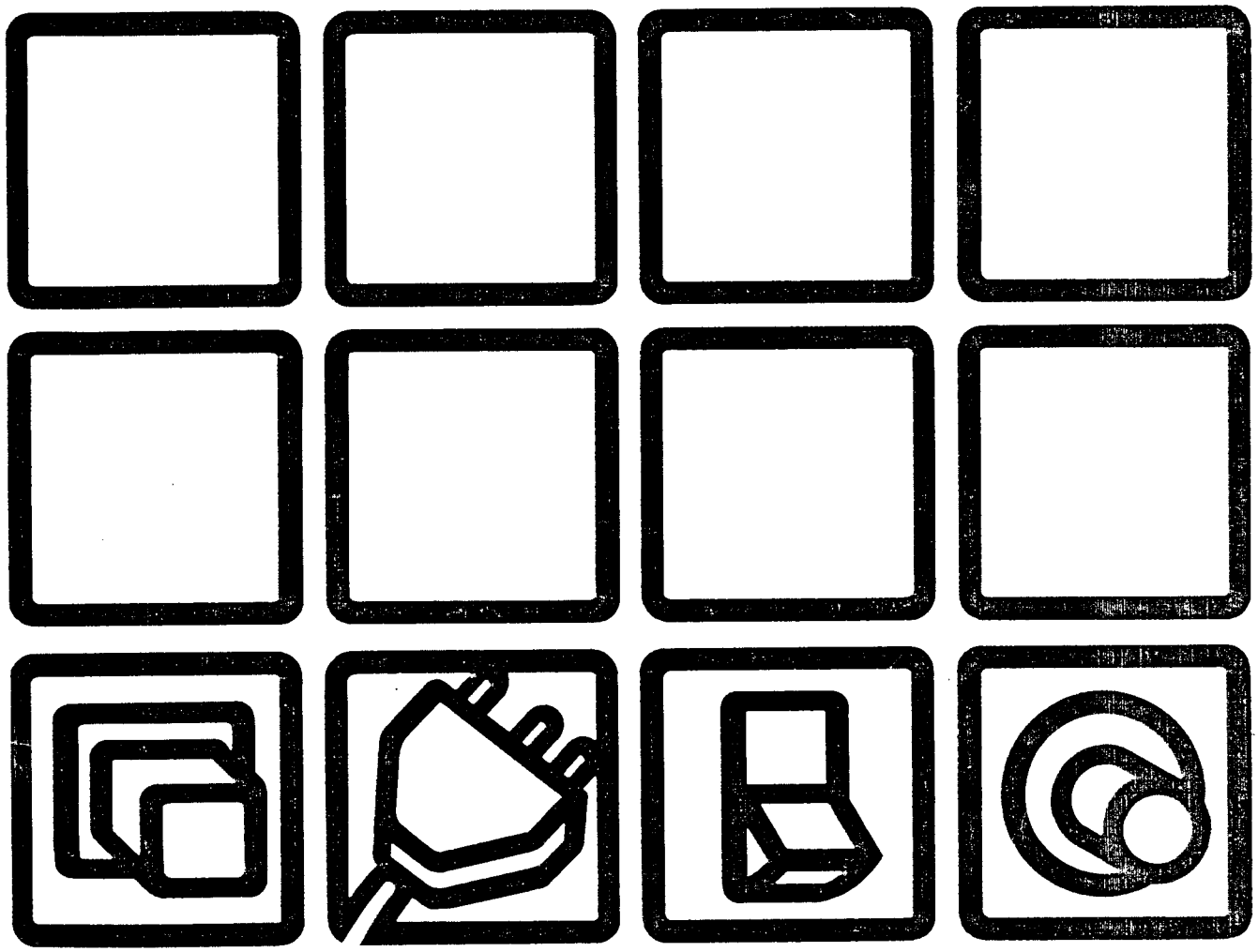


Valleylab

SSE2L

SERVICE MANUAL

SSE2L

SERVICE MANUAL

EFFECTIVITY: NOVEMBER 5, 1982

VALLEYLAB PART NUMBER A 945 100 027 B

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

SECTION I

INTRODUCTION

This Service Manual covers the installation and basic service instructions for the Valleylab Model SSE2 "L" Series Electrosurgical Generators. Also included are sections covering the Technical Specifications, Circuit Descriptions and the Testing and Troubleshooting of the Generator. Detailed instructions in the use of electrosurgery is beyond the scope of this manual and the reader is directed to the Operator's Instruction Manual provided by Valleylab.

Valleylab, its dealers and representatives reserve the right to make changes in equipment built and/or sold by them at any time without incurring any obligation to make the same or similar changes on equipment previously built and/or sold by them.

SECTION 2

INSTALLATION

Generators are shipped with a detachable power cord having a two prong, 220Vac CEE7-7 plug. Also supplied with this unit is an equipotential ground cable with connector, to provide a redundant ground connection. This connector mates with the equipotential ground lug on the rear of the unit.

NOTE: Equipotential ground cable must be connected between earth ground and unit to be utilized.

Considerable power is dissipated within the unit and it is important that the side and rear air vents remain unobstructed for proper cooling. Under continuous use for extended periods of time it is normal for the top and rear panel to feel warm to the touch.

PROPER GROUNDING PRECAUTIONS

One of the most important considerations in assuring patient safety while using electrical equipment is that of providing proper grounding. The ground wire in the power cord is connected to the generator chassis and insures that no dangerous currents will flow from the cabinet of the unit in the event of an internal electrical failure. In addition the equipotential ground wire must be used to provide added safety.

It is the responsibility of the user to assure proper grounding of the equipotential connections and power outlets furnishing power to the unit. Frequent checking is urged both visually and with electrical testing instruments, of all electrical cables and wires associated with the unit.

WARNING

By definition, electrosurgical cutting and coagulation takes place by current arcing or sparking through or to tissue. Electrosurgical procedures, therefore, are inherently NOT explosion proof and should NOT be used in the presence of flammable anesthetics.

SECTION 3

OPERATING CONTROLS

FRONT VIEW

1. Power On Switch and Circuit Breaker. Rock the switch to turn SSE2-L on. Indicator illuminates when the SSE2-L is on. Transistorized circuitry eliminates the need for warmup time. The power switch also interrupts the current flow in case of internal failure or momentary overload. Rock the switch to reset. If the circuit breaker has tripped, it may be necessary to press the switch to OFF, then ON to reset it.

2. COAG Indicator. Indicator illuminates (blue) when coagulation current is selected by depressing the pencil coagulation switch, depressing footswitch coagulation pedal, or by closing the forceps contact switch. Indicator lamps are designed to indicate the presence of a usable radio frequency output. They will NOT illuminate in the presence of zero setting or a generator malfunction. This feature can be used to give a surgeon added confidence when performing a "blind" procedure, or to isolate a problem to the generator or the accessory connected to it.

3. COAG Level Dial. Dial rotates clockwise to increase coagulation current intensity. Selector dial is graduated from 1 to 10.

4. CUT Indicator. Indicator illuminates (yellow) when CUT (pure or blended) current is selected by depressing the pencil CUT switch or by depressing the footswitch pedal. Indicator lamps are designed to indicate the presence of a usable radio frequency output. They will NOT illuminate in the presence of zero setting or a generator malfunction. This feature can be used to give a surgeon added confidence when performing a "blind" procedure.

5. CUT Level Dial. Dial rotates clockwise to increase CUT currently intensity. Selector dial is graduated from 1 to 10.

6. Pure/Blend Selector. The two position switch selects type of cutting current, either pure for minimum hemostasis while cutting, or blend for moderate hemostasis while cutting. Blend current intensity is determined solely by the CUT Level Dial setting, completely independent of COAG Level Dial Setting.

7. Footswitch Selector. This switch selects whether the Monopolar accessory output or the Bipolar output will be activated when the footswitch is depressed. The switch is internally illuminated to indicate which output is selected.

8. Active Switching Receptacles.
Three white position-coded receptacles accept the three prong plug of the Valleylab LectroSwitch pencil or the two prong plug of the switching forceps cord.

9. Active Accessory Receptacle.
This rectangular active receptacle will accept most standard accessories of other manufacturers, or will accept adapter plugs for those accessories that will not fit directly. The SSE2-L is then activated by a footswitch. (For a detailed explanation of how each output may be activated, refer to Section 4.)

10. Patient Receptacle. This receptacle accepts the twin lead plug end of the cord used on the cohesive pad or the single pad patient plate. Present within the receptacle housing is an LED which flashes in the event of a REM alert.

