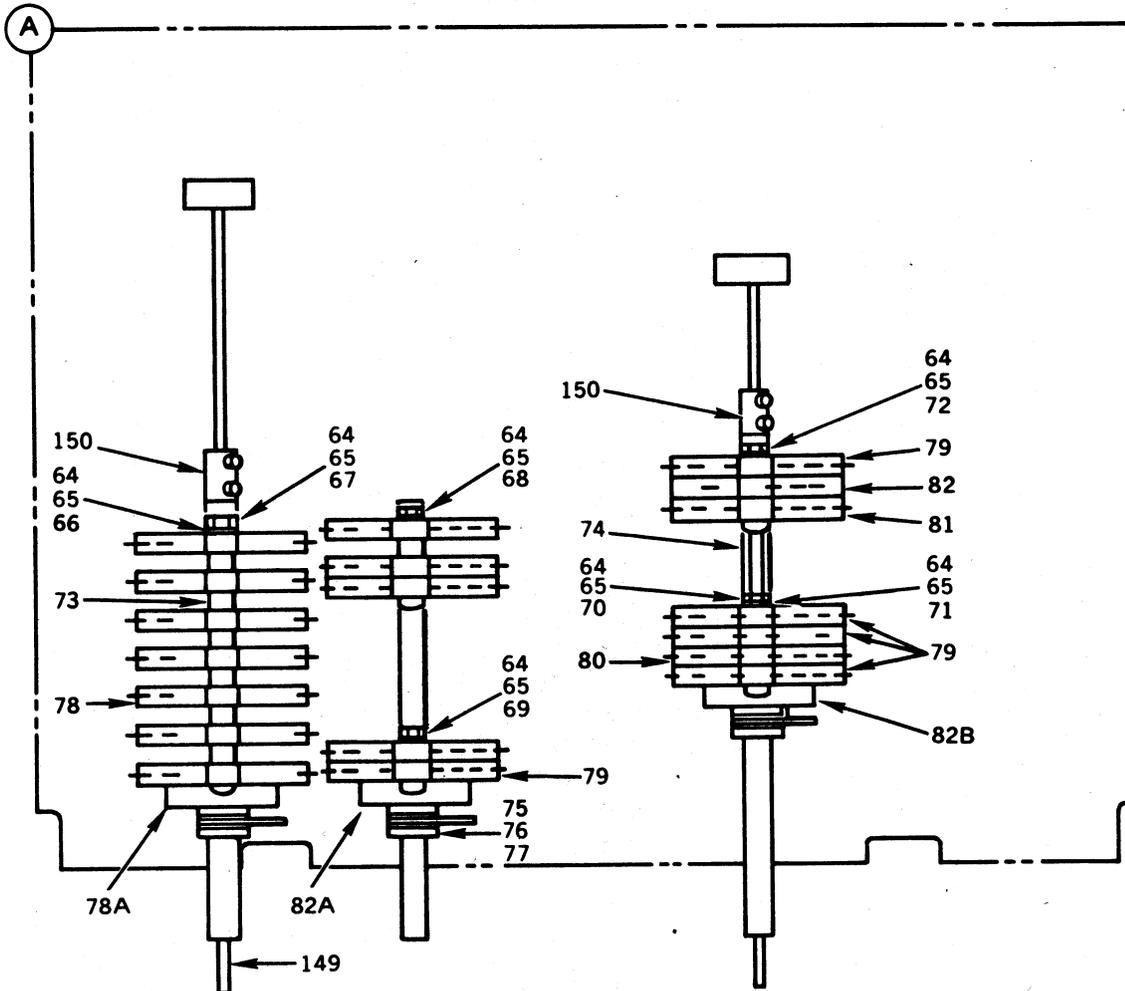


Figure 8-2. Generator Board Assembly (Sheet 3 of 3)

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-2-72	COML	NONE	. SCREW, Pan head, 4-40 x 3/4 L	1		
73	1400-00-7723	23338	. SPACER	7		
74	1400-00-7733	23338	. SPACER	1		
75	COML	NONE	. NUT, 3-8	3		
76	COML	NONE	. LOCKWASHER, Internal . . teeth, 3-8	3		
77	1497	83330	. LUG.	3		
78	5104-02-0016	23338	. WAFER, Switch.	7		
78A	5104-99-0038	23338	. SWITCH (Alt from 5104-01-0010)	1		
	5104-01-0010	23338	. . SWITCH	1		
79	5104-02-0015	23338	. WAFER, Switch.	9		
80	T5	99942	. WAFER, Switch.	1		
81	5104-02-0017	23338	. WAFER, Switch.	1		
82	5104-02-0018	23338	. WAFER, Switch.	1		
82A	5104-99-0038	23338	. SWITCH (Alt from 5104-01-0010)	1		
	5104-01-0010	23338	. . SWITCH	1		
82B	5104-99-0039	23338	. SWITCH (Alt from 5104-01-0010)	1		
	5104-01-0010	23338	. . SWITCH	1		
83	RN55D4991F	81349	. RESISTOR	9		
84	5082-2811	28480	. DIODE.	4		
85	RN55D1500F	81349	. RESISTOR	3		
86	RN55D21R5F	81349	. RESISTOR	2		
87	LB12J2	15801	. THERMISTER, 10%.	1		
	4898-00-0010	23338	. DIODE SET.	1		
88	FD777	33888	. . DIODE, Matched set . .	8		
89	RN55D1912F	81349	. RESISTOR	2		
90	RN55D5230F	81349	. RESISTOR	2		
91	RN55D2000F	81349	. RESISTOR	2		
92	150D565X903582	56289	. CAPACITOR, Tantalum, . . 5.6 μ F, 35V	4		
93	RN55D1302F	81349	. RESISTOR	2		
94	RN55D1211F	81349	. RESISTOR	3		
95	DD102	99942	. CAPACITOR, Ceramic,. . . 0.001 μ F, 1KV	4		
96	RN55D1781F	81349	. RESISTOR	2		
97	RN55D1360F	81349	. RESISTOR	5		
98	DD100	99942	. CAPACITOR, Ceramic,. . . 10pF, 1KV	1		
99	CA3049	86684	. INTEGRATED CIRCUIT . . .	1		
100	2N3642	81349	. TRANSISTOR	2		
101	2N3638A	81349	. TRANSISTOR	2		
102	RN55D8251F	81349	. RESISTOR	2		

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-2-103	RN55D8250F	81349	. RESISTOR	1		
104	CM05CD150J03	84171	. CAPACITOR, Mica, 150pF, . 500V	2		
105	CM05ED68J03	84171	. CAPACITOR, Mica, 68pF, . 500V	2		
106	RN55D1000F	81349	. RESISTOR	1		
107	200B1	15849	. TERMINAL	4		
108	CM05FD150J03	84171	. CAPACITOR, Mica, 15pF, . 500V	3		
109	4609-71-0308	23338	. POTENTIOMETER (Alt . . . from 4600-01-0312)	1		
	4600-01-0312	23338	. . POTENTIOMETER.	1		
110	RN55D39R2F	81349	. RESISTOR	1		
111	FD777	33888	. DIODE.	6		
112	CM05FD221J03	84171	. CAPACITOR, Mica, 220pF, 500V	1		
	4998-00-0009	23338	. TRANSISTOR SET (Select . from 2N5485)	1		
113	2N5485	81349	. . TRANSISTOR (VGS. . . . matched to 10 mV)	2		
114	RN55E1501B	81349	. RESISTOR	2		
115	RN55E7501B	81349	. RESISTOR	2		
116	RN55E1001B	81349	. RESISTOR	2		
117	CM05FD030J03	84171	. CAPACITOR, Mica, 3pF, 500V, select from	1		
	CM05FD050J03	84171	. CAPACITOR, Mica, 5pF, . . 500V, select from	1		
	CM05FD100J03	84171	. CAPACITOR, Mica, 10pF, . 500V, select from	1		
118	CM05FD560J03	84171	. CAPACITOR, Mica, 56pF, 500V	1		
119	DD331	99942	. CAPACITOR, Ceramic, . . . 330pF, 1KV	2		
	4998-00-0010	23338	. TRANSISTOR SET (Select from 2N5485)	1		
120	2N5485	81349	. . TRANSISTOR, Matched. .	2		
121	56-590-65-3B	34206	. FERRITE BEAD	1		
	4998-00-0008	23338	. TRANSISTOR SET (Select . from 2N5462)	1		
122	2N5462	81349	. . TRANSISTOR, Matched. .	2		
123	MA741	33888	. INTEGRATED CIRCUIT . . .	2		
124	CA3140S	86654	. INTEGRATED CIRCUIT . . .	6		
125	RC20GF685	81349	. RESISTOR	1		

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-2-	1509-80-0008	23338	. CAPACITOR SET, Polycarbonate	1		
126	1509-90-0006	23338	. . CAPACITOR, 0.1 μ F, . . . 100V, 1%	1		
127	1509-90-0005	23338	. . CAPACITOR, 0.01 μ F, . . 100V, 1%	1		
128	1509-90-0007	23338	. . CAPACITOR, 1 μ F, 100V, 1%	1		
129	CM05ED820J03	84171	. CAPACITOR, Mica, 82pF, 500V	1		
130	CM05ED911F03	84171	. CAPACITOR, Mica, 910pF, . . 500V	1		
131	RN55D4751F	81349	. RESISTOR	1		
132	RN55D2004F	81349	. RESISTOR, Select from. .	1		
	RN55D1004F	81349	. RESISTOR, Select from. .	1		
	RN55D8253F	81349	. RESISTOR, Select from. .	1		
133	3329P1-501	80294	. POTENTIOMETER, 500 . . .	1		
134	3329P1-103	80294	. POTENTIOMETER, 10K . . .	2		
135	3339P1-102	80294	. POTENTIOMETER, 1K. . . .	2		
136	1500-41-0504	23338	. CAPACITOR, Polycarbonate, 0.1 μ F, 100V	2		
	4789-00-0043	23338	. RESISTOR SET	1		
137	RN55D1002F	81349	. . RESISTOR (Matched) . .	1		
138	RN55D1003F	81349	. . RESISTOR (Matched) . .	1		
139	RN60D1004F	81349	. . RESISTOR (Matched) . .	1		
140	ML181	19647	. RESISTOR, 10M, 6W, 1%. .	1		
141	RN55D1052F	81349	. RESISTOR	1		
142	RN60D6983F	81349	. RESISTOR	1		
143	RC20GF515	81349	. RESISTOR, 5.1M, 1/2W, . . 10%	2		
144	RN55D46R4F	81349	. RESISTOR	1		
145	RN60D1004F	81349	. RESISTOR, 1M, 1/4W, . . . 1%	1		
146	DD151	99942	. CAPACITOR, Ceramic, . . . 150pF, 1KV	1		
147	FT-E12-011-6808	28145	. RECEPTACLE, Cloverleaf .	22		
148	60809-2	00779	. PIN.	14		
149	1400-00-7741	23338	. SHAFT, Extender.	1		
150	180	83330	. COUPLER.	2		
151	6310-4-2C	05791	. STANDOFF	9		
152	1700-00-0608	23338	. BOARD, Main.	1		

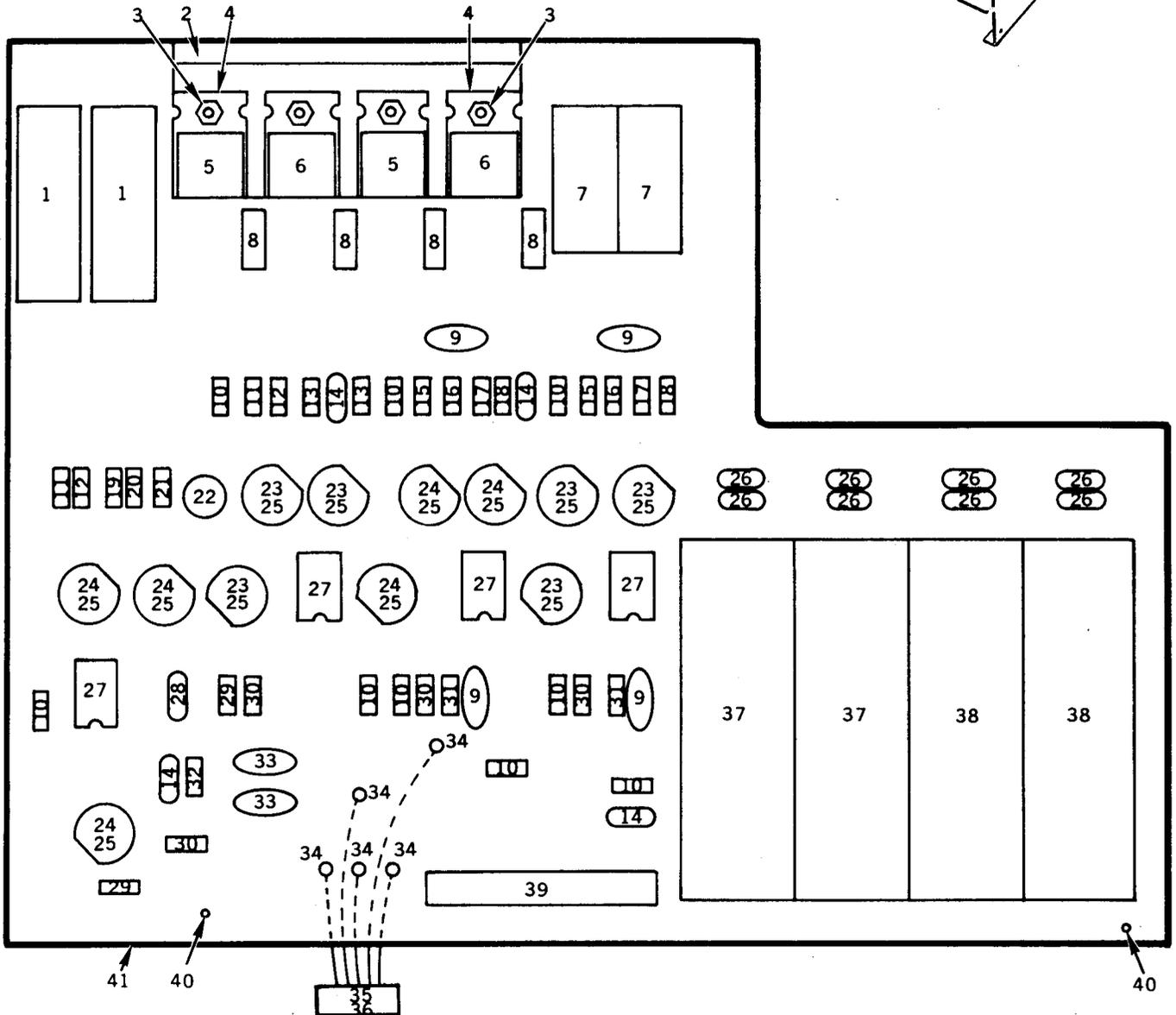
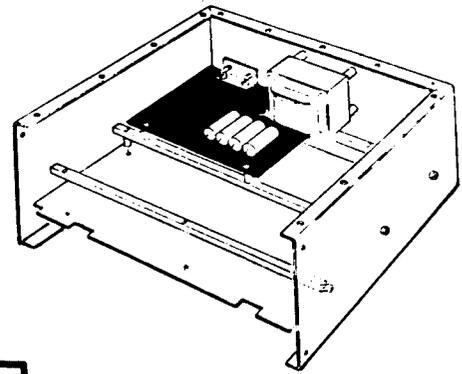


Figure 8-3. Power Supply Assembly

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-3-	0101-00-0607	23338	POWER SUPPLY ASSY, (Drawing No. 0101-00-0607) (See figure 8-1-2 for NHA)	REF		
1	500D257G016DF7	56289	. CAPACITOR, Electrolytic, 250 μ F, 16V	2		
2	1400-00-2043	23338	. HEATSINK	1		
3	COML	NONE	. NUT, Radio, 4-40 (AP) . .	4		
	COML	NONE	. LOCKWASHER, Internal . .	4		
			teeth, No. 4 (AP)			
	COML	NONE	. WASHER, Shoulder,	8		
			No. 4 (AP)			
	COML	NONE	. SCREW, Pan head,	4		
			4-40 x 1/2 L (AP)			
4	1400-00-2080	23338	. INSULATOR, Mica.	4		
5	TIP29	33809	. TRANSISTOR	2		
6	TIP30	33809	. TRANSISTOR	2		
7	500D506G050DD7	56289	. CAPACITOR, Electrolytic, 50 μ F, 50V	2		
8	RC20GF4R7J	81349	. RESISTOR, 4.7, 1/2W, 5%.	4		
9	CK103	99949	. CAPACITOR, Ceramic, . . . 0.01 μ F, 50V	4		
10	RN55D4751F	81349	. RESISTOR	9		
11	RN55D5760F	81349	. RESISTOR	2		
12	RN55D9091F	81349	. RESISTOR	2		
	4789-00-0018	23338	. RESISTOR SET, Matched. .	1		
13	RN55D1003F	81349	. . RESISTOR (Matched to 0.1%)	2		
14	FDH666	33888	. DIODE.	4		
15	RN55D6810F	81349	. RESISTOR	2		
16	RN55D1822F	81349	. RESISTOR	2		
17	RN55D9531F	81349	. RESISTOR	2		
18	RN55D6981F	81349	. RESISTOR	2		
19	RN55D6191F	81349	. RESISTOR	1		
20	RN55D8251F	81349	. RESISTOR	1		
21	RN55D2871F	81349	. RESISTOR	1		
22	3339P1-102	80294	. POTENTIOMETER, 1K. . . .	1		
23	2N2905A	81349	. TRANSISTOR	6		
24	2N2219A	81349	. TRANSISTOR	6		
25	10123N	07047	. TRANSIPAD.	12		
26	SCE1	14099	. DIODE.	8		
27	LM741	27014	. INTEGRATED CIRCUIT . . .	4		
28	1N4581	81349	. DIODE.	1		
29	RN55D4640F	81349	. RESISTOR	2		
30	RN55D2211F	81349	. RESISTOR	4		
31	RN55D3832F	81349	. RESISTOR	2		