11. Bipolar Receptacle. The receptacle consists of two active output connections and two bipolar switching connections. It will accept either two standard banana plug connectors or one Valleylab four pin connector for handswitching bipolar accessories. This output may be activated by either the footswitch or by a handswitching accessory.

REAR VIEW

12. Audio Volume Dial. Dial controls the audio volume from 40dBA to 65dBA.

13. Footswitch Connection. The footswitch is connected to the four-pin footswitch receptacle on the rear of the SSE2-L.

14. Power Cord. Provided it is detachable and has a CEE7-7 plug end. This plug is approved by VDE and most other foreign approval agencies.

15. Cooling Fan Shield. The fan guard directs the air flow downward from the cooling fan and away from the sterile field.

16. Equipotential Lug This lug must be connected to earth ground with the furnished grounding cable.

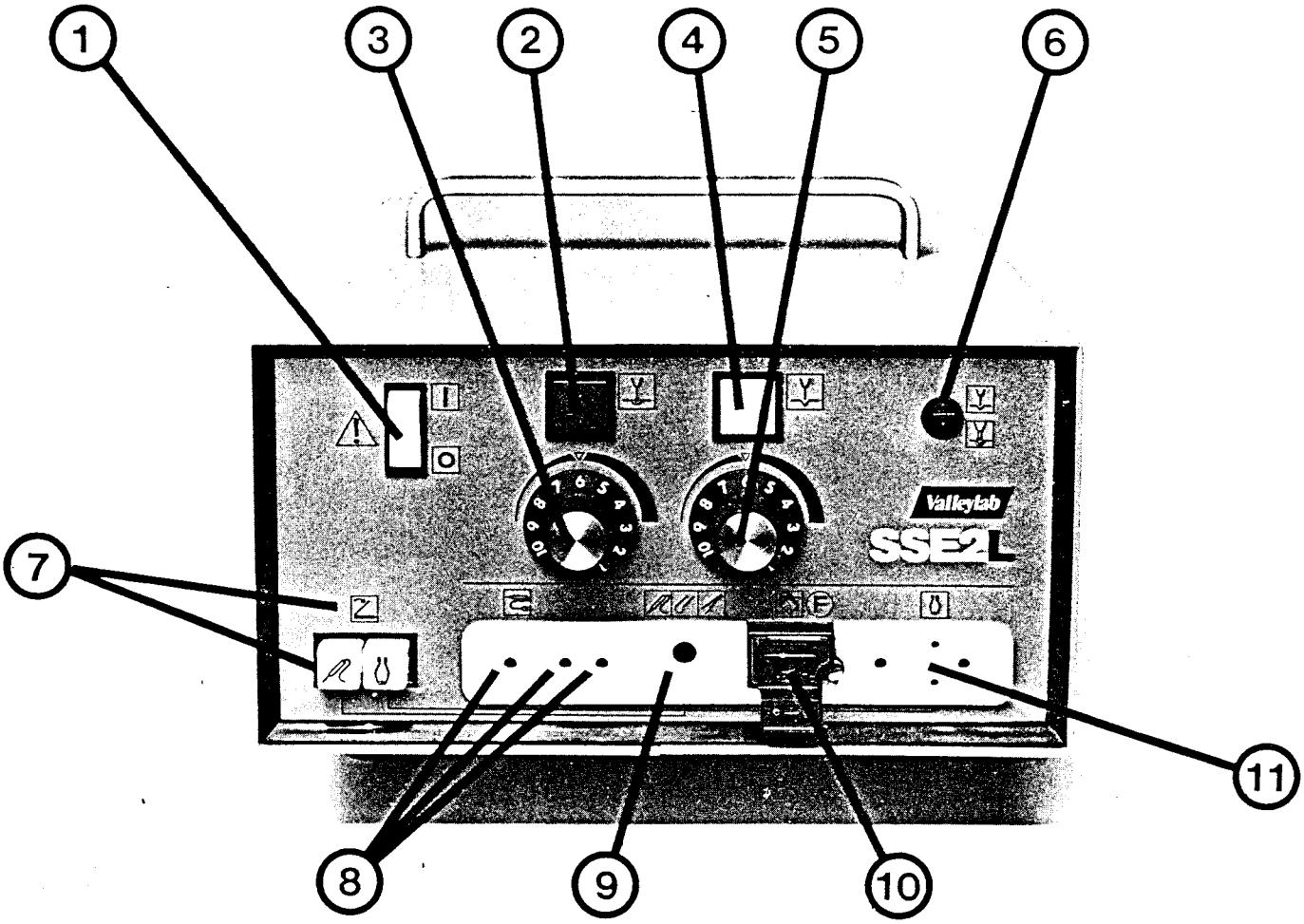


FIGURE 1 FRONT VIEW

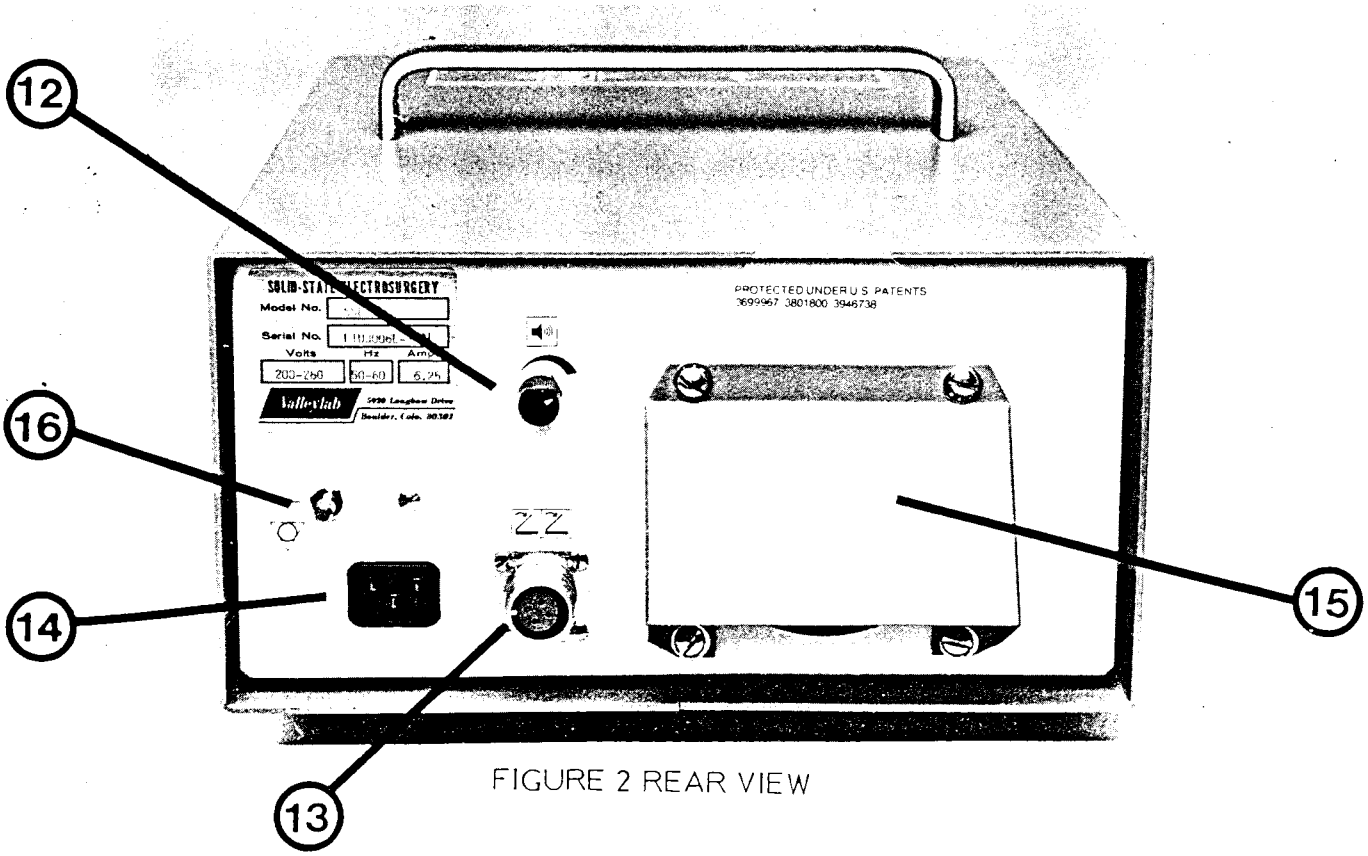


FIGURE 2 REAR VIEW

SECTION 4

MONOPOLAR AND BIPOLAR ELECTROSURGICAL CONFIGURATIONS AND ACCESSORIES

The SSE2-L features three separate outputs which are individually activated. Two of these outputs are used primarily in monopolar configurations. The MONOPOLAR HANDSWITCH output is designed for use with either switching forceps or a switching pencil. The MONOPOLAR ACCESSORY output is designed for use with non-switching accessories and is activated only by the footswitch. The third output is a reduced power BIPOLAR output which may be used with switching or non-switching bipolar accessories and may be activated by either the switching accessory or by the footswitch.

MONOPOLAR CONFIGURATION

Monopolar Accessories:

The SSE2-L has a radio frequency (RF) isolated output. In monopolar operation the radio frequency current passes from the active accessory through the patient and returns to the generator via a large patient plate which contacts the patient's skin.

The Valleylab handswitching LectroSwitch pencil (Model E2502) plugs into the three banana pin jacks at the extreme left of the white plastic front panel jack. All three of these LectroSwitch pins are "HOT" when the unit is keyed. Low switching voltages exist between the pins but all three are "active" with respect to the patient jack. The hand switching coagulation forceps (Model E4001 or E4002) plug into the two far left jacks of the accessory panel. The standard active accessory jack in the center of the panel will accept the plugs of most standard accessories directly or through an appropriate adapter. The footswitch (Model E6008) then controls the current flow to the accessory. The Model E6008 footswitch receptacle on the rear panel of the generator. The footswitch pedals activate the generator in CUT/BLEND or COAG as needed. The SSE2-L has an over-ride circuit to insure that only COAG is activated in the event that both pedals are pushed simultaneously.

The SSE2-L has an extremely safe footswitch circuit. The switching currents are too low to cause a spark even in the most dangerous mixture of flammable gas and oxygen.

An "explosion proof footswitch" is one that is designed to allow explosions to occur within the switch. It is so heavily constructed that burning gases cannot escape to propagate the explosion.

The Patient Plate (REM):

In a monopolar configuration a patient plate is ALWAYS needed to disperse the return current. The accepted standard for patient plate size is 1.5 watts per square centimeter of patient plate, or roughly 9 or 10 square inches per hundred watts (NFPA Bulletin No. 76 CM, Part II).

All 200V-260V SSE2-L model generators come equipped with a "Return Electrode Monitor System" (REM). For use with the REM system, the Cohesive Return Electrode (Model E7505) has been designed. The Cohesive Return Electrode System is a dual Return Electrode, which when used with a REM equipped generator has the capability to monitor the electrical resistance between the two parts of the pad and allow operation only if the resistance is between preset limits. This instrumentation provides increased assurance that the return electrode is in good condition and properly applied to the patient's skin.

To allow compatability with previous return electrode systems, a second mode of operation having only an upper resistance limit is automatically provided if a standard electrode is connected. An adapter or special cord may be required for use with these electrodes. Note: Standard return electrodes, except the Cohesive Electrode (Model E7505) will function with the REM system and monitor cable integrity, but will not monitor patient electrode contact. Warning: All Valleylab return electrodes and mating cables should be inspected prior to each use, for cracks or voids in the insulation and or possible loose connections. In the event a cord fault is present, the cord and/or electrode should be replaced to prevent any reduction of output power during a surgical procedure.

Because the SSE2-L is an isolated system, the circuit path from active to the patient jack must be complete in order for significant current to flow. This protects the patient from possible burns in the event that the patient plate is not touching the patient's skin.

BIPOLAR CONFIGURATION

Bipolar Accessories:

The most common bipolar instruments are forceps, the jaws of which are connected to the BIPOLAR output jack. In bipolar operation the current flow is limited to the tissue which is grasped by the jaws. The SSE2-L BIPOLAR output operates at lower power levels than the MONOPOLAR output and has impedance characteristics optimized for desiccation. This means faster coagulation at a given power setting and an automatic reduction of output power when the coagulation is complete.

The BIPOLAR output is poor for fulguration (sparking) to tissue. If a procedure necessitates the use of greater power than is available from the BIPOLAR output or if it is desirable to fulgruate with the bipolar instrument the MONOPOLAR output may be used. If the bipolar instrument is equipped with standard banana plugs, it may be connected to the SSE2-L using the PATIENT jack and the MONOPOLAR accessory jack with a Valleylab active accessory adapter Model E0005-3.

USE OF MULTIPLE ACCESSORIES

When using more than one active accessory during the course of a procedure, it should be noted that only one ouput at a time will be "HOT'. For example, if the unit is keyed with a handswitching LectroSwitch pencil, only the pencil will be active. If it is then desired to use the MONOPOLAR ACCESSORY output or the BIPOLAR output, it will be necessary to first release the handswitching pencil and then key the desired output as needed. The footswitch will activate either the MONOPOLAR ACCESSORY output as indicated by the illuminated FOOTSWITCH selector switch on the front of the instrument.

SECTION 5

TECHNICAL SPECIFICATIONS

Output Waveform (Typical):
- CUT: 500 KHz ± 10 KHz sinusoid with 65% 120 Hz modulation.
- COAG: Pulse modulated 450 KHz damped sinusoid.
  Burst duration 7.0 sec nominally.
  Burst repetition 20 KHz ± 2 KHz.
- BLEND: 500 KHz ± 10 KHz sinusoid with increased amplitude bursts at 50 sec. intervals.

Output Characteristic: (Typical values for control settings and load conditions specified. Power source is 200-260V AC 50/60 Hz).

Monopolar Output Characteristics:

Mode	P-P Voltage (Open Circuit CS=10)	Power (500 ohm CS=10)	Crest Factor (500 ohm CS=5)
Pure Cut	2380 V	375 ± 25 W	1.7 ± .2
Blend	2440 V	250 ± 25 W	2.9 ± .4
Coag	4070 V	125 ± 15 W	6.7 ± .5

Bipolar Output Characteristics:

Mode	P-P Voltage (Open Circuit CS=10)	Power (100 ohm CS=10)	Crest Factor (100 ohm CS=5)
Pure Cut	625 V	90 + 15-20 W	1.9 ± .2
Blend	640 V	85 + 15-20 W	2.5 ± .2
Coag	1100 V	25 + 5-10 W	5.8 ± .5

Output Power Control:
CUT/BLEND and COAG output power is essentially linear with control rotation from settings of (1) to (10).

Output Interaction:
The maximum power available from any non-activated output must not exceed 20 W for MONOPOLAR output and 3 W for BIPOLAR output. Non-activated power must be measurec into a 500 ohm load for MONOPOLAR output and a 100 ohm load for BIPOLAR output.

Output Isolation:

Line frequency source leakage current 0.4 A rms
Line frequency sink leakage current 300 uA rms (I)
RF patient leakage 150mA rms
Line ground leakage current (50/60 Hertz)
Unit off: 20 uA rms
Unit on: 100 uA

Cooling:

Single speed fan switches on automatically. Airflow directed downward.

Indicators:

Blue coag lamp or yellow cut lamp will illuminate only when RF power is available at unit output connections. High frequency coag tone or low frequency cut tone will sound when footswitch or handswitch is depressed.

Audio Volume:

Idle: Four Feet 40dBA (Approximately, fan off)
Active: 65dBA (Volume set to maximum)

Input Power: (Control setting of 10, output short circuit)

90-135 V AC 50/60Hz	180-270 V AC 50/60Hz
Idle: 0.4 Amperes	Idle: 0.2 Amperes
Cut: 12 Amperes	Cut: 6 Amperes
Coag: 4 Amperes	Coag: 2 Amperes

Input voltage range is selected through internal connections. Approved Hospital Duty power plug is standard. Explosion-proof connectors can be provided is specified.

Line Regulation:

For settings used for most electrosurgical procedures, i.e., settings which produc 0-200 watts in cut and blend and 0-75 watts in coag, with line voltages varying between 200 and 260 volts, power will not vary by more than ± 25 watts in cut and
blend, and ± 17 watts in coag.

Weight: 36.5 pounds (16.4 kilograms)

Size: 7.6 inches high (19.3 centimeters high)
11.6 inches wide (29.5 centimeters wide)
16.6 inches long (42.2 centimeters long)

Note:

(1) Line frequency sink current is that current which flows from an external voltage source of 200 V AC, 60 Hz applied to all front panel terminals in parallel. Also, 100 K ohms is in series with 220 V AC source for safety.

REM Subsystem Specification:

Output Waveform: Sinusoid
Frequency 140 kHz ± 5%
Open circuit voltage 1.25 ± 10%
S.C. Current 3ma Max.