Figure & Index Number	Part Number	FSCM	1 2 3 4 5 6 7 Description	Units Per Assy	Usable on Code	SMR Code
8-3-32	RN55D3921F	81349	. RESISTOR	1		
33	UK20-104	99949	. CAPACITOR, Ceramic, . . . 0.1 μ F, 20V	2		
34	60809-2	03554	. PIN, Male.	5		
35	08-50-0105	27264	. PIN.	5		
36	09-50-7091	27264	. CONNECTOR.	1		
37	39D507G050GL4	56289	. CAPACITOR, Electrolytic, 500 μ F, 50V	2		
38	39D108G035GL6	56289	. CAPACITOR, Electrolytic, 1000 μ F, 35V	2		
39	09-60-1091	27264	. CONNECTOR.	1		
40	6310-4-2C	05791	. STANDOFF	2		
41	1700-00-0607	23338	. BOARD, Power supply. . .	1		

SECTION C. NUMERICAL INDEX

Part Number	Fig. & Index Number	Qty Per End Item	SMR	Part Number	Fig. & Index Number	Qty Per End Item	SMR
ABMS-A-C	8-1-50	4		LOCKWASHER	8-1-11	6	
AD812	2-8	3			1-33		
CA3049	2-99	1			F1-105		
CA3140S	2-124	6		LOCKWASHER	1-19	4	
CK103	2-13	41		MA741	2-123	2	
	3-9			ML181	2-140	1	
CK104	2-6	12		NUT	1-48	5	
CM05CD101J03	2-7	3			1-53		
CM05CD150J03	2-104	2			1-59		
CM05ED68J03	2-105	2		NUT	1-67	5	
CM05ED820J03	2-129	1			1-73		
					2-75		
CM05ED911F03	2-130	1		NUT	1-23	1	
CM05FD030J03	2-117	1		NUT	1-93	4	
CM05FD050J03	F2-117	1		NUT	2-64	12	
CM05FD100J03	F2-117	1			3-3		
CM05FD150J03	2-109	3		NUT	1-32	2	
CM05FD221J03	2-112	1			1-105		
CM05FD560J03	2-118	1					
DD050	2-40	2		RC20GF4R7	3-8	4	
DD100	2-98	1		RC20GF515	2-143	2	
DD102	2-95	4		RC20GF685	2-125	1	
				RETAINER	1-52	3	
DD151	2-146	1			1-58		
DD331	2-119	2		RN55D10ROF	2-27	18	
D2655-4	1-17	2		RN55D1000F	2-44	21	
FDH666	2-17	13			2-106		
	3-14			RN55D1001F	2-9	18	
FD777	2-88	14		RN55D1002F	2-137	4	
	2-111				2-51		
FP301-3/4	1-89	2		RN55D1003F	2-138	3	
FT-E12-011-6808	2-147	22			3-13		
GAP103	1-64	1		RN55D1004F	F2-132	3	
KC19-152	1-51	3			2-139		
	1-57				F2-58		
LB12J2	2-87	1					
				RN55D1052F	2-141		
LC12GT2	1-35	1		RN55D1101F	2-47	2	
LH73/1	1-37	1		RN55D1211F	2-94	3	
LM741	3-27	4		RN55D1302F	2-93	2	
LOCKWASHER	1-54	3		RN55D1360F	2-97	5	
	1-68			RN55D15ROF	2-46	4	
LOCKWASHER	1-24	5		RN55D1500F	2-85	3	
	1-74			RN55D1501F	2-11	11	
	2-76			RN55D1502F	2-35	3	
LOCKWASHER	F1-93	27		RN55D1503F	2-10	1	
	1-100						
	2-65			RN55D1781F	2-96	2	
	F3-3			RN55D1822F	3-16	2	

Part Number	Fig. & Index Number	Qty Per End Item	SMR	Part Number	Fig. & Index Number	Qty Per End Item	SMR
	8-				8-		
RN55D1912F	2-89	2		RN55D90R9F	2-4	1	
RN55D1961F	2-12	1		RN55D9091F	3-12	2	
RN55D2000F	2-91	2		RN55D9531F	3-17	2	
RN55D2001F	2-31	6		RN55E1001B	2-116	2	
RN55D2004F	F2-132	2		RN55E1501B	2-114	2	
	2-58			RN55E7501B	2-115	2	
RN55D21R5F	2-86	2		RN60D1004F	2-139	2	
RN55D2211F	3-30	4			2-145		
RN55D2490F	2-11	6		RN60D1210F	2-61	4	
RN55D2491F	2-16	7		RN60D3160F	2-57	2	
RN55D2492F	2-48	4		RN60D6983F	2-142	1	
RN55D2740F	2-60	7					
				RN60D75R0F	2-22	4	
RN55D2871F	3-21	1		RN65D1210F	2-59	2	
RN55D3011F	2-24	1		RN65D2740F	2-63	1	
RN55D3013F	2-56	1		RN70D1000F	2-62	1	
RN55D33R2F	2-2	24		SCE1	3-26	8	
RN55D3651F	2-19	8		SCREW	1-18	4	
RN55D3832F	3-31	2		SCREW	F3-3	4	
RN55D39R2F	2-110	1		SCREW	1-28	3	
RN55D3920F	2-34	3		SCREW	2-72	1	
RN55D3921F	3-32	1		SCREW	1-34	5	
RN55D4021F	2-18	1			1-75		
					2-66		
RN55D46R4F	2-144	1		SCREW	1-99	13	
RN55D4640F	2-53	8			2-69		
	3-29			SCREW	1-98	2	
RN55D4642F	2-20	1		SCREW	1-78	2	
RN55D4751F	3-10	10		SCREW	1-80	10	
	3-131				1-95		
RN55D4990F	2-55	2			1-97		
RN55D4991F	2-83	9		SCREW	2-68	1	
RN55D5004F	2-58	1		SCREW	2-71	1	
RN55D5230F	2-90	2		SCREW	2-70	1	
RN55D5760F	3-11	2		SCREW	2-67	1	
RN55D61R9F	2-38	3		SCREW	1-27	1	
				SCREW	F1-93	4	
RN55D6191F	3-19	1					
RN55D6810F	2-26	3		SCREW	1-10	4	
	3-15			SCREW	1-14	36	
RN55D6981F	3-18	2			1-16		
RN55D7500F	2-21	4		SCREW	1-82	4	
RN55D7501F	2-36	7		SPACER	1-93	4	
RN55D8250F	2-103	1		SR6W1	1-91	1	
RN55D8251F	2-102	3		SST1M	1-49	4	
	3-20			S440-2	1-103	43	
RN55D8253F	F2-132	1					

Part Number	Fig. & Index Number	Qty Per End Item	SMR	Part Number	Fig. & Index Number	Qty Per End Item	SMR
	8-				8-		
S632-2	1-12	4		1400-00-7553	1-96	2	
S832-2	F1-82	4		1400-00-7569	1-30	1	
TIP29	3-5	2		1400-00-7613	1-94	1	
TIP30	3-6	2		1400-00-7723	2-73	7	
UK20-104	3-33	2		1400-00-7733	2-74	1	
WASHER	1-101	14		1400-00-7741	2-149	1	
	1-29			1400-00-7750	1-7	1	
WASHER	1-56	1		1410-14	1-42	1	
WASHER	1-55	1		1414-10	1-65	1	
WASHER	F3-3	8		1497	1-60	5	
T5	2-80	1			1-71		
					1-77		
01-167-0001	1-83	1		150D105X9035A2	2-37	4	
0101-00-0607	3	REF		150D565X903582	2-92	4	
08-50-0105	1-85	1		1500-41-0504	2-136	2	
	3-35			1509-80-0008	F2-125	1	
09-50-7091	1-86	2		1509-90-0005	2-127	1	
	3-36			1509-90-0006	2-126	1	
09-60-1091	2-1	2		1509-90-0007	2-128	1	
	3-39			1700-00-0607	3-41	1	
1N4581	2-33	6		1700-00-0608	2-152	1	
	3-28			180	2-150	2	
1000-00-0112	1	1		196D276X0035TE4	2-52	2	
10123N	2-43	14					
	3-25			2N2219A	2-39	7	
10160	2-30	4			3-24		
1100-00-0607	1-2	1		2N2905A	2-49	7	
					3-23		
1100-00-0608	1-1	1		2N3563	2-25	3	
1101-00-0609	F1-2	1		2N3638A	2-101	2	
1125-0406	1-84	2		2N3640	2-23	4	
1131-0306	1-8	4		2N3642	2-100	2	
1201-00-0606	F1-22	1		2N3903	2-50	5	
1204-00-0624	1-92	1		2N3905	2-14	13	
1400-00-0183	1-31	1		2N4047	2-29	2	
1400-00-1193	1-26	1		2N5160	2-42	2	
1400-00-1321	F1-30	1					
1400-00-2043	3-2	1		2N5462	2-122	2	
				2N5485	2-113	4	
1400-00-2080	3-4	4			2-120		
1400-00-7460	1-6	1		2001B1	2-107	4	
1400-00-7472	1-13	1		207	2-41	2	
1400-00-7482	1-15	1		209	2-28	2	
1400-00-7491	1-79	1		2098W	1-81	4	
1400-00-7502	1-106	1		2197W	1-9	4	
1400-00-7510	1-77	1					

Part Number	Fig. & Index Number	Qty Per End Item	SMR	Part Number	Fig. & Index Number	Qty Per End Item	SMR
2259N253	8- 1-46	3		4998-00-0009	8- F2-112	1	
2264N385	1-46			4998-00-0010	F2-87	2	
2267N385	1-63	2			F2-119		
2664	1-69			50-1WD1G	1-21	2	
2668	1-61	1		500D257G016DF7	3-1	2	
3x4x.004	1-41	1		500D506G050DD7	3-7	2	
3000-00-0020	1-62	2		5082-2811	2-84	4	
312.250	1-70			5104-01-0010	F2-78A	3	
313.500	1-5	1			F2-82A		
3329P1-103	1-3	1			F2-82B		
3329P1-104	1-4	2		5104-02-0015	2-79	9	
3339P1-102	1-87	2		5104-02-0016	2-78	7	
3339P1-104	2-134	2					
3339P1-501	2-5	2		5104-02-0017	2-81	1	
3339P1-102	2-133	1		5104-02-0018	2-82	1	
3339P1-104	2-135	3		5104-99-0038	2-78A	2	
3339P1-501	3-22				2-82A		
345001	2-54	2		5104-99-0039	2-82B	1	
387	2-45	2		56-590-65-3B	2-121	1	
39D108G035G16	2-88	2		6001-80-0004	1-90	1	
39D507G050GL4	1-36	1		60809-2	2-148	19	
4L2FF	3-38	2			3-34		
4600-01-0304	3-37	2		6310-4-2C	1-102	22	
4600-01-0312	1-3	3			2-158		
4600-05-0105	1-72	1			3-40		
4600-05-0200	F2-109	1		7S-TRIK002-3-5- 13PF	2-32	3	
4609-71-0308	F2-3	1		70-3BL2G	1-20	3	
4609-75-0102	1-25	1					
4701-03-1000	2-109	1		70-3CB2G	1-22	2	
4789-00-0018	2-3	1		7007	1-47	2	
4789-00-0043	2-106	1		7099	1-39	3	
4998-00-0008	F3-12	1			1-45		
	F2-136	1		7201P3DZQN	1-38	2	
	F2-121	1			1-43		
				7203P3DZQN	1-44	1	
				82A1A-B28H18	1-66	1	

SECTION D. REFERENCE DESIGNATION INDEX

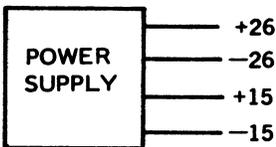
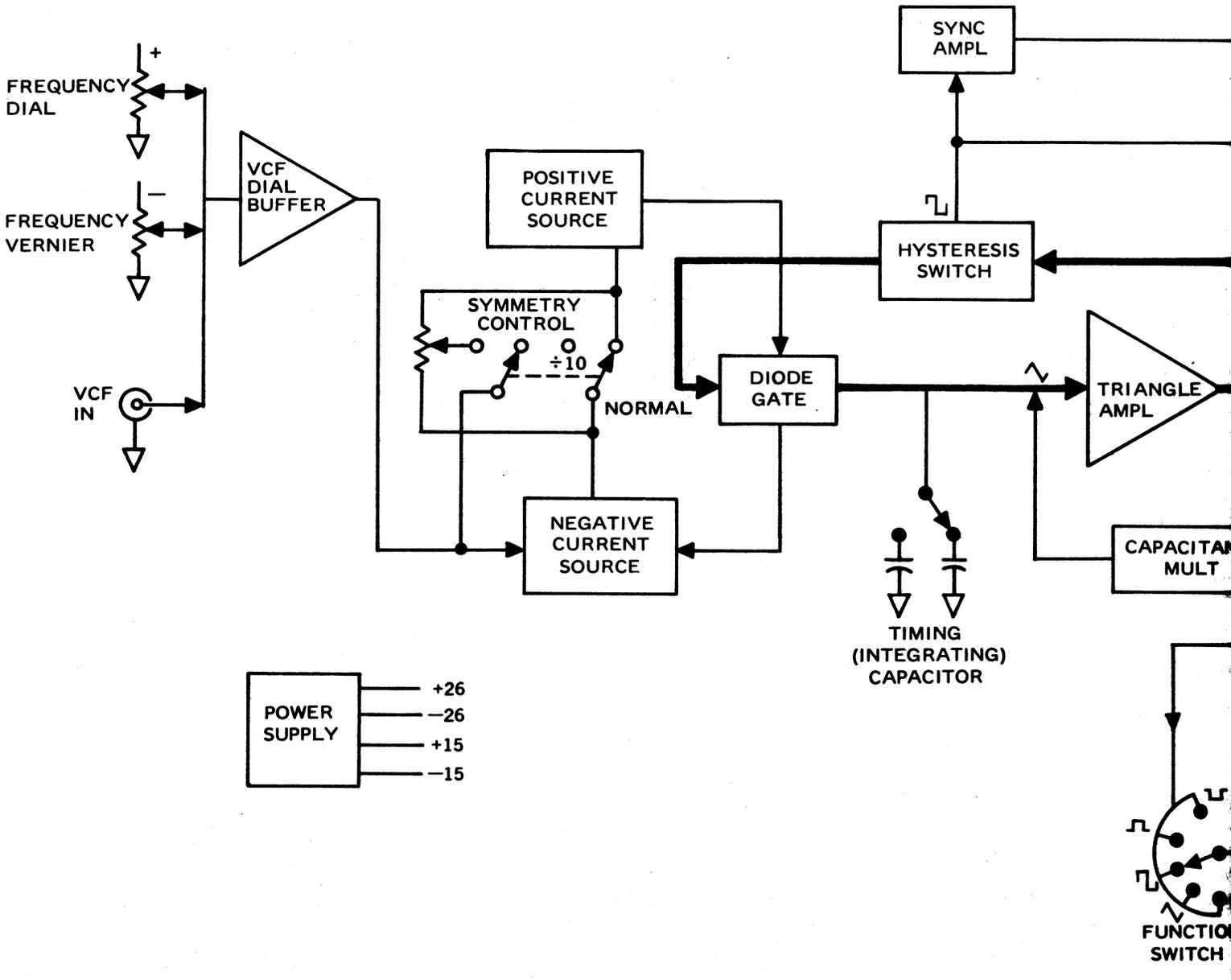
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1A1	1-1	1A1C3	2-13	1A1C70	2-13
	2	1A1C30	2-6	thru	
1A1CR1	2-17	thru		1A1C73	
1A1CR10	2-111	1A1C35		1A1C74	2-7
thru		1A1C36	2-13	1A1C75	2-13
1A1CR14		thru		1A1C76	2-32
1A1CR15	2-17	1A1C37		1A1C77	2-13
1A1CR16	2-33	1A1C38	2-108	1A1C78	2-6
1A1CR17	2-17	1A1C39	2-7	thru	
thru		1A1C40	2-112	1A1C79	
1A1CR19		1A1C41	2-13	1A1C8	2-119
1A1CR2	2-33	thru		1A1C80	2-52
1A1CR20	2-17	1A1C42		1A1C81	2-37
1A1CR22	2-88	1A1C43	2-108	thru	
thru		1A1C44	2-105	1A1C82	
1A1CR29		1A1C45	2-104	1A1C83	2-52
1A1CR3	2-33	thru			
		1A1C46		1A1C84	2-92
1A1CR30	2-84			1A1C86	2-13
thru		1A1C47	2-105	1A1C87	2-7
1A1CR31		1A1C48	2-108	1A1C88	2-13
1A1CR33	2-17	1A1C49	2-13	thru	
1A1CR34	2-84	thru		1A1C89	
1A1CR4	2-33	1A1C51		1A1C9	2-37
1A1CR5	2-84	1A1C52	2-98	1A1C91	2-6
1A1CR6	2-17	1A1C53	2-13	1A1C92	2-92
thru		1A1C54	2-40	1A1C93	2-6
1A1CR7		1A1C55	2-13	1A1C94	2-13
1A1CR8	2-33	1A1C56	2-95	1A1C95	2-94
1A1CR9	2-11	1A1C57	2-13		
1A1C1	2-13	thru		1A1C96	2-40
1A1C10	2-95	1A1C58		1A1IC1	2-124
		1A1C59	2-117	thru	
1A1C11	2-119			1A1IC2	
1A1C12	2-136	1A1C6	2-38	1A1IC3	2-123
thru		1A1C60	2-129	1A1IC4	2-124
1A1C13		1A1C61	2-32	thru	
1A1C14	2-95	1A1C62	2-130	1A1IC5	
1A1C15	2-13	1A1C63	2-127	1A1IC6	2-123
thru		1A1C64	2-126	1A1IC7	2-124
1A1C19		1A1C65	2-128	thru	
1A1C2	2-146	1A1C66	2-32	1A1IC8	
1A1C20	2-6	1A1C67	2-118	1A1IC9	2-99
1A1C21	2-13	1A1C68	2-13	1A1J2	2-1
1A1C22	2-92	thru		1A1Q1	2-120
1A1C23	2-13	1A1C69		1A1Q10	2-25
thru				1A1Q11	2-14
1A1C28		1A1C7	2-95		
1A1C29	2-6				