Thresholds:
Single pad mode: Alarm off, R = 20 ± 1
Cohesive mode: Low impedance alarm, 20 ± 1
High impedance alarm, 135 ± 2
Hysteresis of thresholds: This is the impedance difference between alarm and alarm silence
low impedance 3 ± 1 , high impedance, 12 ± 2
Threshold shift: With the generator keyed at full output, cut or coag, into load or open circuit, thresholds will shift by 5 ohm or less.

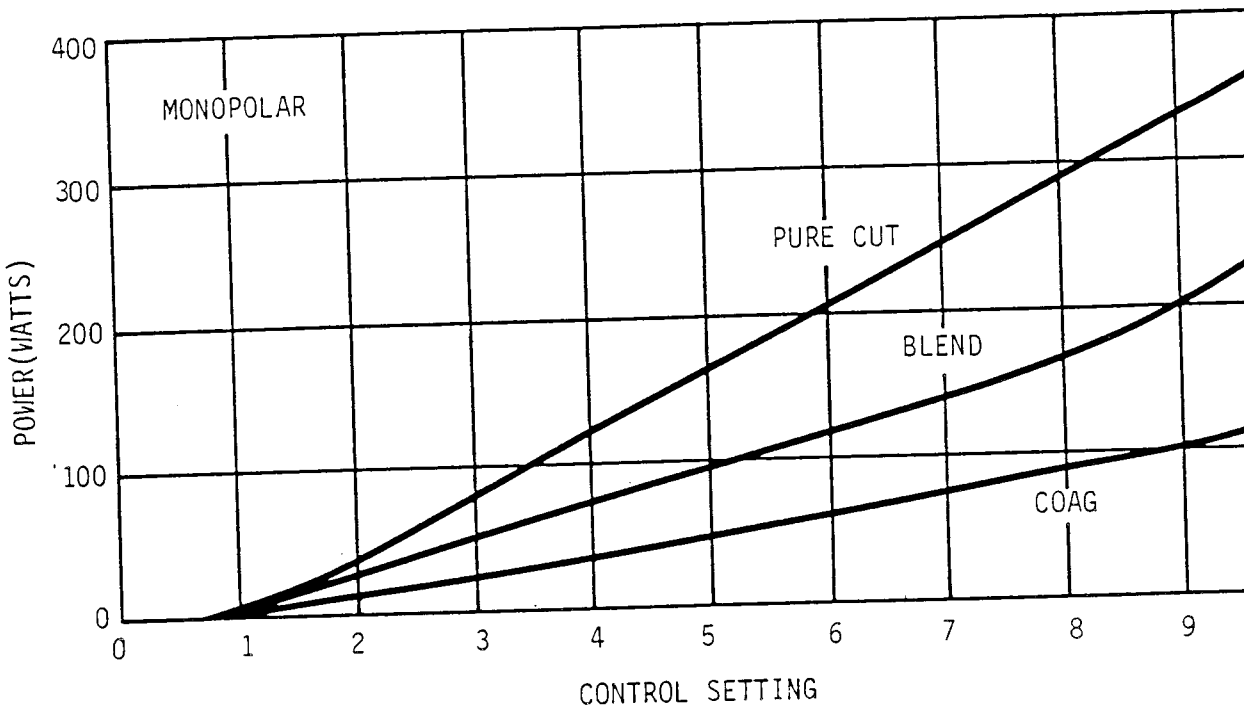
Audio Tone: 1.2 kHz intermittent
Volume level 65 dBA min. at 1 meter

LED Function: LED enables simultaneously with audible alarm.

Specifications subject to change without notice.

Data obtained using methods prescribed in service manual.

CAUTION: Per C.S.A. 22.2 #125, the degree of isolation of the SSE2-L is suitable for Risk Class 2 application.



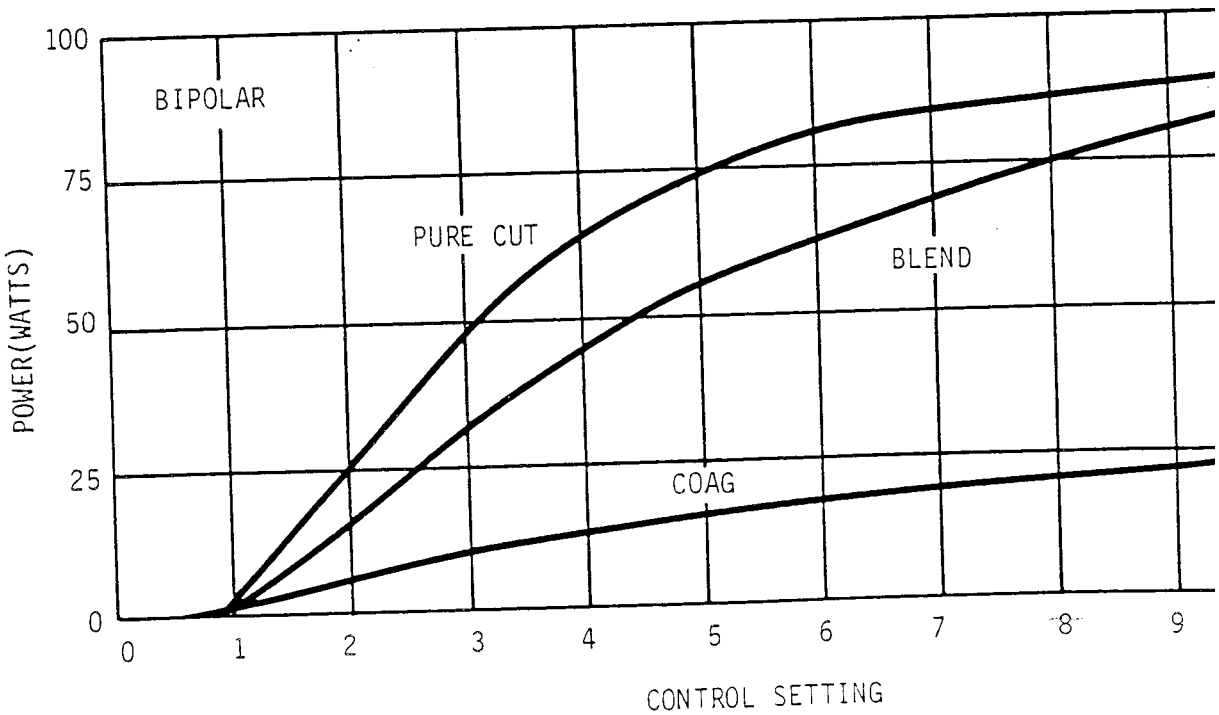
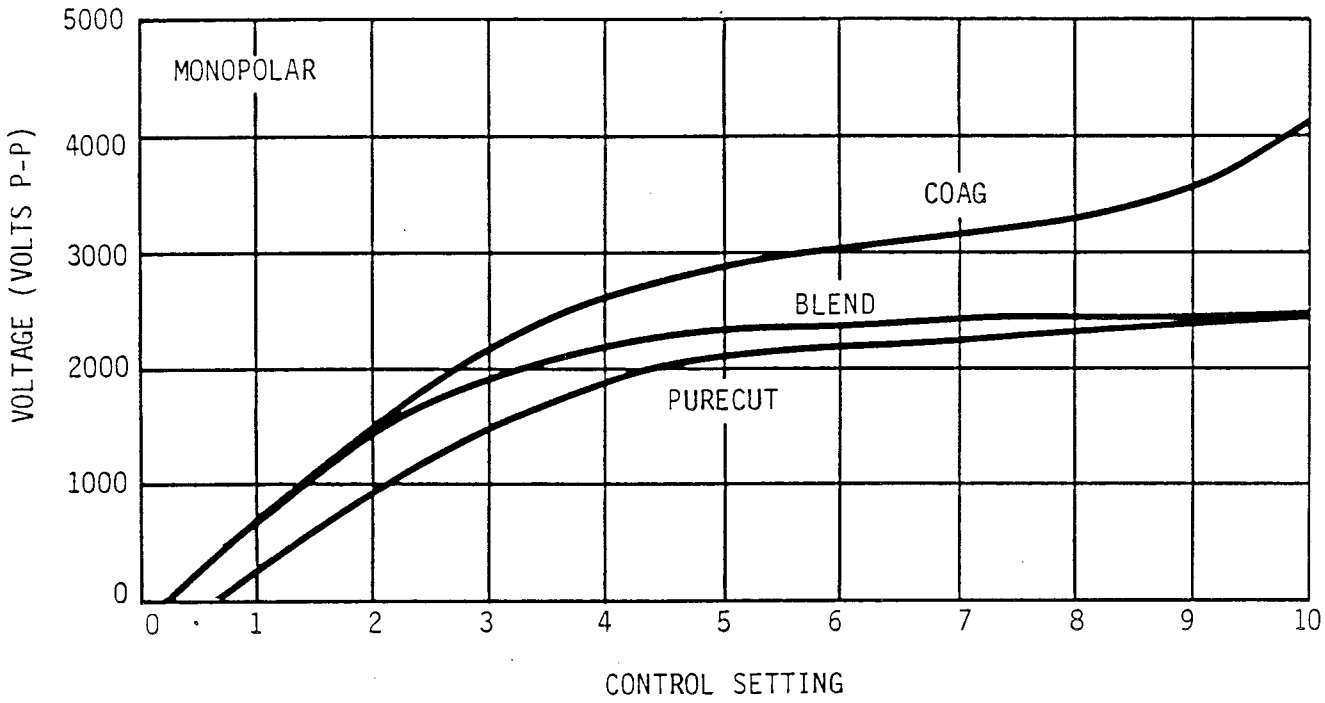