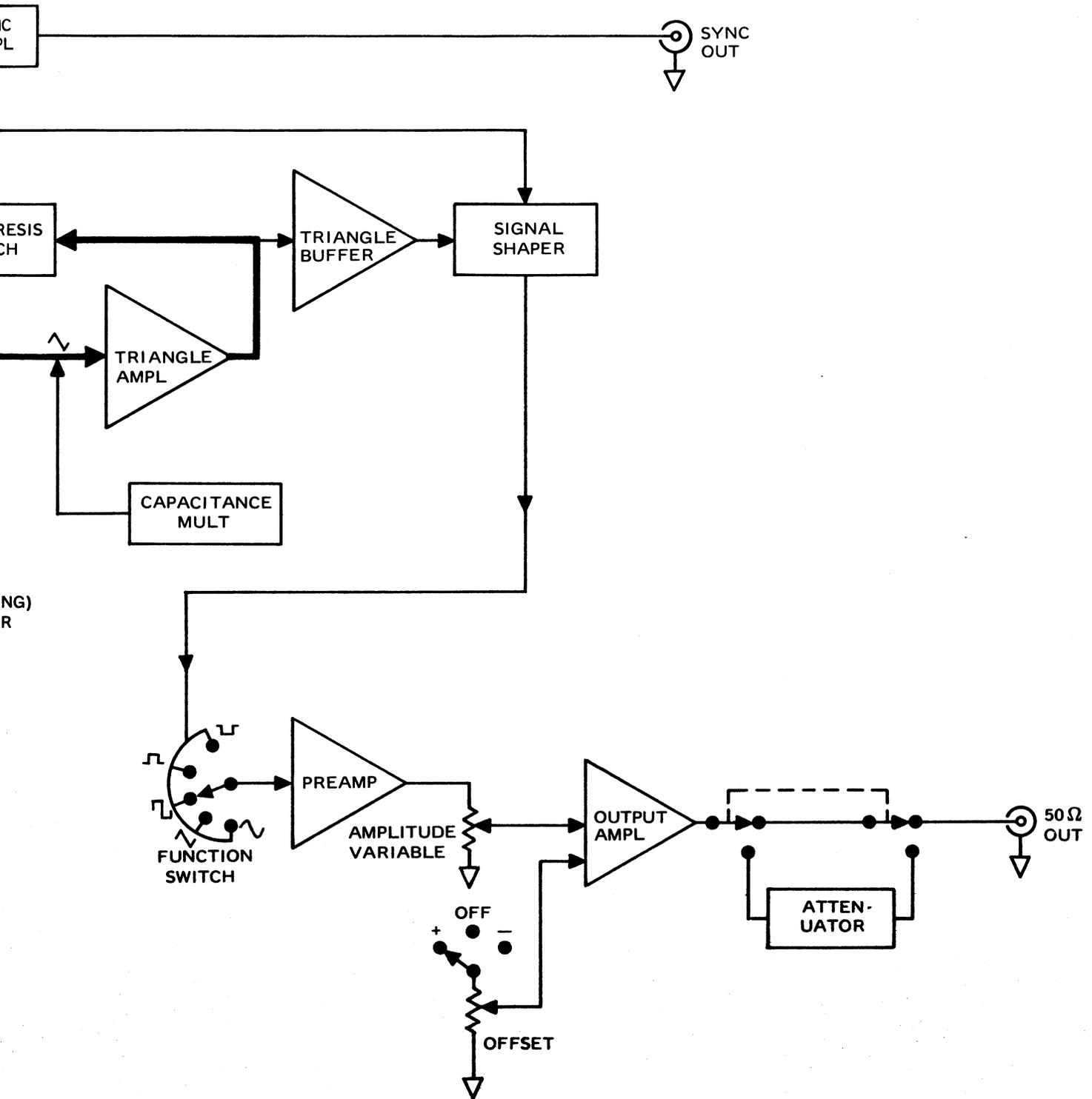
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1A1Q12	2-23	1A1Q45	2-50	1A1R131	2-2
thru		1A1Q5	2-120	thru	
1A1Q13		1A1Q6	2-50	1A1R132	2-2
1A1Q14	2-14	1A1Q7	2-113	1A1R133	2-19
thru		thru		1A1R134	2-27
1A1Q15		1A1Q8		1A1R135	2-94
1A1Q16	2-50	1A1Q9	2-14	1A1R136	2-51
1A1Q17A	2-8	1A1R10	2-109	1A1R137	2-102
thru		1A1R100	2-21	1A1R138	2-27
1A1Q17B		1A1R101	2-2	thru	
1A1Q18	2-14	1A1R102	2-44	1A1R139	
1A1Q2	2-14	1A1R103	2-27	1A1R14	2-83
1A1Q20	2-50			1A1R140	2-102
1A1Q21	2-14	1A1R104	2-83		
1A1Q22	2-101	1A1R105	2-44	1A1R141	2-110
1A1Q23	2-100	1A1R106	2-2	1A1R143	2-5
thru		1A1R107	2-9	1A1R144	2-10
1A1Q24		1A1R108	2-44	1A1R145	2-12
		1A1R109	2-27	1A1R146	2-11
1A1Q25	2-101	1A1R11	2-143	1A1R147	2-3
1A1Q26	2-14	1A1R110	2-103	1A1R148	2-2
thru		1A1R111	2-35	1A1R149	2-15
1A1Q27		1A1R112	2-36	1A1R15	2-10
1A1Q28A	2-8			1A1R150	2-16
thru		1A1R113	2-44	thru	
1A1Q28B		thru		1A1R151	
1A1Q29	2-25	1A1R115			
1A1Q3	2-122	1A1R116	2-97	1A1R152	2-21
1A1Q30	2-42	1A1R117	2-21	1A1R153	2-19
1A1Q31	2-23	1A1R118	2-36	1A1R154	2-2
1A1Q32	2-29	1A1R119	2-48	1A1R155	2-34
1A1Q33	2-50	1A1R12	2-5	thru	
1A1Q34	2-39	1A1R120	2-89	1A1R157	
		1A1R121	2-27	1A1R158	2-44
1A1Q35	2-14	1A1R122	2-11	1A1R159	2-27
1A1Q36	2-49	1A1R123	2-36	1A1R16	2-31
1A1Q37	2-29			1A1R160	2-31
1A1Q38	2-42	1A1R124	2-27	1A1R161	2-9
1A1Q39	2-14	1A1R125	2-2	1A1R162	2-20
1A1Q4	2-122	thru		1A1R163	2-18
1A1Q40	2-14	1A1R126		1A1R164	2-19
1A1A41A	2-8	1A1R127	2-36	1A1R165	2-2
thru		thru			
1A1Q41B		1A1R128		1A1R166	2-24
1A1Q42	2-23	1A1R129	2-27	1A1R167	2-27
1A1Q43	2-25	1A1R13	2-134	1A1R168	2-53
1A1Q44	2-14	1A1R130	2-19	thru	
				1A1R169	

Reference Designation	Figure & Index No.	Reference Designation	Figure & Index No.	Reference Designation	Figure & Index No.
	8-		8-		8-
1A1R17	2-54	1A1R210	2-44	1A1R252	2-15
1A1R170	2-53	1A1R211	2-60	1A1R253	2-2
1A1R171	2-44	1A1R212	2-44	1A1R254	2-27
1A1R172	2-48	1A1R213	2-60	1A1R255	2-26
1A1R173	2-47	1A1R214	2-44	1A1R256	2-4
1A1R174	2-48	1A1R215	2-63	1A1R257	2-2
1A1R175	2-44	1A1R216	2-27	1A1R258	2-53
thru		1A1R217	2-86	1A1R259	2-83
1A1R176		1A1R218	2-87	1A1R26	2-27
1A1R177	2-38	1A1R22	2-116	1A1R260	2-62
1A1R178	2-22				
thru		1A1R222	2-90	1A1R261	2-2
1A1R179		1A1R223	2-91	thru	
1A1R18	2-125	1A1R224	2-9	1A1R263	
		thru		1A1R264	2-93
1A1R180	2-46	1A1R225		1A1R27	2-11
thru		1A1R226	2-91	1A1R28	2-83
1A1R183		1A1R227	2-90	thru	
1A1R184	2-38	1A1R228	2-48	1A1R29	
1A1R185	2-22	1A1R229	2-89	1A1R3	2-35
thru		1A1R23	2-114	1A1R30	2-31
1A1R186		1A1R230	2-93	1A1R33	2-31
1A1R187	2-47	1A1R231	2-53	1A1R34	2-15
1A1R188	2-57			1A1R35	2-16
1A1R189	2-59	1A1R232	2-5	1A1R36	2-131
1A1R19	2-15	1A1R233	2-86		
1A1R190	2-61	1A1R234	2-54	1A1R37	2-29
thru		1A1R235	2-56	1A1R38	2-15
1A1R193		1A1R236	2-9	1A1R39	2-27
1A1R194	2-59	1A1R237	2-2	1A1R4	2-83
1A1R195	2-57	1A1R238	2-16	1A1R40	2-11
		thru		1A1R41	2-116
1A1R196	2-9	1A1R239		1A1R42	2-114
thru		1A1R24	2-115	1A1R43	2-115
1A1R199		1A1R240	2-19	1A1R44	2-19
1A1R2	2-83	1A1R241	2-55	1A1R45	2-55
1A1R20	2-16				
1A1R200	2-9	1A1R242	2-38	1A1R46	2-9
thru		1A1R243	2-36	1A1R47	2-135
1A1R201		1A1R244	2-11	1A1R48	2-44
1A1R203	2-60	1A1R245	2-35	1A1R49	2-27
1A1R204	2-44	1A1R246	2-15	1A1R5	2-135
1A1R205	2-60	1A1R247	2-51	1A1R50	2-137
1A1R206	2-44	1A1R248	2-36	1A1R51	2-9
1A1R207	2-60	1A1R249	2-16	1A1R52	2-138
1A1R208	2-44	1A1R25	2-15	1A1R53	2-139
		1A1R250	2-2	1A1R54	2-134
1A1R209	2-60	thru		1A1R55	2-140
1A1R21	2-83	1A1R251		1A1R56	2-44

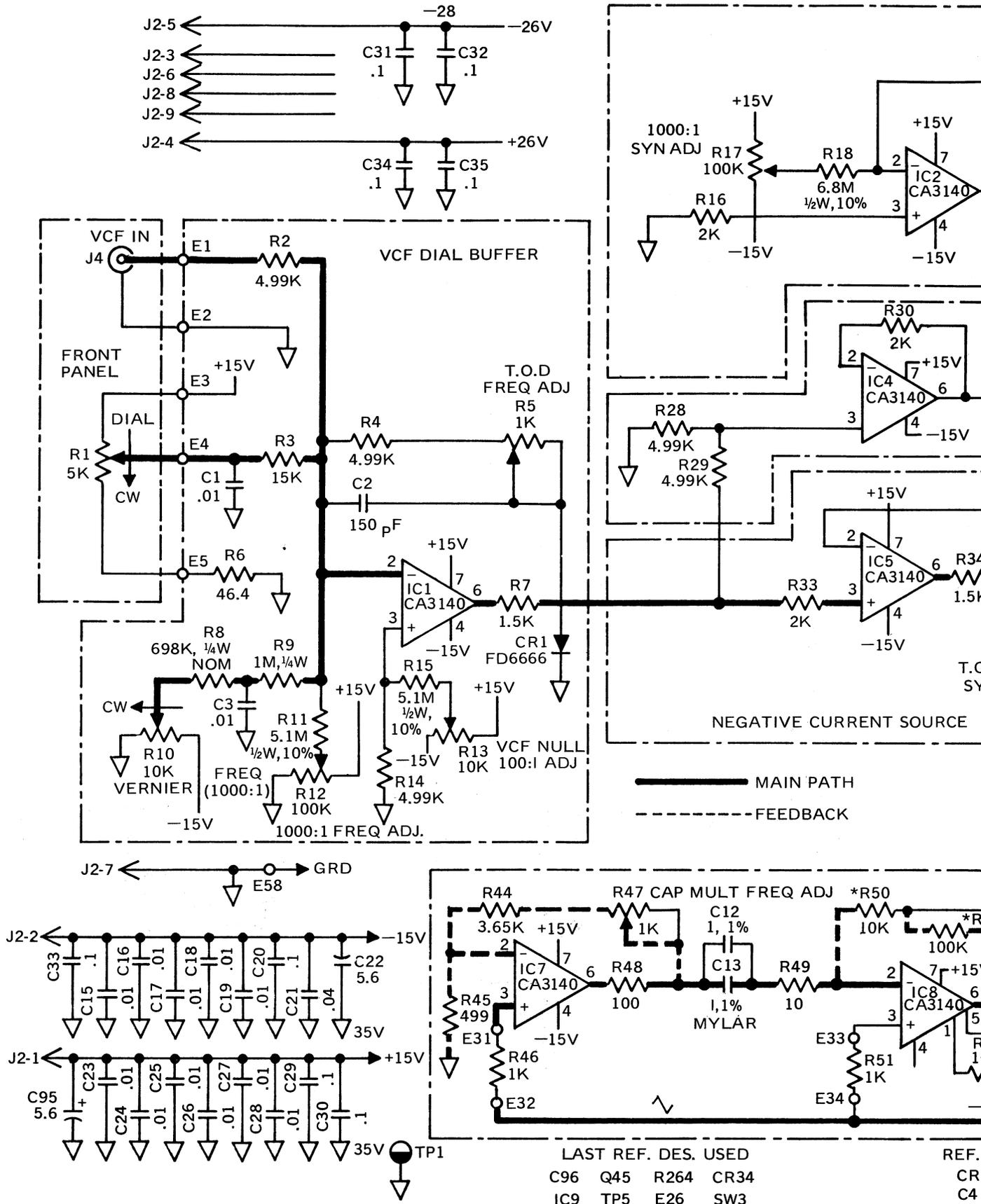
Reference Designation	Figure & Index No.	Reference Designation	Figure & Index No.	Reference Designation	Figure & Index No.
	8-		8-		8-
1A1R57	2-141	1A1R91	2-51	1A2C13	3-9
1A1R58	2-83	1A1R92	2-15	1A2C16	3-9
		1A1R93	2-85	1A2C17	3-9
1A1R59	2-27	1A1R94	2-11	1A2C2	3-38
1A1R6	2-144	1A1R95	2-94	1A2C20	3-9
1A1R60	2-15	1A1R96	2-2	1A2C21	3-7
thru		1A1R97	2-9	1A2C22	3-7
1A1R61		thru		1A2C3	3-33
1A1R62	2-85	1A1R98		1A2C8	3-33
1A1R63	2-97	1A1R99	2-53	1A2C9	3-1
1A1R64	2-2	1A1SW1	2-82B		
thru		1A1SW1A	2-79	1A2IC1	3-27
1A1R65				thru	
1A1R66	2-27	1A1SW1B	2-80	1A2IC4	
1A1R67	2-97	1A1SW1C	2-79	1A2J1	3-39
		thru		1A2P1	3-36
1A1R68	2-2	1A1SW1D		1A2Q1	3-5
1A1R69	2-27	1A1SW1E	2-81	1A2Q10	3-24
1A1R7	2-15	1A1SW1F	2-82	thru	
1A1R70	2-21			1A2Q12	
1A1R71	2-44	1A1SW1G	2-79	1A2Q13	3-23
thru		1A1SW2	2-82A	1A2Q14	3-23
1A1R72		1A1SW2A	2-79	1A2Q15	3-6
1A1R73	2-19	thru		1A2Q16	3-23
1A1R74	2-97	1A1SW2E		1A2Q2	3-24
thru		1A1SW3	2-78A	thru	
1A1R75		1A1SW3A	2-78	1A2Q4	
1A1R76	2-19	thru			
1A1R77	2-106	1A1SW3G		1A2Q5	3-23
1A1R78	2-45	1A1TP1	2-107	thru	
		thru		1A2Q7	
1A1R79	2-96	1A1TP4			
1A1R8	2-142			1A2Q8	3-6
1A1R80	2-31	1A2	1-2	1A2Q9	3-5
thru			3		
1A1R81		1A2CR1	3-26	1A2R1	3-10
1A1R82	2-96	1A2CR10	3-14	1A2R10	3-11
1A1R83	2-45	thru		1A2R11	3-8
1A1R84	2-9	1A2CR12		1A2R12	3-8
1A1R85	2-94	1A2CR13	3-28	1A2R15	3-21
1A1R86	2-2	1A2CR2	3-26	1A2R16	3-32
1A1R87	2-9	thru		1A2R17	3-10
1A1R88	2-2	1A2CR8		1A2R18	3-13
thru		1A2CR9	3-14	1A2R19	3-13
1A1R89		1A2C1	3-38	1A2R2	3-10
		1A2C10	3-37		
1A1R9	2-145	1A2C11	3-1	1A2R20	3-20
1A1R90	2-9	1A2C12	3-37	1A2R21	3-22