FIGURE 3 TYPICAL OUTPUT POWER VS CONTROL SETTINGS



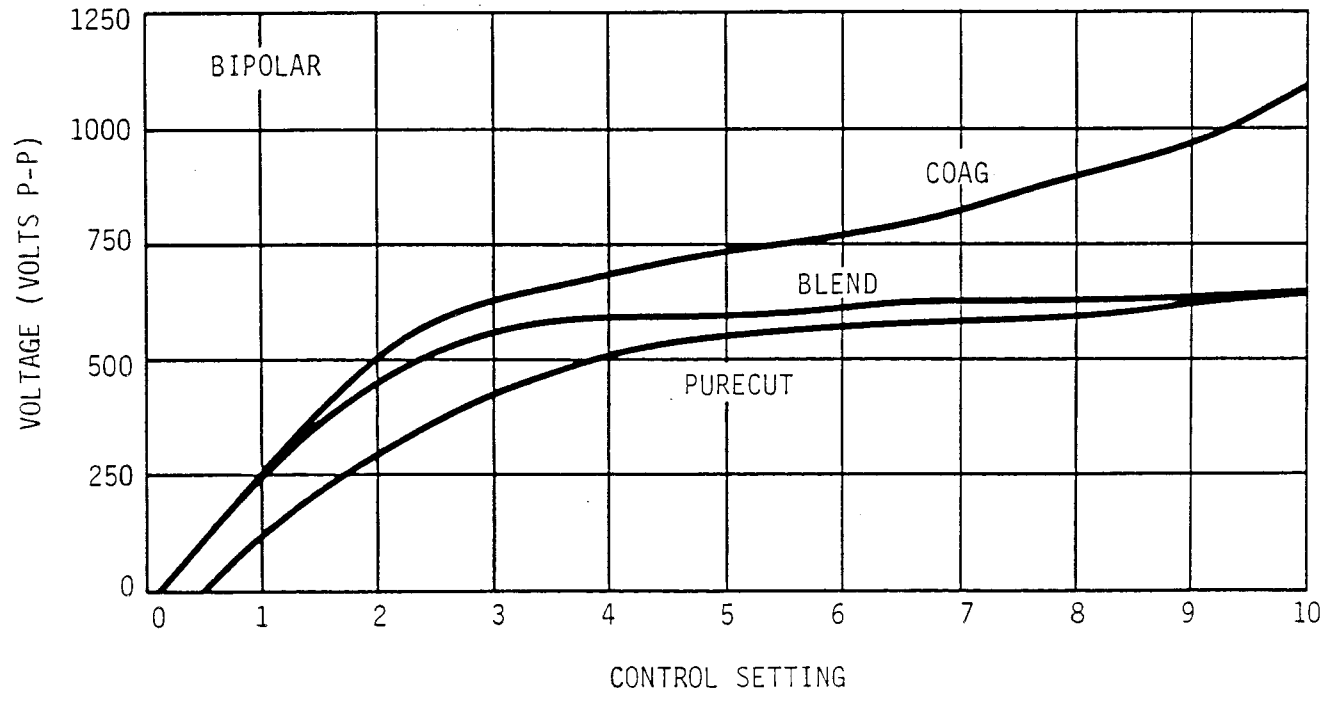
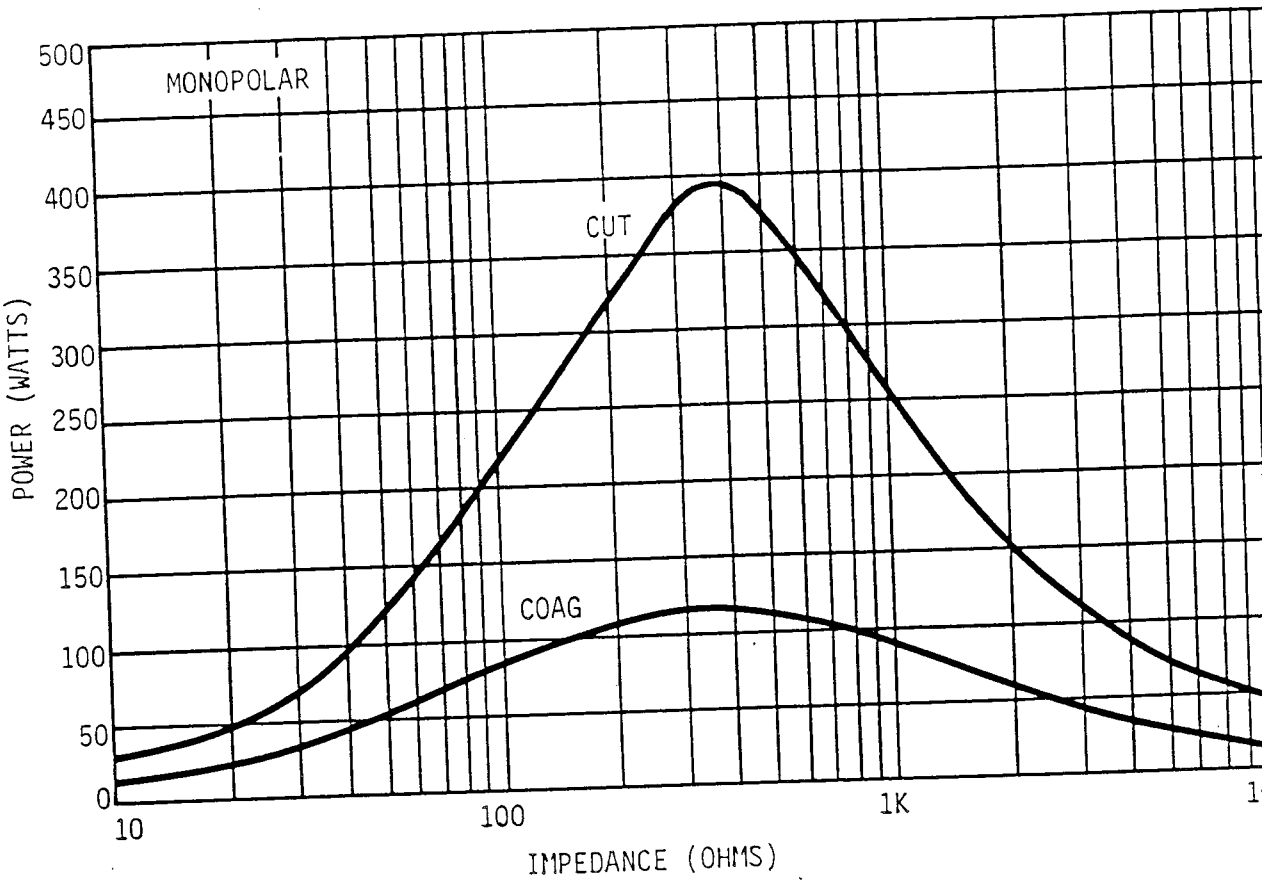