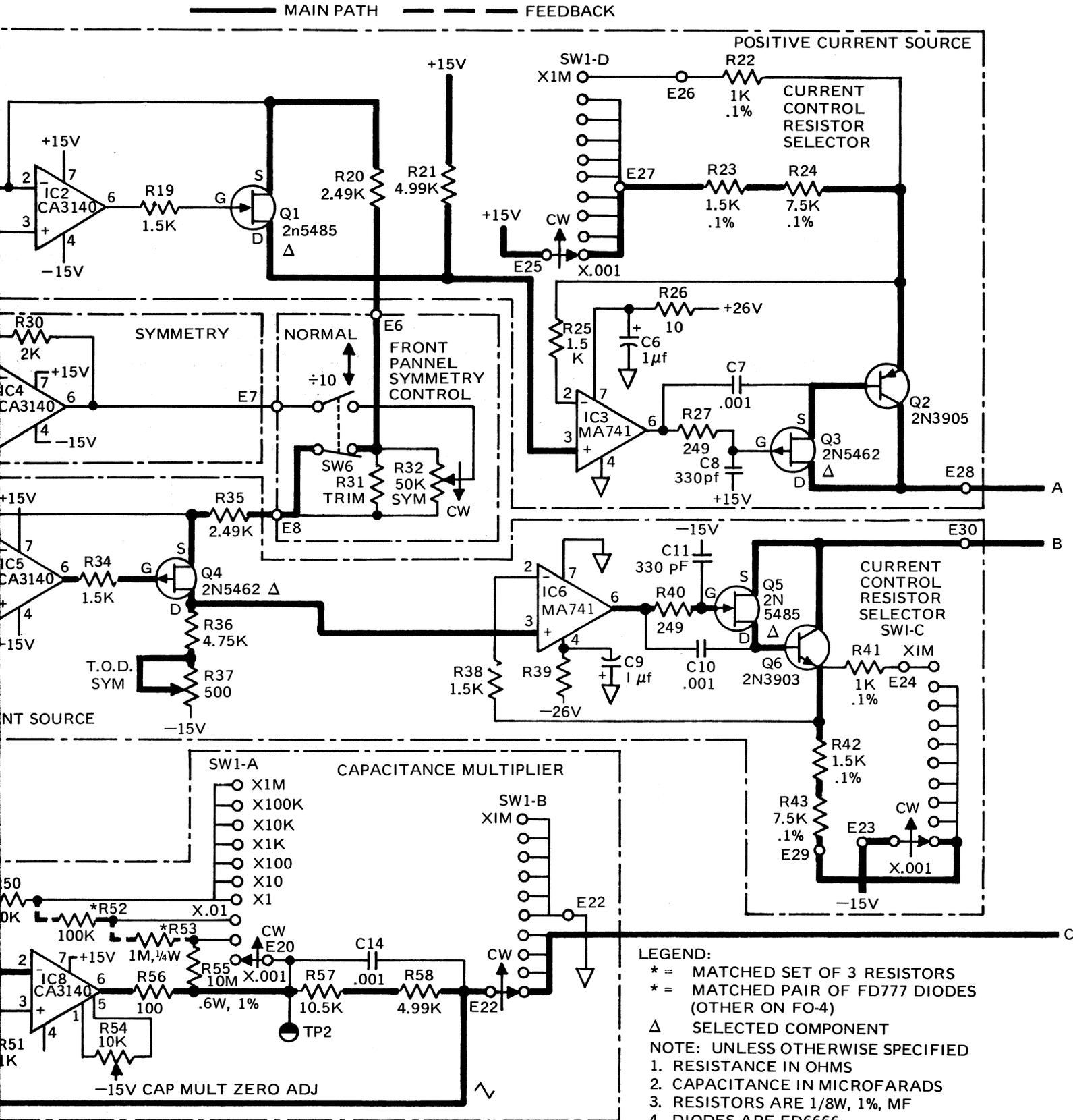
Reference Designation	Figure & Index No.	Reference Designation	Figure & Index No.	Reference Designation	Figure & Index No.
	8-				
1A2R22	3-19				
1A2R23	3-10				
thru					
1A2R26					
1A2R27	3-8				
1A2R28	3-15				
1A2R29	3-30				
1A2R3	3-29				
1A2R30	3-31				
1A2R31	3-31				
1A2R32	3-30				
1A2R33	3-15				
1A2R34	3-8				
1A2R35	3-16				
1A2R36	3-16				
1A2R39	3-10				
1A2R4	3-29				
1A2R40	3-10				
1A2R41	3-18				
1A2R42	3-17				
1A2R43	3-17				
1A2R44	3-18				
1A2R5	3-11				
1A2R6	3-30				
1A2R7	3-12				
1A2R8	3-12				
1A2R9	3-30				
1A3	F1-2				
1A3C23	1-64				
1A3J1	1-86				
1A3J3	1-51				
thru					
1A3J4					
1A3J5	1-57				
1A3R1	1-25				
1A3R142	1-72				
1A3SW4	1-43				
1A3SW6	1-38				
1A3SW7	1-44				
1A3T1	1-92				





Overall Block Diagram
FO-1

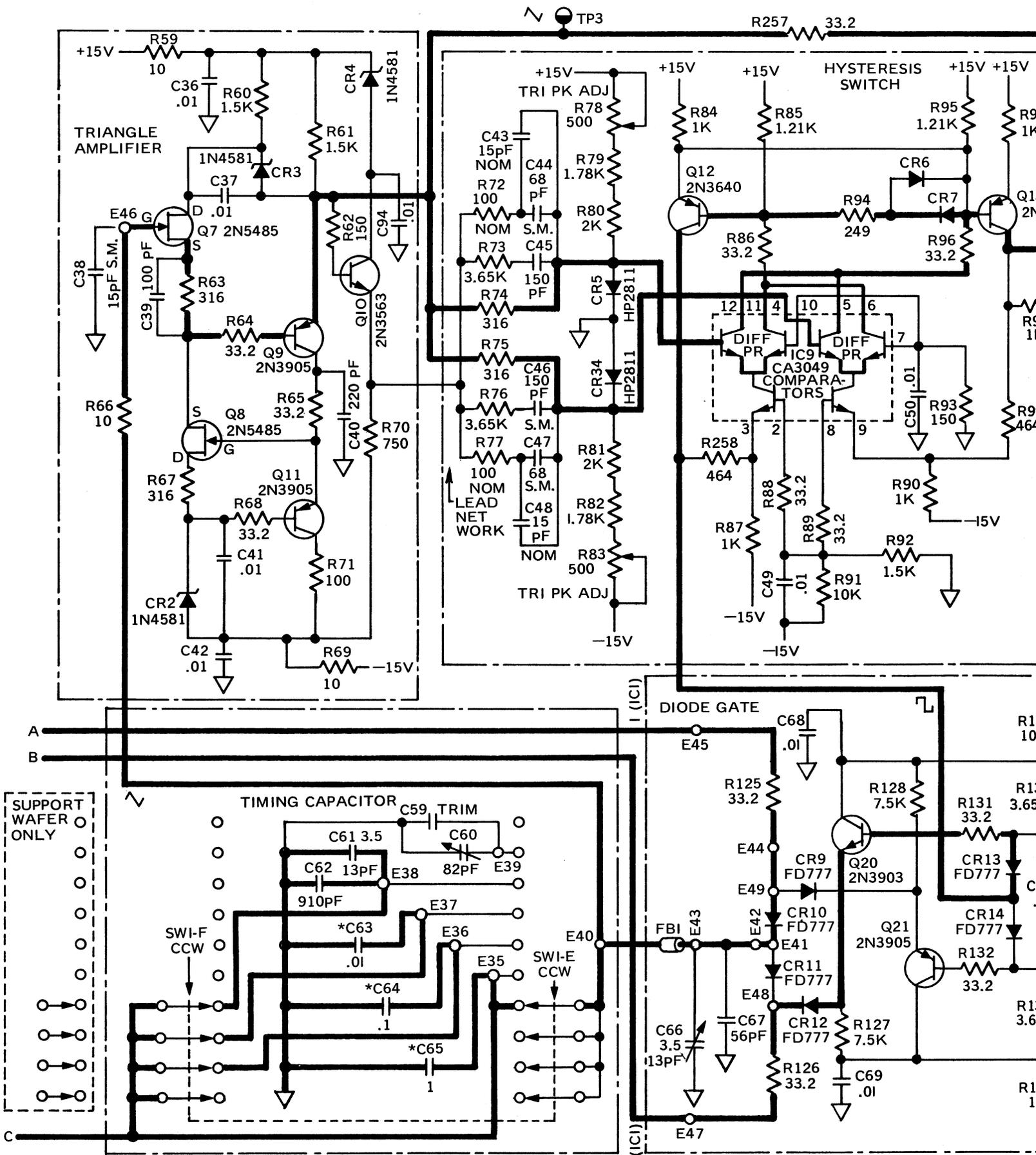


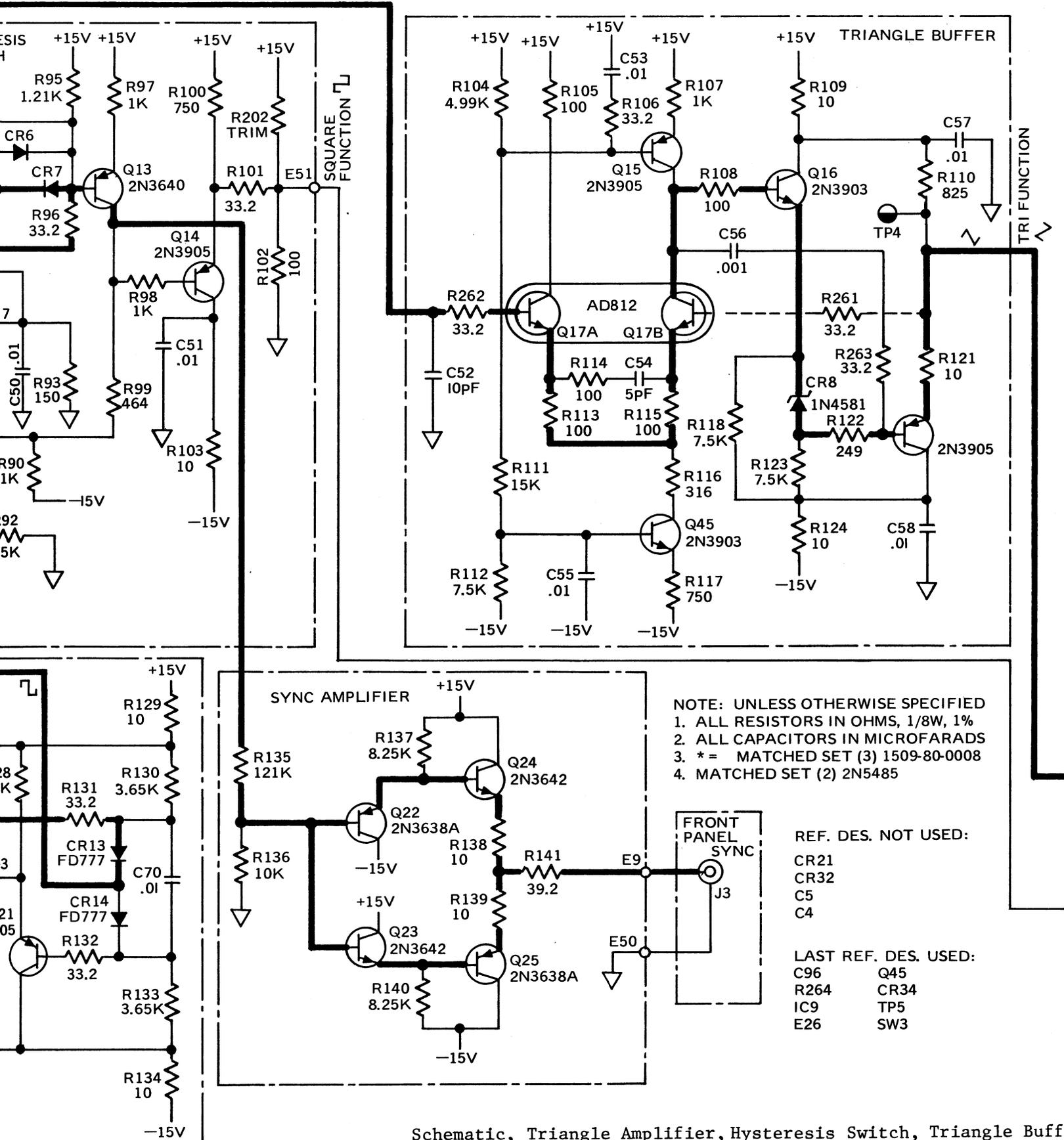


LEGEND:
 * = MATCHED SET OF 3 RESISTORS
 * = MATCHED PAIR OF FD777 DIODES (OTHER ON FO-4)
 Δ SELECTED COMPONENT
 NOTE: UNLESS OTHERWISE SPECIFIED
 1. RESISTANCE IN OHMS
 2. CAPACITANCE IN MICROFARADS
 3. RESISTORS ARE 1/8W, 1%, MF
 4. DIODES ARE FD6666

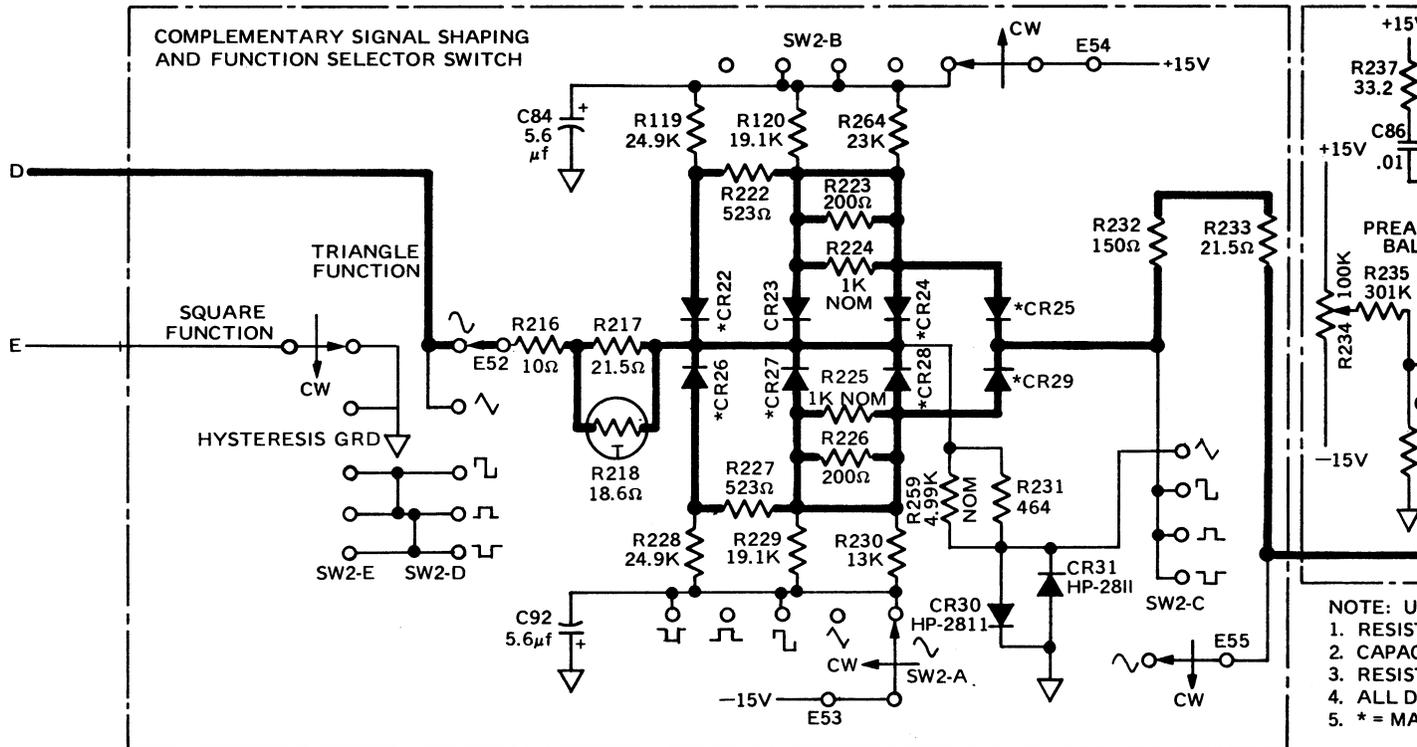
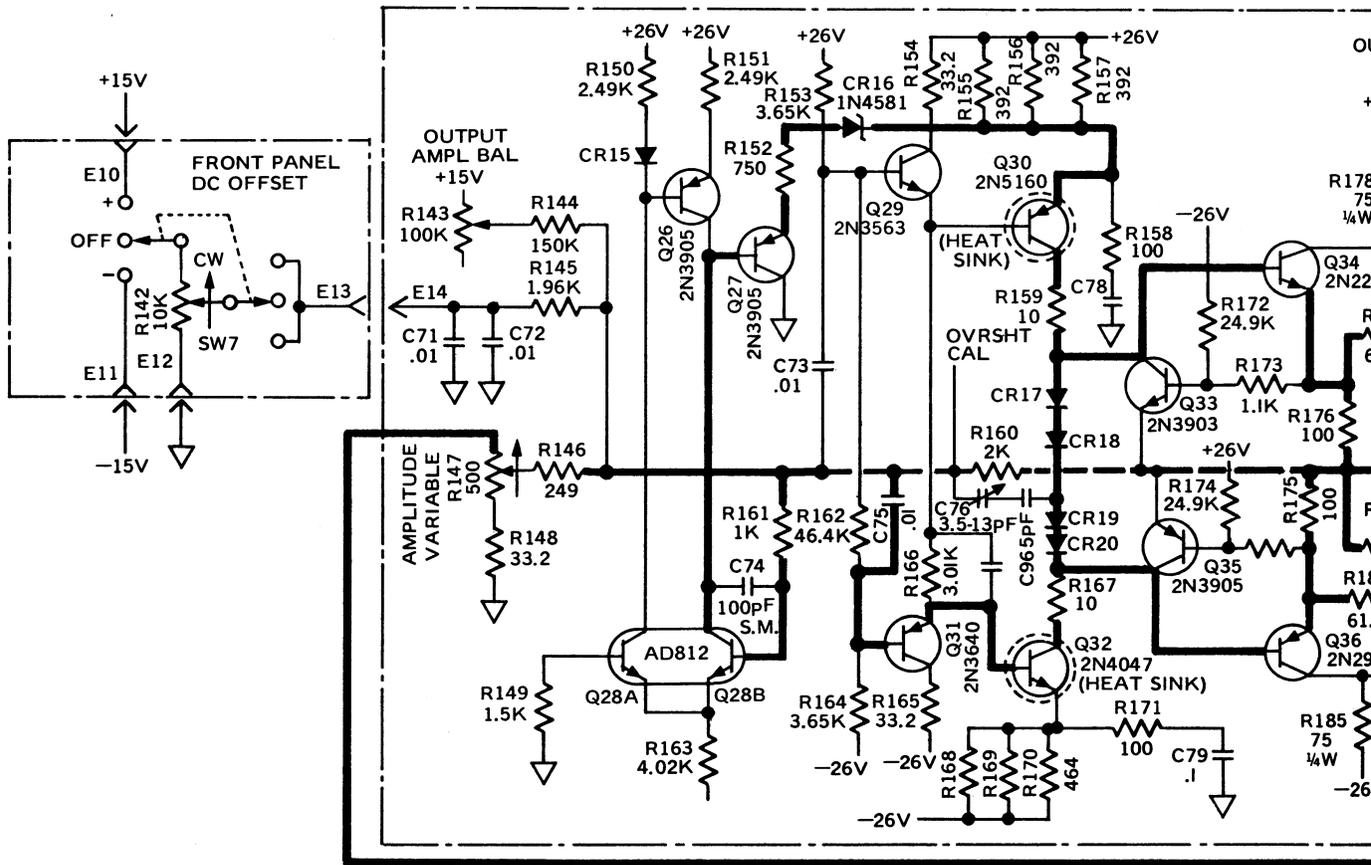
REF. DES. NOT USED
 CR21 CR32
 C4 C5

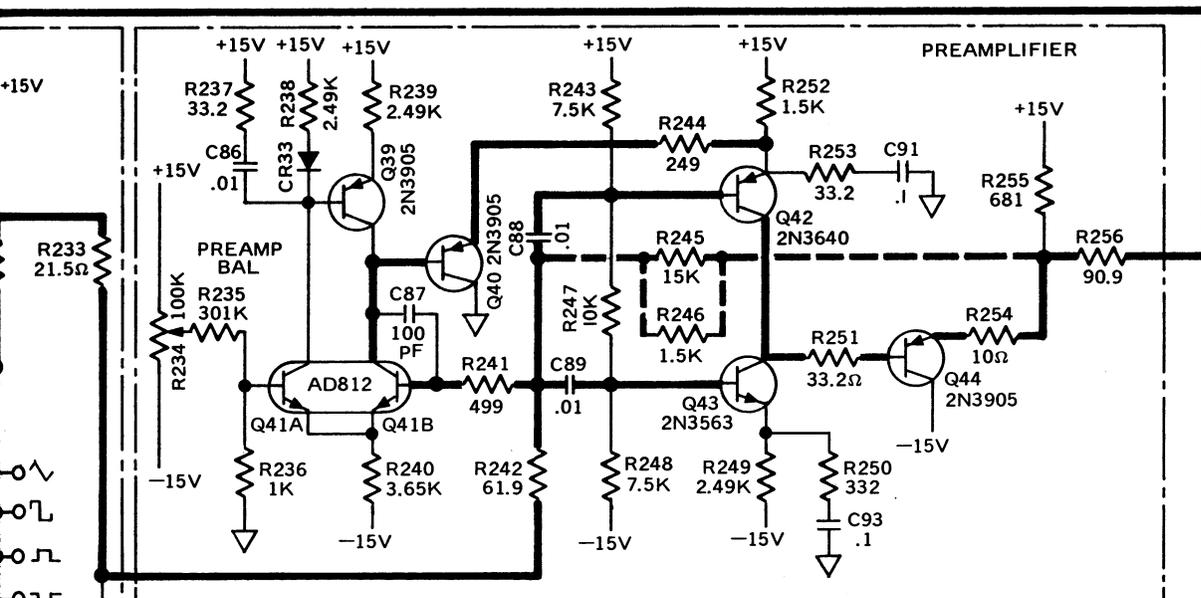
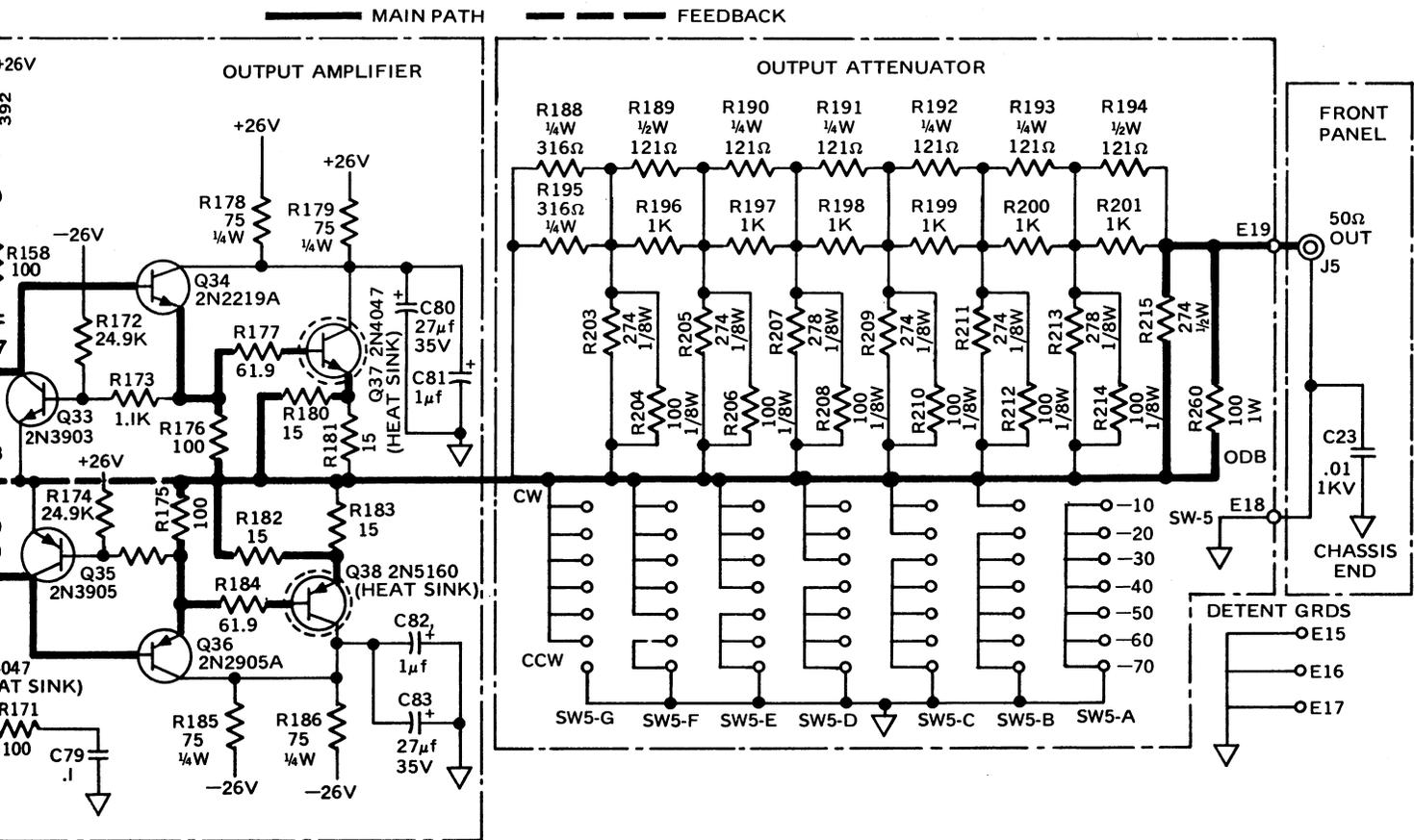
Schematic, Buffer, Current Source and Capacitance Multiplier FO-2





Schematic, Triangle Amplifier, Hysteresis Switch, Triangle Buffer, Timing Capacitor, Diode Gate and Sync Amplifier