FIGURE 4 TYPICAL OUTPUT VOLTAGE VS CONTROL SETTINGS



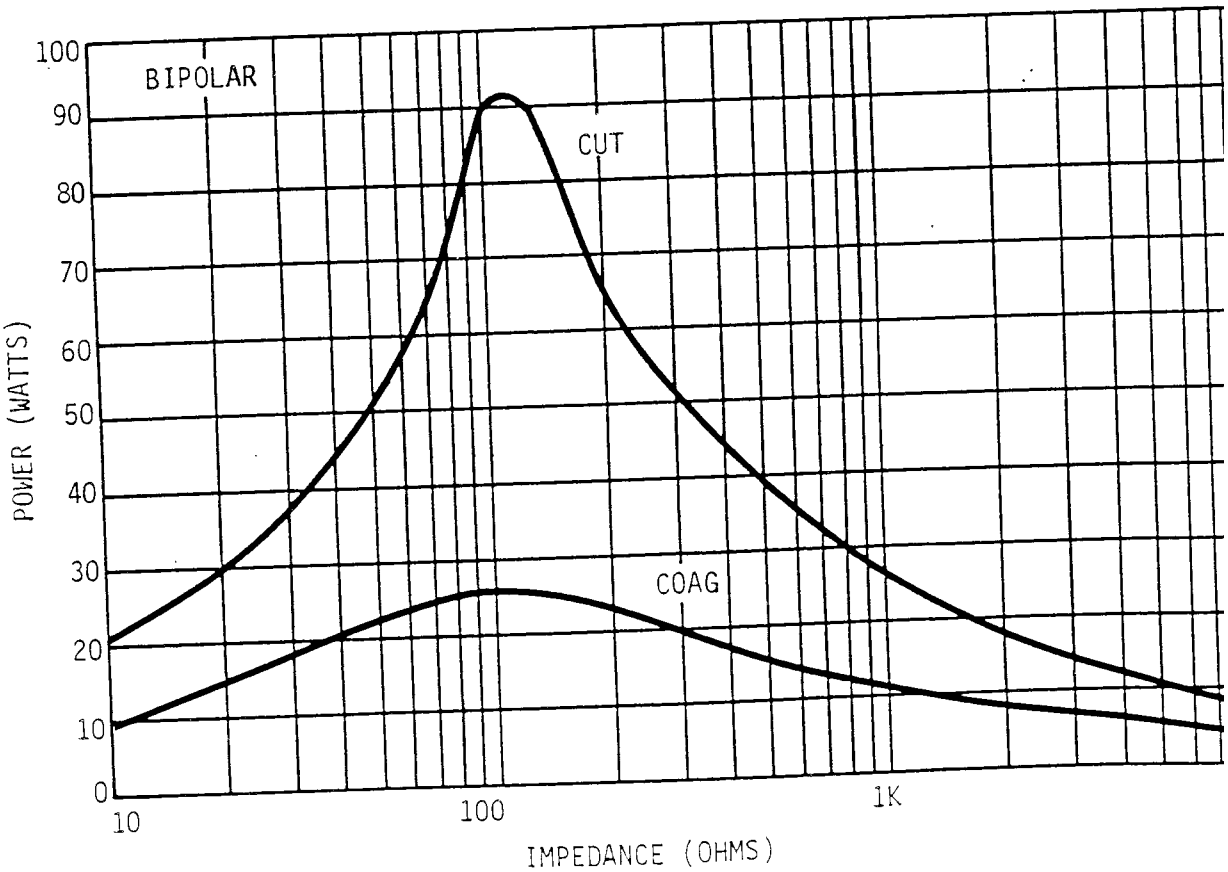
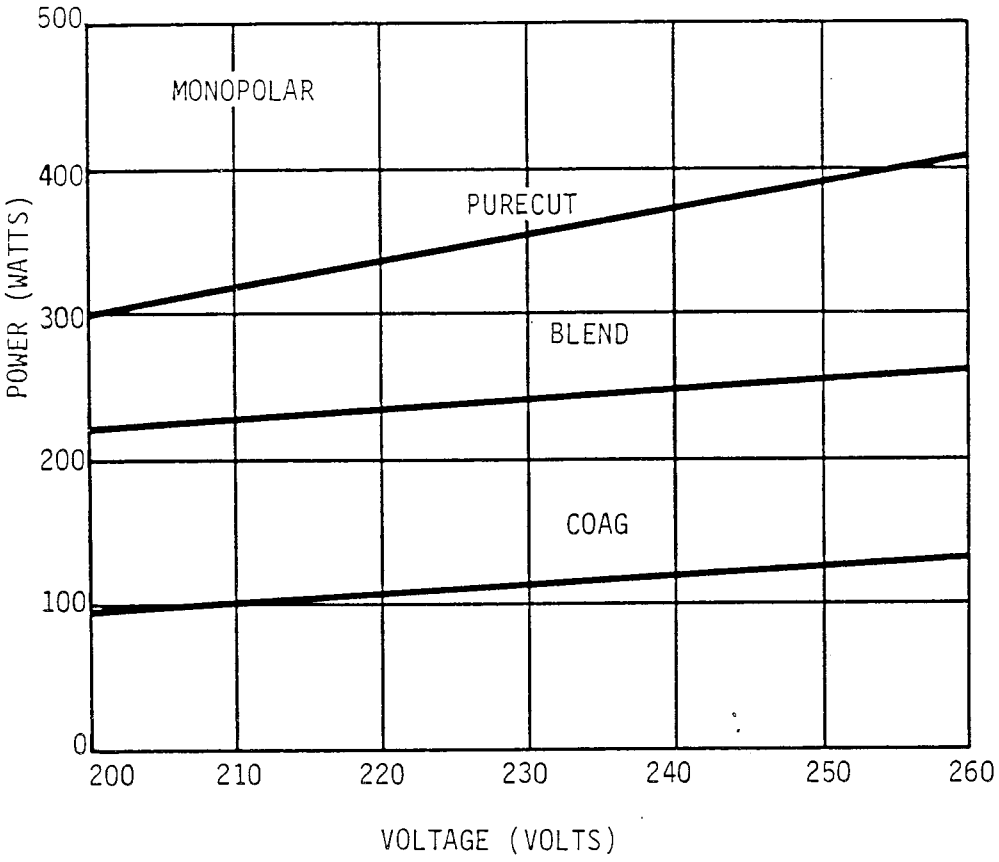


FIGURE 5 TYPICAL MAXIMUM OUTPUT POWER VS LOAD IMPEDANCE



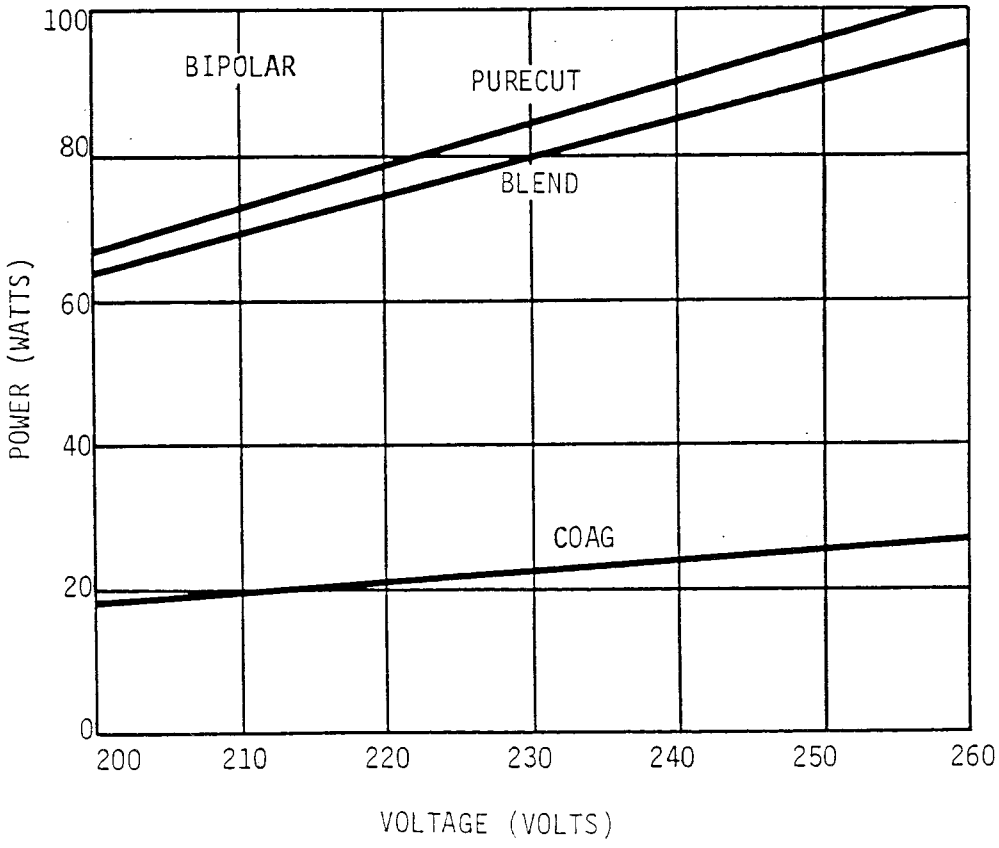


FIGURE 6 TYPICAL MAXIMUM OUTPUT POWER VS SUPPLY VOLTAGE

R16, C11, and R17 C12 assure that A5K3 and A5 K4 "cold switch" to prevent contact burning. The CUT and COAG logic signals from the footswitch are isolated from ground and enter the multivibrator board (A3) at pins U and W. On (A3) the signals are referenced to ground with the use of the isolated supply U3 and the opto-isolators OPI 1-2. The ground referenced CUT and COAG signals leave (A3) at pins 17 and 19 and enter the logic board (A2) at pins B and A respectively.