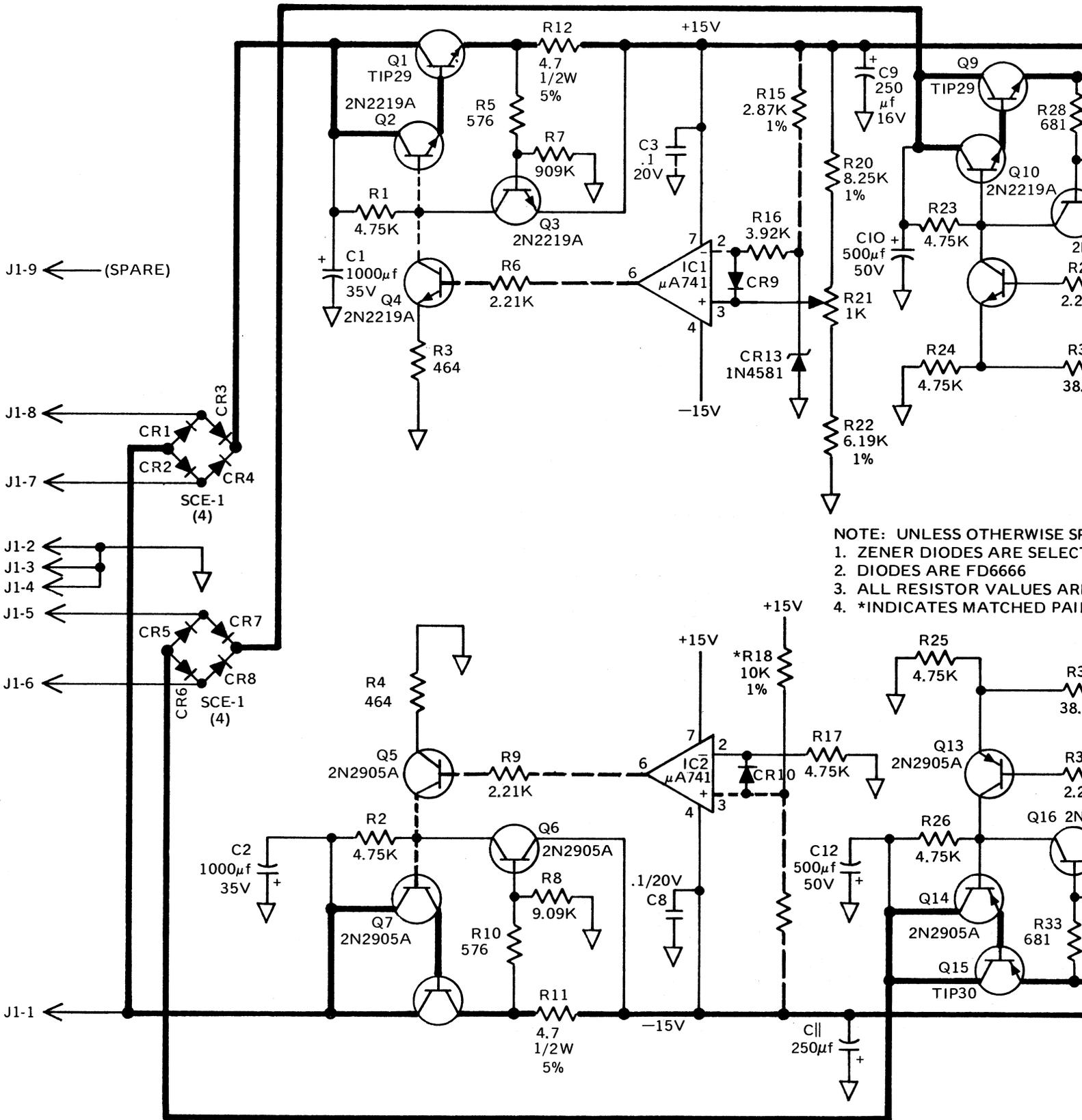




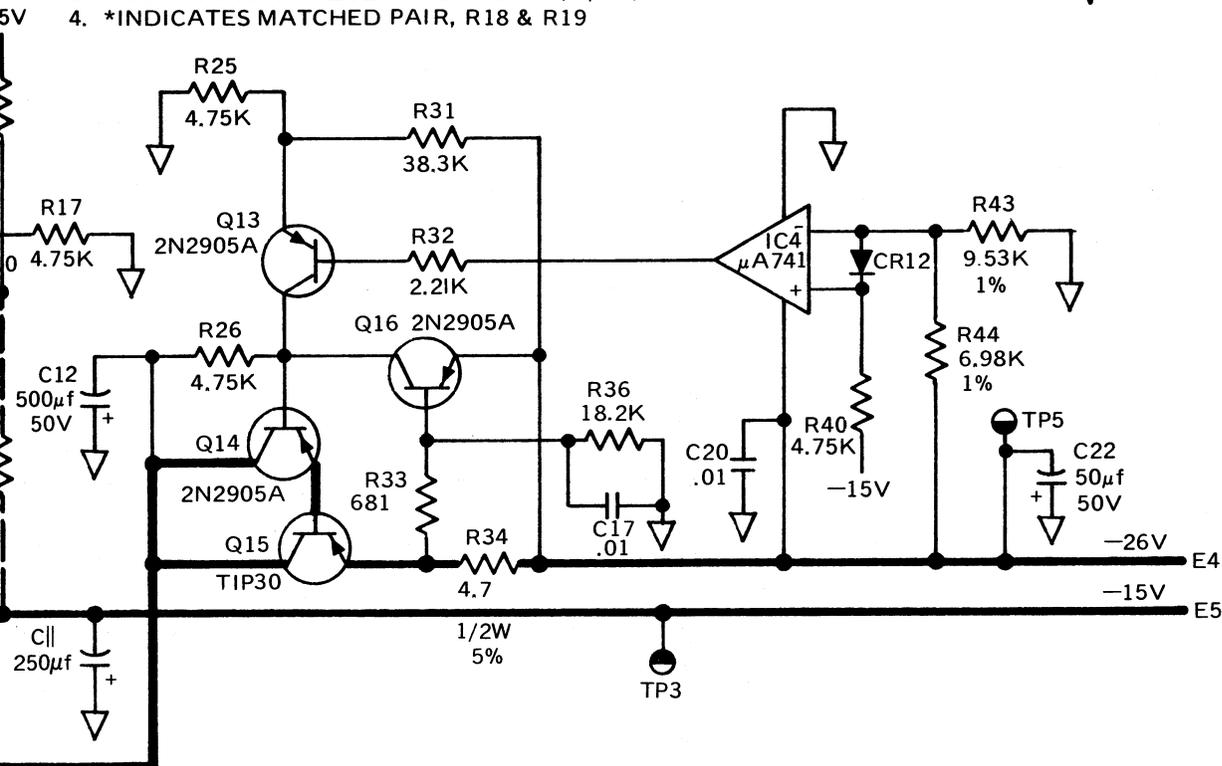
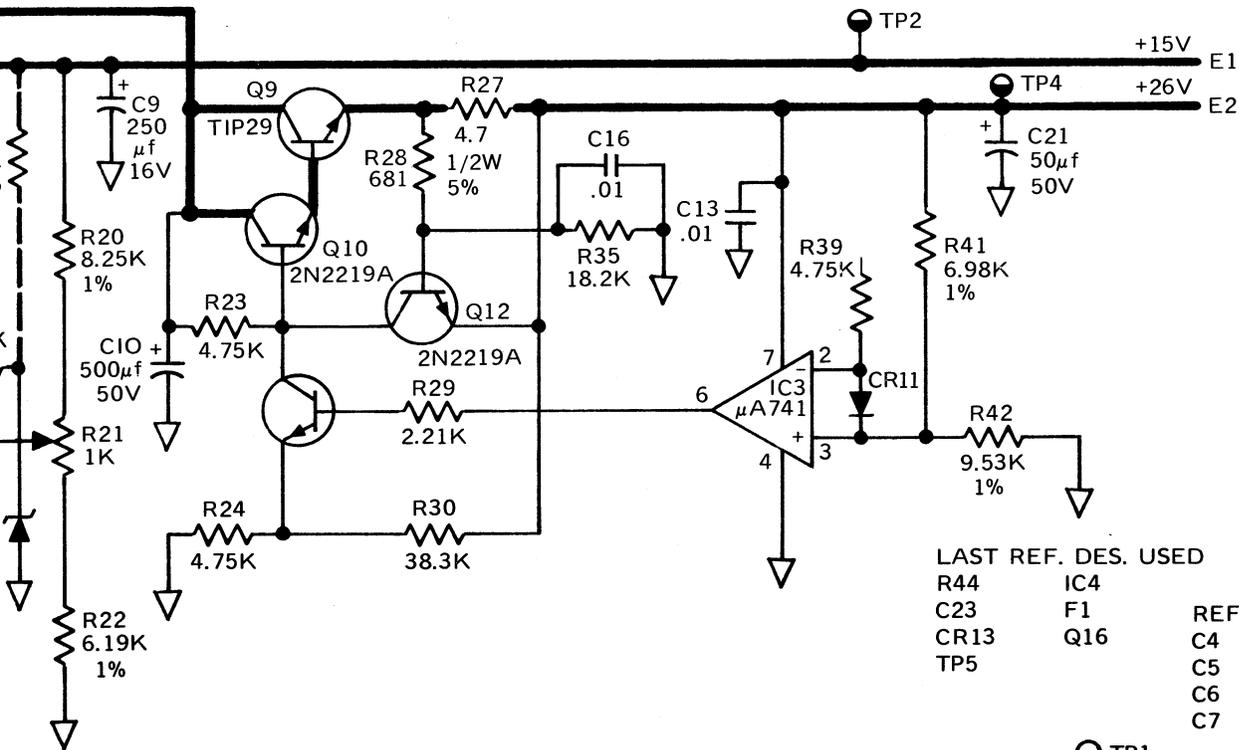
- NOTE: UNLESS OTHERWISE SPECIFIED
1. RESISTANCE IN OHMS
 2. CAPACITANCE IN MICROFARADS
 3. RESISTORS ARE 1/8W, 1%, MF
 4. ALL DIODES ARE FD6666
 5. * = MATCHED SET OF 8 FD777 DIODES

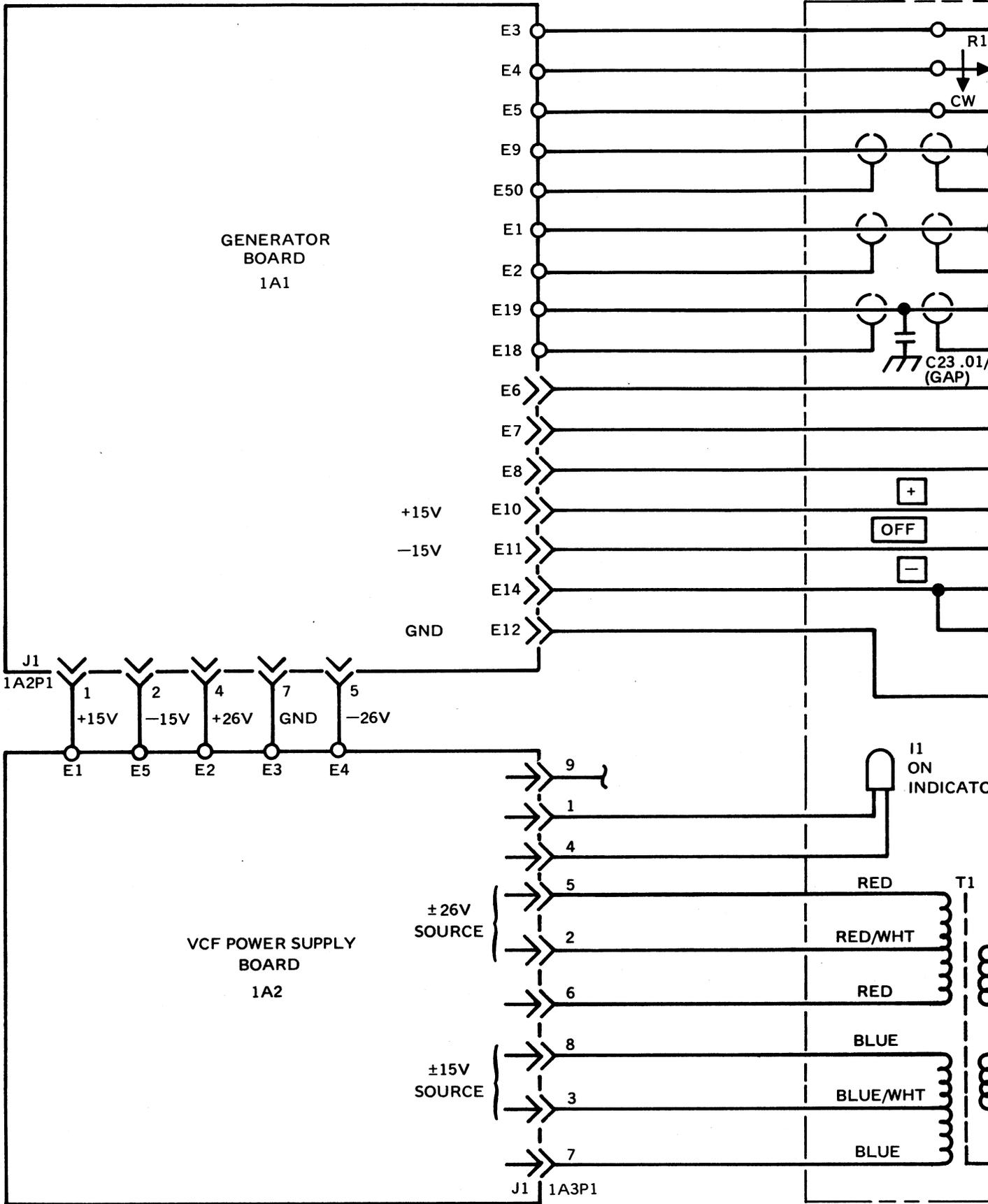
- | | |
|--------------------|---------------------|
| REF. DES. NOT USED | LAST REF. DES. USED |
| CR21 | C96 |
| CR32 | R264 |
| C5 | IC9 |
| C4 | E26 |
| | Q45 |
| | CR34 |
| | TP5 |
| | SW3 |

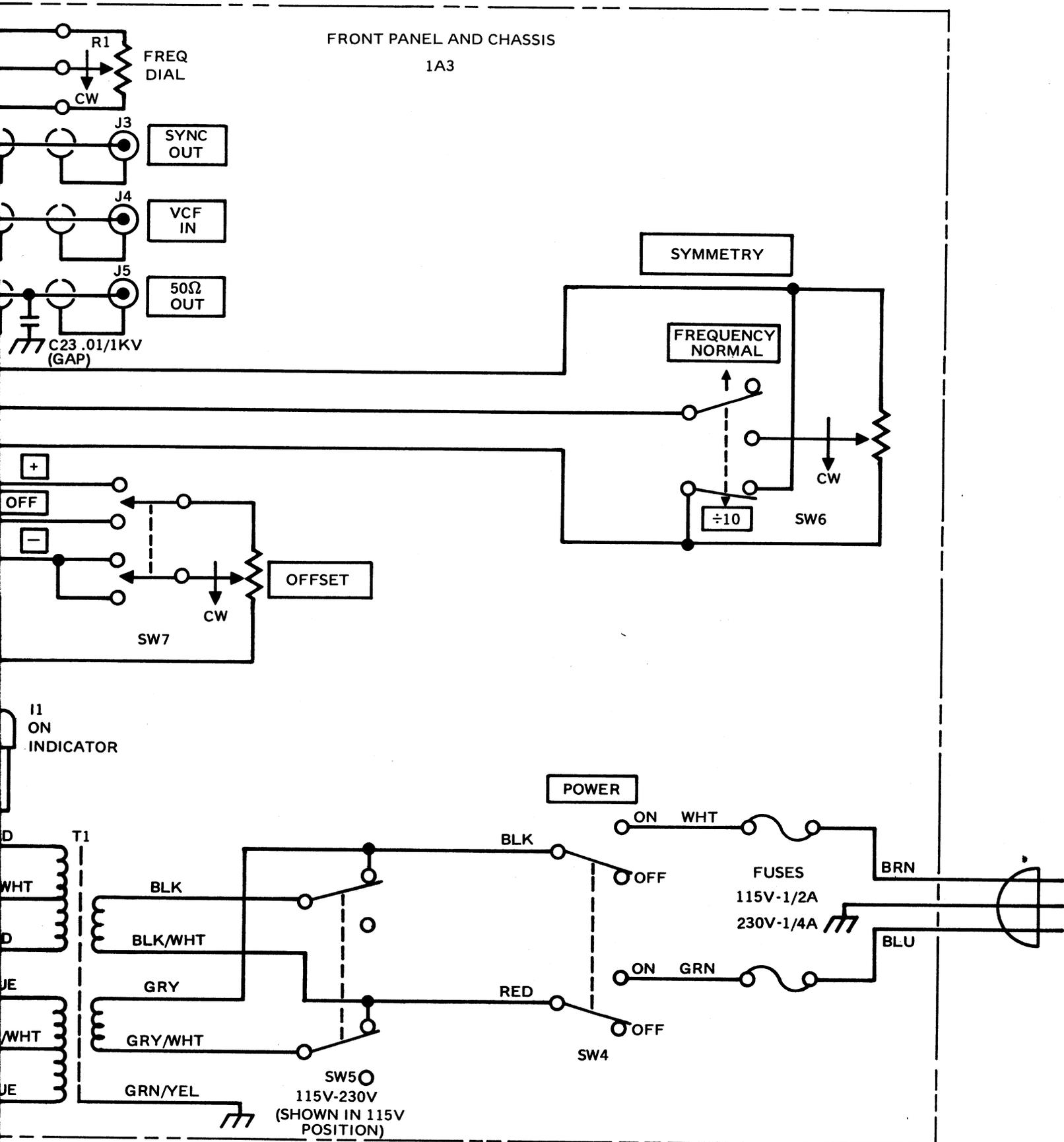
Schematic, Signal Shaping, Preamplifier, Output Amplifier, and Output Attenuator



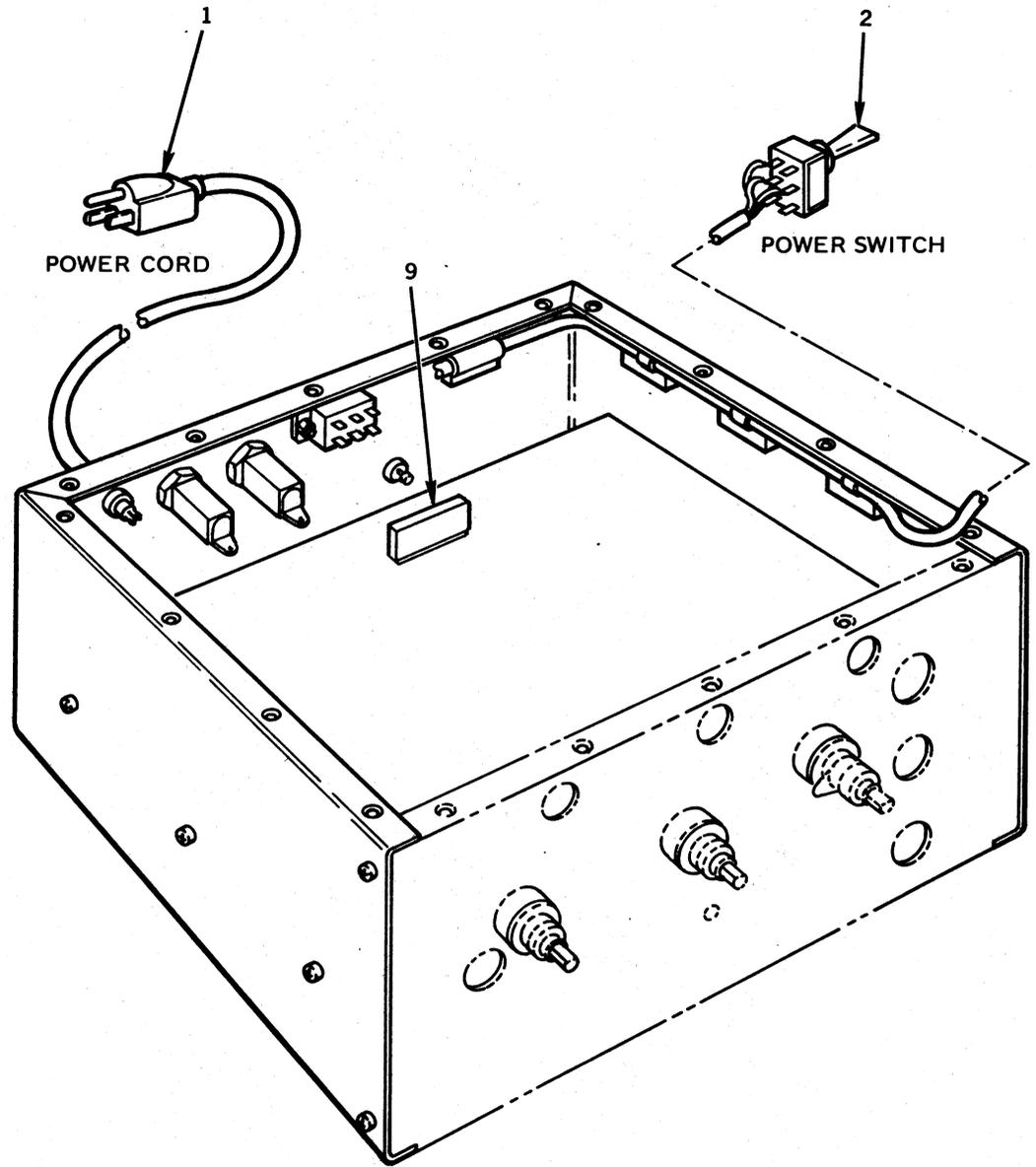
NOTE: UNLESS OTHERWISE SPECIFIED
 1. ZENER DIODES ARE SELECTED
 2. DIODES ARE FD6666
 3. ALL RESISTOR VALUES ARE IN OHMS
 4. *INDICATES MATCHED PAIR



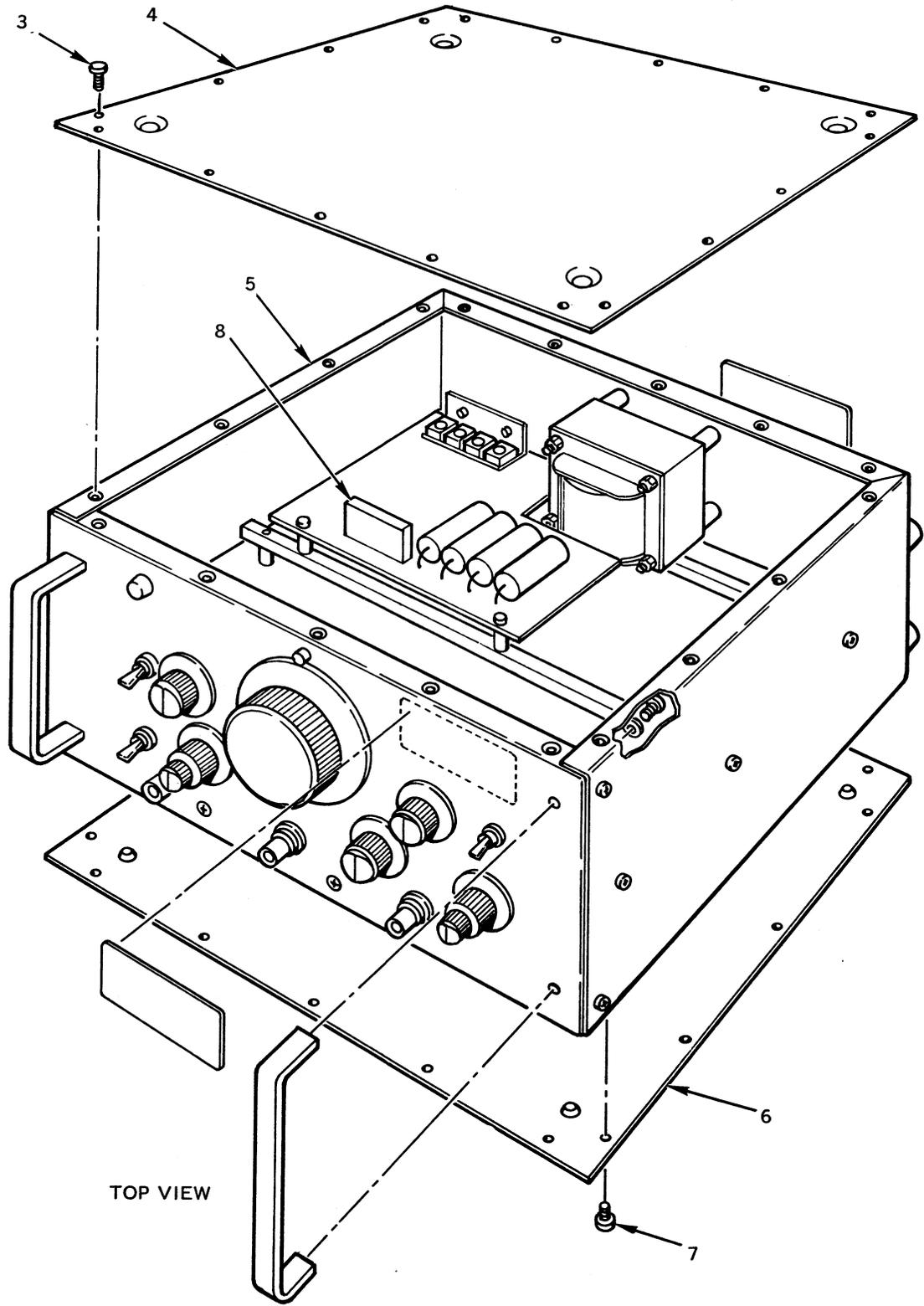




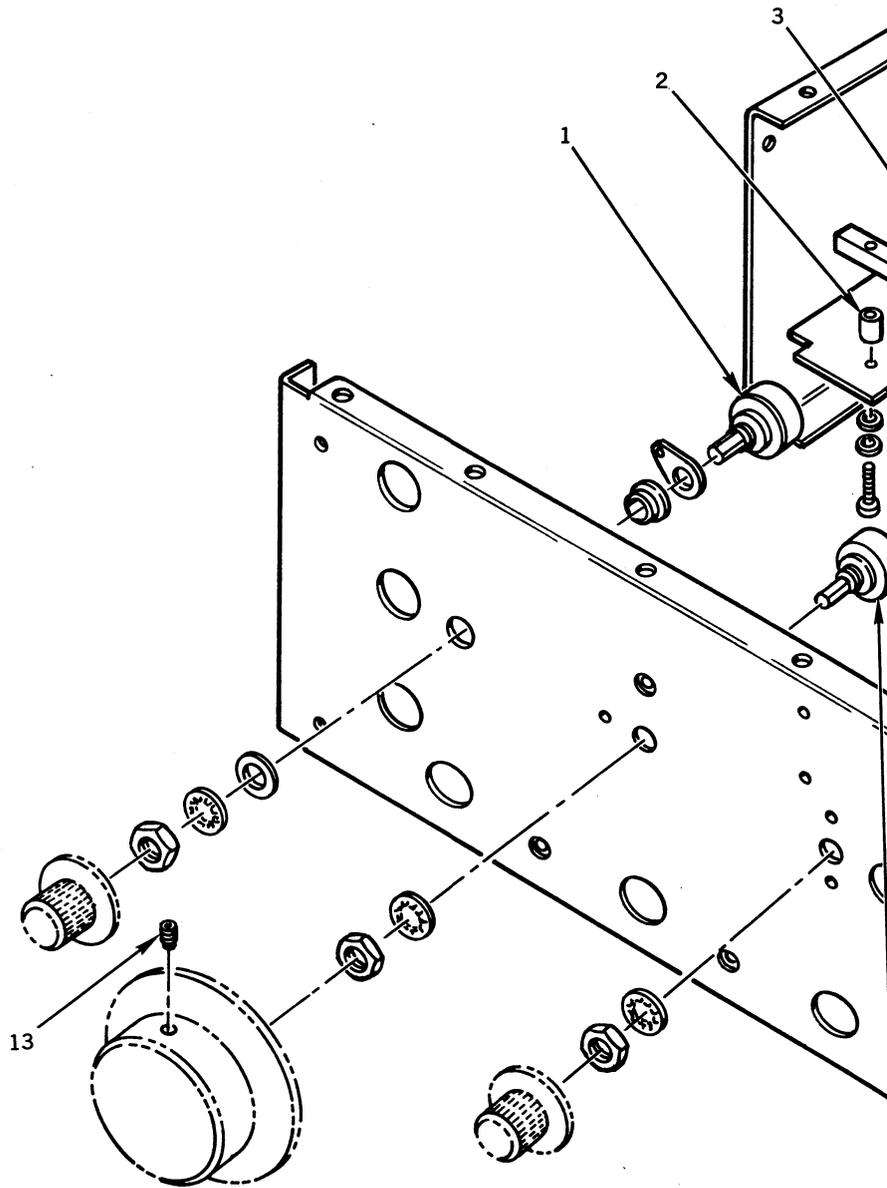
Wiring Diagram
FO-6



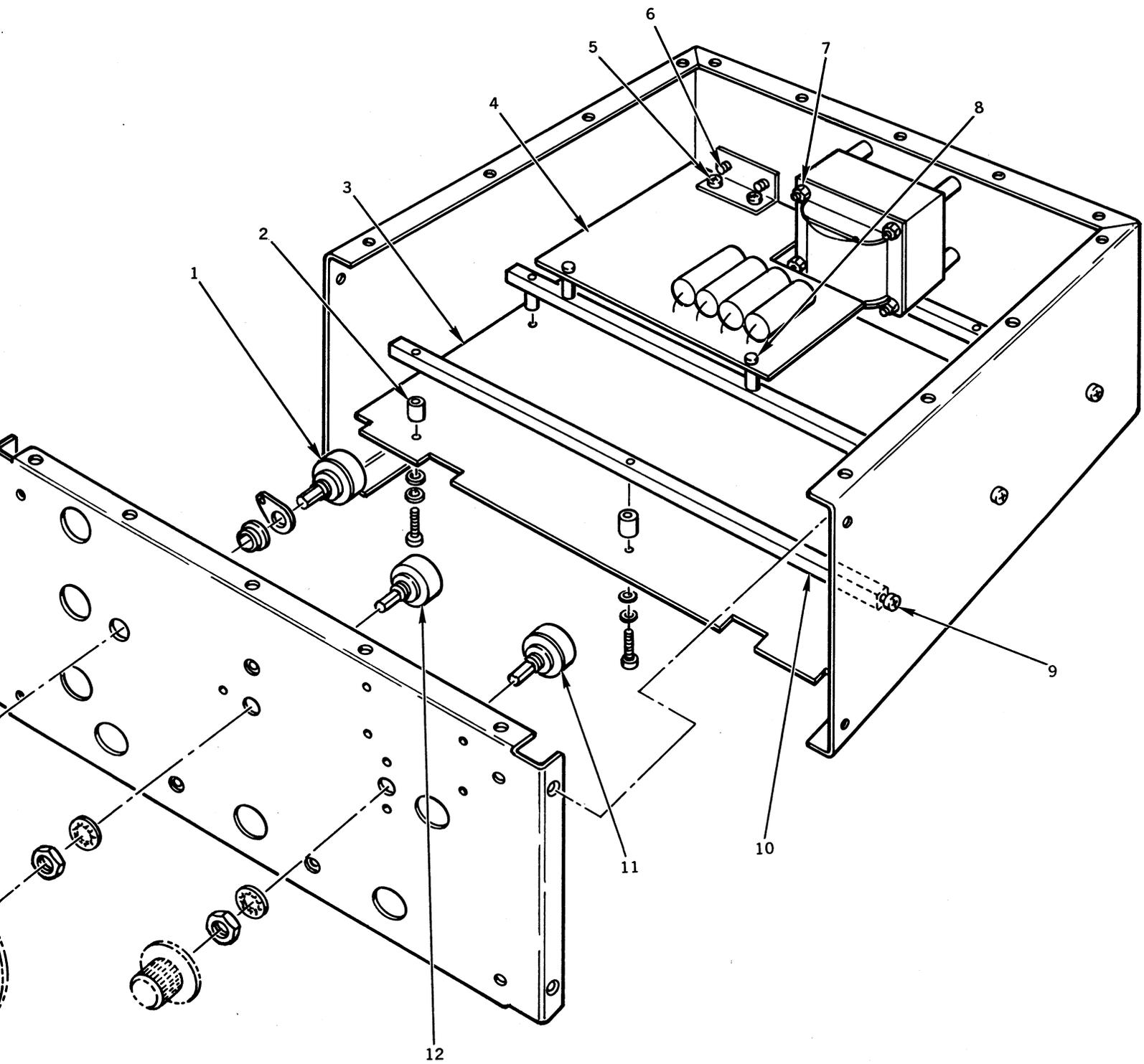
BOTTOM VIEW



TOP VIEW



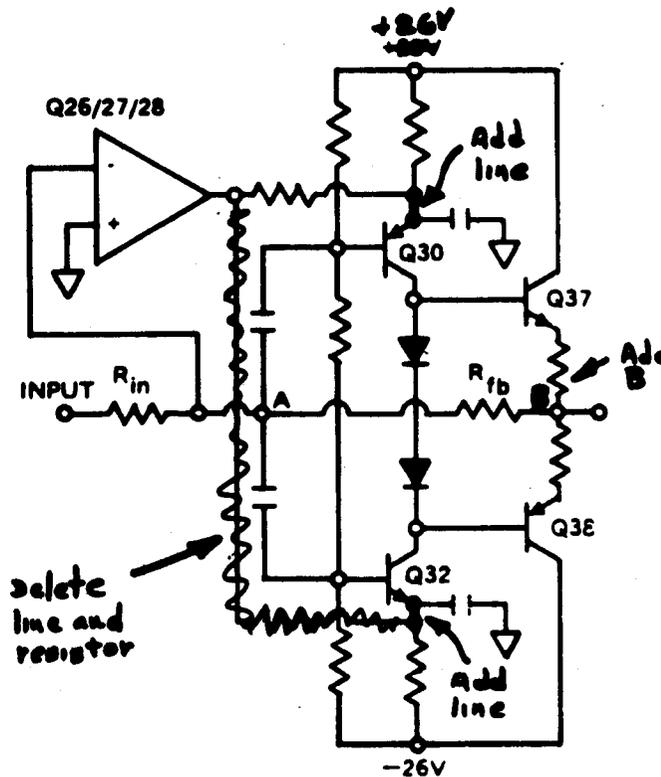
1. KNOBS ARE SHOWN FOR REF ONLY



Chassis Assembly Exploded View
FO-8

**ERRATA SHEET FOR
INSTRUCTION MANUAL,
MODEL 142-S-527,
FUNCTION GENERATOR,
ISSUE 7/77,
WAVETEK, SAN DIEGO**

Page	Change
1-1	Change weight and dimensions to 5 kg (11 lb), 30 cm (12 in.) wide, 15 cm (6 in.) high and 33 cm (13 in.) deep.
2-1	Paragraph 2-6: Change "MODEL 142-S-521" to "MODEL 142-S-527".
3-3	Second column, fourth line: Change "changing" to "charging".
3-4	First column, first paragraph, next to last line: Insert "dial" before "nonlinearity". First column, third line from the bottom: Change "I to change" to "I- to charge". First column, second line from bottom: Delete "voltage".
3-5	First column 15 lines from the bottom: Delete "and at the from -26 volts". Ninth line from the bottom: Delete "while the Q32 base junction". Sixth line from the bottom: Change to "point B, which is the output voltage, will". Second line from bottom: Change to "zero, by pulling current through the feedback resistor R_{fb} , the collector currents of Q30 and Q32 will again be equal and the output voltage". Second column, 11 lines down: Change to "amplifier is isolated from low frequency signals at the". Fifteenth line down: Change "emitters" to "emitter".
3-6	Figure 3-2.



Page	Change
3-6	First column, seventh line from the bottom: Change "junciton" to "junction". Paragraph 3-23, third line: Change to "The ac power is coupled by the transformer to the bridge".
4-1	Paragraph 4-4, eighth line: Change "paragraph 4-1" to "table 4-1".
4-3	Index No. 14, Function column: Change "Vac" to "Vac peak".
4-5	First Note: Change ± 5 volts" to "+5 volts".
5-4	Steps p through w, Result column: Change to "90.1 ms to 112.0 ms, 98.0 ms to 102.0 ms, 901 ms to 1120 ms, 980 ms to 1020 ms, 9.01s to 11.20s, 9.8s to 10.2s, 90.1s to 112s and 98.0s to 102s". Step 4b: Delete "and FREQ RANGE X10".
5-12	First diamond: Change to read "ALL FUNCTIONS BAD".
5-14	Callout "ALL FUNCTIONS GOOD AT JUNCTION R254 & R255 WHEN SW4 ROTATED": Change "SW4" to "SW2". Diamond " \surd GOOD AT TP3 BAD AT TP4": Change "YES" to "NO" and "NO" to "YES" on arrows leaving diamond.
5-14 & 5-18	Last diamond: Add "NO" to arrow without a callout.
5-19	Step 3b: Change "1A1SW4-c" to "1A1SW2-C". Step 3f: Change "steps 3d and 3" to "steps 3d and 3e".
5-20	Step o, Adjustment/Result column: Change "for 100 100 msec" to "for 100 msec".

Page	Figure & Index Number	Part Number Is	Part Number Should Be	FSCM Is	FSCM Should Be
8-14	8-2-	1101-00-0608	1100-00-0608		
8-14	5			80294	32997
8-14	7			84171	81349
8-14	32	7S-TRIK002-3-5- 13PF	7S-TRIK002-3-5/13		
8-15	40			99949	99942
8-15	45			80294	32997
8-15	54			80294	32997
8-17	80			99942	32997
8-17	92	150D565X903582	150D565X9035B2		
8-17	97	RN55D1360F	RN55D3160F		
8-18	104	CM05CD150J03	CM05CD151J03	84171	81349
8-18	105	CM05ED68J03	CM05ED680J03	84171	81349
8-18	107	200B1	2000B1	15849	88245
8-18	108			84171	81349
8-18	112			84171	81349
8-18	118			84171	81349
8-18	124			86654	86684
8-19	129			84171	81349
8-19	130			84171	81349
8-19	133			80294	32997
8-19	134			80294	32997
8-19	135			80294	32997
8-19	136	1500-41-0504	210B1C105F	23338	27556
8-21	8-3-	0101-00-0607	1100-00-0607		
8-21	9			99949	99942
8-21	15	RN55D6810F	RN55D8250F		
8-21	22			80294	32997
8-21	31A*	—	RC20GF6R8J	—	81349
8-22	33			99949	99942
8-22	34			03554	00779

*Add after Index No. 31; Units Per Assy are 2.