ISOBLOC CIRCUIT (A6)

The Isobloc circuit permits keying the generator with hand held accessories such as the Valleylab E2502 LectroSwitch while maintaining a high degree of RF isolation. Q1 is a 130KHz oscillator which supplies current to the light emitting diodes in the photo-isolators PI1, PI2, PI3 and PI4. CR1 C5 and CR2 C6 rectify and filter the energy transferred through T1. When the anode of this LED portion of one of the photo-isolators is connected to the appropriate ACTIVE lead, the diode emits light and current flows in the corresponding phototransistor. For instance, when the unit is keyed in CUT mode with a MONOPOLAR handswitching accessory, the circuit will be completed from MONO CTSW to MONO HS ACT and HSCT will be enabled.

LAMP ENABLE CIRCUIT (A6)

When RF is present at the primary of output transformer T1, current flows through C11 causing Q2 to turn on supplying current to the appropriate indicator lamp. In this way the lamps are directly indicative of available output power. The lamps will not light at zero setting.

AUDIO CIRCUIT (A2)

U9 is a quad 2 input NOR logic gate which is connected as an astable oscillator to generate two different pitched tones for audible warning of the selected function. The output of the oscillator drives the speaker amplifier Q5. (A1)R3 allows control of the speaker volume. REM alert is explained in the REM section.

LEAKAGE CANCELLING CIRCUITS (A5)

Active-to-ground capacitance causes undesirable RF patient leakage current. L1 and L2 form a pole of impedance with typical active stray capacitance so that the net leakage producing effect of the active-to-ground capacitance is reduced. The ground connection of the inductance is isolated by a capacitor so that the low frequency sink capability is limited. R1 and R2 provide adequate damping in this circuit for the coagulation mode.

RETURN ELECTRODE MONITOR (REM) (A8)

Referring to the schematic, on figure 25, a two wire return electrode is connected between E1 and E2, an RF source to E3 and a speaker to J103-1 and J103-2. J101-1 is used to inhibit ESU operation in the event of a detected error. Oscillator U4 drives a transformer network T2 and a snychronous detector U6 so that a differential voltage between C12 and C13 is representative of the resistance between E1 and E2. A very high degree of normal mode noise rejection is required. Flip-flop U7 is used to provide a symmetrical square wave, and U5 provides fast edges for accurate multiplexer operation. C18-C20 isolate the tansformer from all D.C. drive voltages, so that in the event of transformer failure, no hazardous potentials will be presented to the patient. A double-ended output is presented so that the detector will be loaded symmetrically, however only one of the outputs is used by the comparator circuit. The single-ended output voltage is approximately 0 to +300mv with respect to the +6v supply for a 0 to 135 ohm range.

Two comparators contained in U4 and U2 are set to give high and low limits on return-electrode resistance. Hysteresis is provided on each comparator to insure stable switching. Exclusive OR gate U3a is keyed by a switch in the jack assembly. If the switch is not activated by a plug pin, the low resistance value is used for an upper limit. This mode is used for conventional electrodes. The dual area cohesive electrode has a pin on its plug which keys the switch, and the low resistance value becomes the lower limit. In either case, when the resistance is within its acceptable range, Q1 is on and the RF output is not inhibited. U5c and U5d along with U1 and T1 form an audio oscillator where output impedance is high when inhibited by a logic 1 on U1 pin 2 and low with logic zero. This allows direct connection across an existing speaker and audio driver of an electrosurgical generator. When U1 pin 5 output is high, C11 is being charged and when U1 switches state the charge on C11 is discharged through pin 4 U1. This discharge current lights an LED mounted in the patient receptacle housing.

SECTION 7

TESTING PROCEDURE

OPERATIONAL TESTING--GENERATOR OUTPUT AND REM

The purpose of the operational test is to quickly determine whether the generator is functional and is generating the necessary electrosurgical waveforms. In the Acceptance Test Procedure detailed measurement procedures will be described to accurately determine the condition of the Generator.

The Return Electrode Monitor, (REM) must be functioning and in the correct mode to get a power output. To test the REM, first turn the generator power on, without a return electrode connected. The REM alarm should sound, the LED should flash and power output should be inhibited, if the REM is functioning properly. There are two modes of REM operation, the single pad mode and the cohesive pad mode. To test these modes, connect the correct return electrode and test the resistance parameters. In the single pad mode, the two pins of the patient connector are shorted together. Offering a resistance range of 0 to 20 ohms. The REM alerts should cease and power output will be available when keyed if a single pad return electrode is connected. To switch the REM into cohesive pad made use only a Cohesive Return Electrode, with a pin protruding from the connector. Proper operation will be achieved only when the resistance between the two pins of the patient connector fall in the range of 20 to 135 ohms. Any other resistance will cause a REM alert and output power to be inhibited.

A significant amount of information can be obtained about the generator's output by a simple arc-test. By observation of the arc, it can be determined quickly whether the CUT, COAG or BLENDED outputs are present.

Because the SSE2-L features individually activated outputs, operational tests must be performed with care to assure that the activated output is the one being tested. The testing procedure is written under the assumption that the MONOPOLAR HANDSWITCH output will be used. However, the MONOPOLAR ACCESSORY output may be used by keying the unit with the footswitch.

To test the output of the generator, a functional switching pencil is required along with a patient plate. For this purpose a dummy electrode could be used to avoid burning surgical electrodes.

While switching the pencil in the COAG mode, starting at a setting of (1), attempt to start an arc to the patient plate. At low settings a very small arc should occur, growing larger as the control level is increased. The arc appears to be a thin, feathery looking arc with a distinct high-pitched squeal. At full output (10) it should be possible to sustain an arc 1/8-1/4" from the plate.

In the PURE CUT mode the arc is much stronger and larger with a distinct sputtering sound. At full output (10) a very strong arc should be obtained which will quickly melt the stainless steel electrode.

In the BLEND mode the arc is again very strong and sputtering, but it also emits the high-pitched squeal noted in the COAG mode. It is usually much easier to sustain an arc in the BLEND mode than in PURE CUT mode.

The Bipolar output may be evaluated in a similar manner by keying the generator with the footswitch and arcing between the tines of a bipolar forceps connected to the BIPOLAR output terminals. Caution must be exercised to avoid burning the forceps tips. The characteristics of the arc will be similar to that described for the MONOPOLAR output but the arc will be much smaller.

These quick tests are, of course, very subjective but can be used to effectively evaluate a unit when one is familiar with a known good generator.

NOTE: Electrosurgical generators are not continuous-duty devices and should not be operated continuously.

OPERATIONAL TESTING -- RADIO FREQUENCY LEAKAGE CURRENT

RF leakage to earth ground is detrimental in the use of isolated electrosurgery. The leakage is minimized in the Valleylab unit at less than 150MA rms in PURE CUT. When the SSE2-L is keyed with a footswitch plugged into the rear connector, this leakage can be seen as a small spark between an active electrode or patient wire and the chassis. This spark can best be evaluated through comparison with a test generator known to be working properly. The Acceptance Test Procedure outlines the method used to accurately measure this leakage current. Because of the high crest-factors in the wave-forms involved, the use of a thermocouple type RF Ammeter is imperative to prevent errors in this measurement. Excessive RF leakage from the PATIENT terminal has the effect of raising the patient to an RF potential with respect to ground. These voltages, when allowed to become too high, can cause operating room personnel to be "shocked" when lightly touching the patient. These shocks are, in reality, tiny pin-point RF burns and although not dangerous to the patient or operating room personnel, are disagreeable and should be avoided.

Excessive RF leakage from an ACTIVE jack has the effect of allowing surgery to be performed without benefit of a ground plate and again is an undesirable situation. For this reason, RF leakage measurements should be performed periodically to ensure patient safety.

OPERATIONAL TESTING -- 50/60Hz CURRENT LEAKAGE

There is no simple means of making these measurements. Sensitive instruments

are needed to measure the low values of current involved. The 50/60Hz leakage is measured with the SSE2-L ON, but NOT keyed.

The measuring procedure is described in detail in the Acceptance Test Procedure. Because of the potential danger to an electrically-susceptible patient in the case of excess 50/60Hz leakage, generators suspected of this fault should be carefully tested and inspected.

ACCEPTANCE TEST PROCEDURE

Equipment needed:
Tektronix type 453 Oscilloscope
Tektronix type P6013A HV Probe
Tektronix type P6007 X100 Probe
Tektronix type P6010 X10 Probe
Hewlett-Packard type 427A Voltmeter Simpson Model 1339 RMS Ammeter 0-250 mA
Wattmeter, 0-500 W, 500 ohm load
Wattmeter, 0-100 W, 100 ohm load
General Radio Co. 0-280 VAC Variac
Cohesive Return Electrode,
Connector with Pin
Decade Resistance Box, (or a multiturn 150ohm or greater Potentiometer.

NOTE on Acceptance Test Procedure: In testing RF type equipment, proper test procedures must be adhered to in order to have a reasonable change of duplicating factory obtained data. Test leads must be kept to the minimum length usable (lead inductance and stray capacity can adversely affect readings). The selection of suitable "ground" points must be made with care to avoid ground-loop errors. Keep in mind that meter accuracy of many RF instruments is 5-10% of full scale. This may have a large effect upon measured values. In measuring high voltage RF waveforms, the effect of an uncompensated scope probe may cause large errors. In measuring fractional-microampere leakage currents, accidental capacitive or indictive coupling may cause order-of-magnitude errors in the observed values.

CHASSIS GROUND INTEGRITY

Check for the existance of a low impedance connection between the generator chassis and the equipotential earth ground, with the power cord disconnected. Disconnect equipotential connection and connect power cord to unit. Follow same procedure to check the chassis to ground connection of the power plug. To avoid any problems of contact resistance in measuring this impedance (0.1 ohm) it is recommended that 4-wire resistance measuring technique be utilized. The recommended maximum impedance of 0.1 ohm is for the standard factory installed 10 foot 16/3 AWG line cord. Use of longer cords is not recommended.

INITIAL FUNCTIONAL TEST

Powering the generator from a variable, voltage transformer capable of furnishing at least 6.5 amperes at 260V AC, turn the unit ON and key it in the CUT mode. Insure that it starts to function at 200V AC or lower. The presence of an audible tone and appearance of CUT and COAG lamps is indicative of proper operation for this test. The CUT and COAG lamps are turned on by a circuit which detects an RF output. Therefore, the level controls must be set at about (1) before the light will appear.

RETURN ELECTRODE MONITOR (REM)

In the event the REM did not function as described in the "Operatonal Testing" text on Page 17, a REM alignment should be conducted as follows:

Remove the brass shield box from the REM Module. The REM PC Assembly may be placed on top of the power transformer with the insulating bracket underneath.

Oscillator Alignment

Connect the DMM to TP1 (+) and TP2 (-), set it to 2.0V DC full scale. With no connection to the RF Return Connector, adjust L1 (Oscillator Inductor) for a maximum reading on DMM. (NOTE: C7 is a .0033 uF polycarbonate dielectric capacitor which may be installed to set the range of adjustment on L1. If the capacitor is not in place, and the peak voltage is not reached when L1 adjustor is fully clockwise, install C7 (using only the Valleylab part) and return L1. Conversely, if a peak reading is not obtained with L1 adjusted fully counter clockwise, remove C7 and readjust L1).

Threshold Adjustment

Set the decade resistor to 135 ohm. Rotate R20 counter-clockwise until the alert flashes and sounds. Rotate R20 clockwise to silence alert, then slowly counter-clockwise until alert flashes and sounds. This adjustment must be precise.

Volume Adjustment

Adjust R16 for 2.5V peak-to-peak at the speaker using an oscilloscope.

Reinstall the REM board and shield can. Replace the generator cover and verify that the REM system meets the specifications. This completes the REM alignment procedure.

OUTPUT POWER LEVELS

For the return patient connection use a connector without pin and connect the 2 leads together. Monopolar output levels are specified for the MONOPOLAR ACCESSORY output of the SSE2-L. Component variations between the MONOPOLAR ACCESSORY and the MONOPOLAR HANDSWITCH output circuits may cause the relationship between control setting and output power to differ slightly between the two. Adjustment of output power levels must be done while in the MONOPOLAR ACCESSORY mode. It is then necessary to repeat the measurement procedure while in the MONOPOLAR HANDSWITCH mode to verify that corresponding output power levels track within 10%. The measurement procedure must be performed a third time in BIPOLAR mode to insure that bipolar output levels are within specification.

When measuring output power levels it is important to maintain a line voltage of 230 V AC. If a Variac is not available for this purpose and the generator must be tested with the existing voltage, the output power will differ from that at 230 V AC input. To determine the full output (10+) power at other line voltages, refer to Figure 6. Intermediate output powers will be proportionately higher or lower depending on the line voltage available. Within the range of power from 0 to 200 watts in PURE and BLEND, 0 to 75 watts in COAG, and input voltages from 200 to 230 V AC, the output is regulated and varies less than $\pm$ 25 watts in CUT and $\pm$ 17 watts in COAG.

PURE CUT LEVELS

Connect a 500 ohm wattmeter rated at $\pm$ 400W, between the monopolar accessory and patient terminals. Key the unit using a footswitch (Valleylab E6004, E6008, or equivalent). The PATIENT terminal may be connected to chassis ground to insure proper operation of an oscilloscope. Set the CUT level to (10) and place the PURE/BLEND switch in the PURE position and key the generator. Power output should be 375 $\pm$ 25 watts RMS. Set the CUT level to (7) and verify that the power is 245 $\pm$ 30 watts RMS. Set the CUT level to (2) and verify that the power is 35 $\pm$ 20 watts.

Set the CUT level to (10). Remove the 500 ohm load and check the open circuit output voltage. This should not exceed 2800 volts peak-to-peak.

If the generator does not meet the requirements of the preceeding paragraph it will be necessary to make the following adjustments.

Connect a frequency counter to the collector of (A3) Q3 on the multiboard and select the value for (A3) Q3 which will give a carrier frequency of 500 $\pm$ 10 KHz. Set the COAG level to (1) and key the unit in COAG mode. Note that the frequency is 450 $\pm$ 10 KHz.

Set the CUT level to (10) and connect the 500 ohm wattmeter as described above. Key the generator in PURE CUT mode and select value for (A3) R30

which gives 375 ± 25 watts of RF output power.

Check power at CUT level setting of (7), (5) and (2) to see that they are within the limits set above. Power at mid-range settings may be adjusted by changing the value of (A3)R32. See figure 3 for typical output curves.

BLEND LEVELS

Connect the 500 ohm wattmeter as before and set CUT level to (10). Place the PURE/BLEND switch in BLEND position and key the generator. Power output should be 250 ± 25 watts. Set the CUT level to (7) and verify that the power is 140 ± 20 watts. Set the CUT level to (5) and verify that the power is 95 ± 20 watts. Set the CUT level to (2) and verify that the power 25 ± 15 watts. Mid-range power levels may be adjusted by changing the value of (A1) R2.

With the wattmeter still connected, set the CUT level to (5) and key the generator. Observe the output waveform with the oscilloscope and insure that the ratio of peak COAG to peak CUT voltage is between 1.6:1 and 2.0:1. If the ratio is higher than 2.0:1 it may not be possible to meet the power requirements of the preceding paragraph. The ratio is set by (A3) R25.

Crest factor may be calculated from the formula C.F. = Epk/Erms or Ipk/Irms. The peak voltages or current may be measured with an oscilloscope and the RMS values with an RMS voltmeter or ammeter.

COAG LEVELS

Connect the 500 ohm wattmeter as before. Set COAG level to (10) and key the generator in COAG. Power output should be 125 ± 15 watts. Set the COAG level to (7) and verify that the power is 75 ± 10 watts. Set the COAG level to (5) and verify that the power is 45 ± 10 watts. Set the COAG level to (2) and verify that the power is 10 ± 5 watts.

Check that the Pulse Repetition Rate is 20 ± 2 KHz (50 ± 5 uS and that the burst width is 7 ± 3 uS.). (A3) R14 and (A3) R15 may be changed in value to vary the PRR and burst width respectively within the limits stated. Varying these parameters will allow control over maximum output power in COAG.

Set the COAG level to (10), remove the 500 ohm load