Page	Part Number Is	Part Number Should Be	Figure & Index Number Is	Figure & Index Number Should Be	Qty Per End Item Is	Qty Per End Item Should Be
8-23	CK103				41	39
8-23	CM05CD150J03	CM05CD151J03				
8-23	CM05ED68J03	CM05ED680J03				
8-23	RC20GF4R7	RC20GF4R7J			4	2
8-23	RC20GF515	RC20GF515				
	RC20GF685	RC20GF6R8J	-	3-31A	-	2
		RC20GF685				
8-23	RN55D1004F		F2-132 2-139 F2-58	F2-58 2-132	3	2
8-23	RN55D1052F				-	1
8-23	RN55D1501F		2-11	2-15	11	15
8-24	RN55D2004F		F2-132 2-58	F2-58 2-132		
8-24	RN55D3013F	RN55D3013F				
	RN55D33R2F	RN55D3160F		2-97		5
		RN55D33R2F				
8-24	RN55D4751F		3-10 3-131	2-131 3-10		
8-24	RN55D6810F		2-26 3-15	2-26	3	1
8-24	RN55D8250F		2-103	2-103 3-15	1	3
8-25	0101-00-0607	Delete	3	Delete	REF	Delete
8-25	08-50-0105				1	13
8-25	1000-00-0112				1	REF
8-25	1500-41-0504	Delete	2-136	Delete	2	Delete
8-25	207	207				
	209	208		1-104		1
		209				
8-25	2098W	2098W				
	2197W	210B1C105F		2-136		2
		2197W				
8-26	2259N253		1-46 1-46	1-40 1-46		
8-26	2264N385		1-63	1-56 1-63	2	4
8-26	2668		1-62 1-70	1-55 1-62 1-70	2	4
8-26	4L2FF		1-3	1-76		
8-26	4998-00-0010		F2-87	F2-119	2	1
8-26	7S-TRIK002-3-5- 13PF	7S-TRIK002-3-5/13	F2-119			

Page	Reference Designation Is	Reference Designation Should Be	Figure & Index Number Is	Figure & Index Number Should Be
8-27	1A1	1	8- 1-1 1A1	8- 1-REF 1-1
8-29	1A1R201 1A1R203	1A1R201 1A1R202 1A1R203	2-60	2-58 2-60
8-31	1A2R27		3-8	3-31A
8-31	1A2R34		3-8	3-31A

ERRATA SHEET Page 6

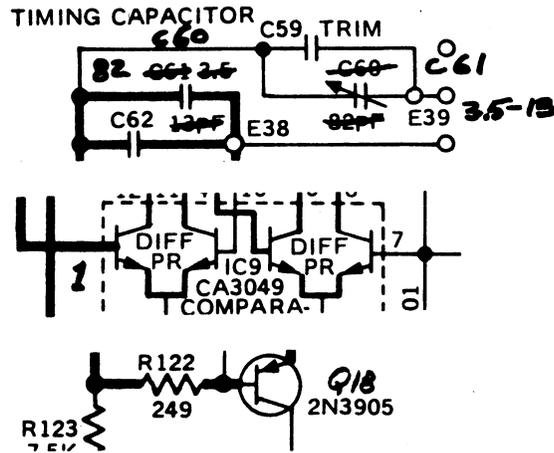
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Change

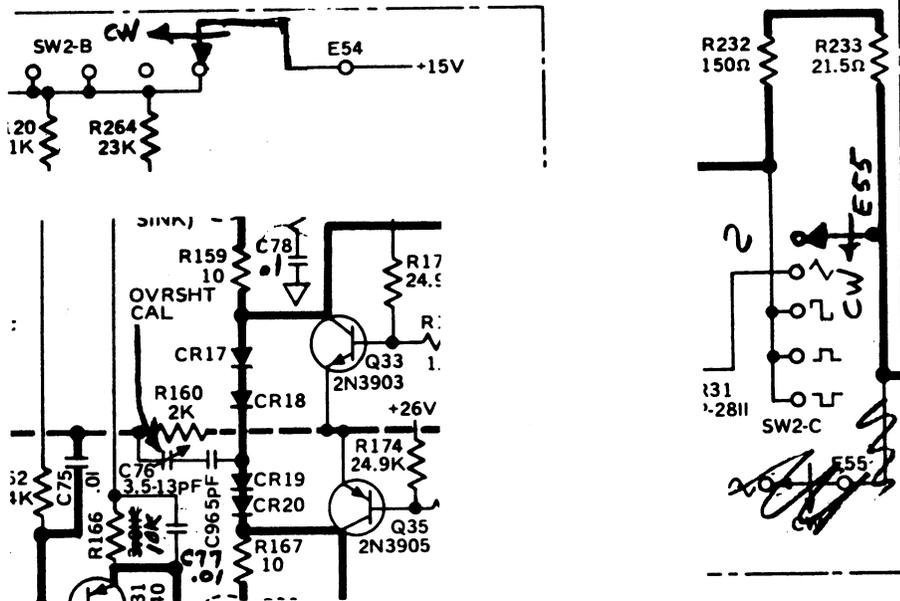
FO-2

Show a connection of the lines of components R7 and CR1. R39 is 10Ω.

FO-3



FO-4

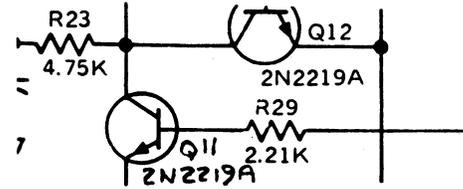
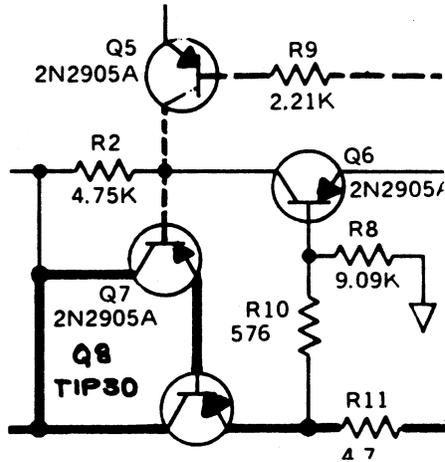


ERRATA SHEET Page 7

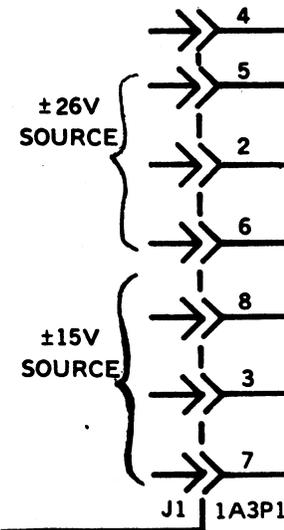
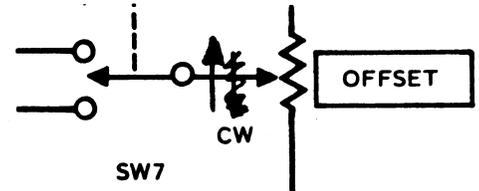
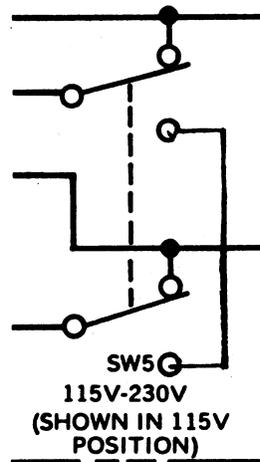
Page

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FO-5



FO-6



ERRATA SHEET FOR
INSTRUCTION MANUAL
MODEL 142-S-527
FUNCTION GENERATOR
ISSUE 7/77
WAVETEK, SAN DIEGO

8/80

<u>Page</u>	<u>Step</u>	<u>Adjustment/Result</u> <u>Is</u>	<u>Adjustment/Result</u> <u>Should Be</u>
5-20	o.	Adjust 1A1R47 for 100 100 msec <u>+2</u> msec	Adjust 1A1R47 for 100 msec <u>+2</u> msec
	<u>Figure & Index number</u>	<u>Description</u> <u>Is</u>	<u>Description</u> <u>Should Be</u>
8-5	8-1-4	FUSE 230V,1/4A	FUSE 250V 1/4A
		<u>Units per Assy</u> <u>Is</u>	<u>Units per Assy</u> <u>Should Be</u>
8-5	8-1-8	4	8
		<u>Item Is</u>	<u>Item Should Be</u>
8-8	8-1-B	29 28	28 29
		<u>Part Number Is</u>	<u>Part Number</u> <u>Should Be</u>
8-9	8-1-83	01-167-0001	46256-LF
8-9	8-1-88	345001	031.1653
		<u>Description Is</u>	<u>Description Should Be</u>
8-11	8-1-95	SCREW, Phillips	SCREW, Flathead
8-11	8-1-97	SCREW, Phillips	SCREW, Flathead
		<u>Units Per Assy</u> <u>Is</u>	<u>Units Per Assy</u> <u>Should Be</u>
8-14	8-2-2	24	26
8-14	8-2-15	11	13

ERRATA SHEET PAGE 2

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<u>Page</u>	<u>Figure & Index number</u>	<u>Description Is</u>	<u>Description Should Be</u>		
8-9	8-1-89	Sleeving, 3/4	Clear shrink sleeving, 3/4		
8-14	8-2-6	Capacitor, Ceramic 1 uF, 50V	Capacitor, Ceramic .1 uF, 50V		
		<u>Part Number Is</u>	<u>Part Number Should Be</u>		
8-14	8-2-24	RN55D3011F	RN55D1002F		
		<u>Units Per Assy Is</u>	<u>Units Per Assy Should Be</u>		
8-15	8-2-44	20	18		
8-15	8-2-47	Delete this item			
		<u>Description Is</u>	<u>Description Should Be</u>		
8-15	8-2-68	SCREW, pan head 4 - 40 X 7/8L	SCREW, pan head 4 - 40 X 1L		
8-15	8-2-69	SCREW, pan head 4 - 40 X 1/2L	SCREW, pan head 4 - 40 X 5/8L		
8-19	8-2-130	CAPACITOR, mica 910pF 500V capacitor, Polycarbonate	CAPACITOR, mica, 910pF 100V		
8-19	8-2-136	Capacitor, Polycarbonate 0.1uF, 100V	Capacitor, Polycarbonate 1uF, 100V		
		<u>Units Per Assy Is</u>	<u>Units Per Assy Should Be</u>		
8-21	8-3-8	4	2		
8-21	8-3-9	4	2		
		<u>Part Number Is</u>	<u>Part Number Should Be</u>		
8-21	8-3-15	RN55D6810F	RN55D8250F		
		<u>Description Is</u>	<u>Description Should Be</u>		
8-21	8-3-3	Lockwasher, internal teeth, No. 4 (AP)	Lockwasher, split, No. 4 (AP)		
		<u>Part Number</u>	<u>FSCM</u>	<u>Description</u>	<u>Units Per Assy</u>
8-21	8-3-31A	Add: RC2-GF6R8J	81349	Resistor	2
		<u>Part Number Is</u>	<u>Part Number Should Be</u>		
8-21	8-3-13	RN55D1003F	RN55DF1002F		

<u>Page</u>	<u>Part Number</u>	<u>Figure Index Number Is</u>	<u>Figure Index Number Should Be</u>
8-23	RN55D1501F	8-2-11	8-2-15

		<u>Qty Per End Item Is</u>	<u>Qty Per End Item Should Be</u>
8-23	RN55D1000F	21	18
8-23	RN55D1101F	2	0
8-23	RN55D1501F	11	13
8-23	CK103	41	39
8-23	RC20GF4R7	4	2

8-23 RC20GF515 After this item add:

<u>Part Number</u>	<u>Fig & Index No.</u>	<u>Qty Per End Item</u>
RC20GF6R8J	8-3-31A	2

	<u>Part No.</u>	<u>Fig & Index No.</u>	<u>Qty Per End Item Is</u>	<u>Qty Per End Item Should Be</u>
8-24	RN55D33R2F	8-2-2	24	26
8-24	RN55D8250F		1	3

Add Fig. & Index Number 3-15

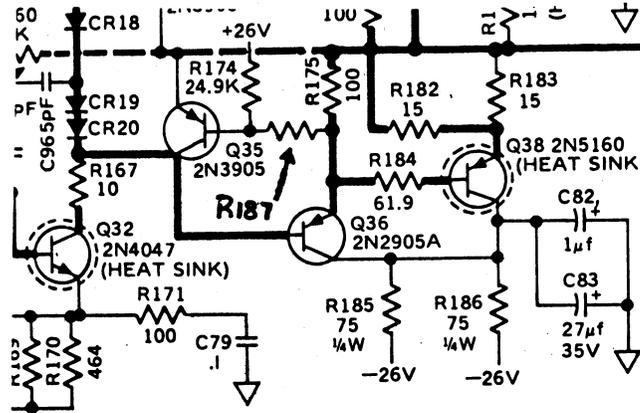
8-24	RN55D6810F		3	1
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Delete Fig. & Index Number 3-15

		<u>Figure Index Number Is</u>	<u>Figure Index Number Should Be</u>
8-28	1A1R158	8-2-44	8-2-2
8-29	1A1R171	8-2-44	8-2-2
8-29	1A1R173	8-2-47	8-2-15
8-29	1A1R187	8-2-47	8-2-15
8-30	1A2C16	8-3-9	Delete
8-30	1A2C17	8-3-9	Delete
8-31	1A2R27	3-8-8	3-8-31A
8-31	1A2R34	3-8-8	3-8-31A

<u>Page</u>	<u>Reference Designation</u>	<u>Value Is</u>	<u>Value Should Be</u>
FO-4	R158	100	33.2
	R171	100	33.2
	R173	1.1k	1.5k
	R187	1.1k	1.5k

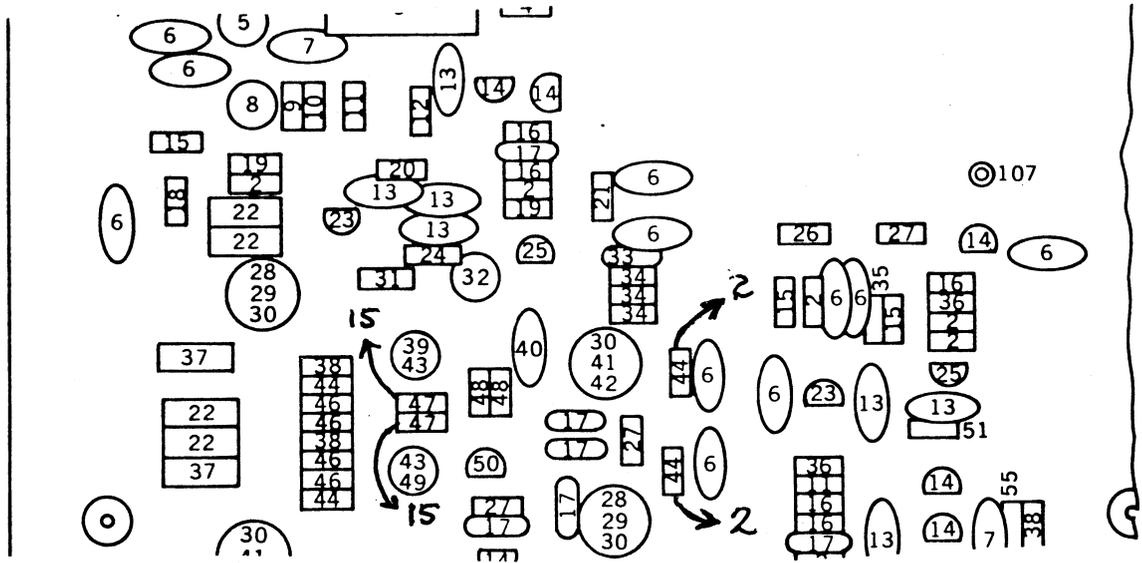
Add reference designator R187 to the output amplifier schematic as shown:



	<u>Reference Designation</u>	<u>Value Is</u>	<u>Value Should Be</u>
FO-5	R28	681	825
	R33	681	825
FO-5	C16	.01	Delete
	C17	.01	Delete
FO-5	R27	4.7	6.8
	R34	4.7	6.8
FO-6	C23	.01/1kV (GAP)	.01/1.5kV (GAP)

Page
8-12

Change the following "47" and "44" components to "15" and "2" as shown:



Page
8-20

Change the following "8" and "9" components to "31A" and delete as shown:

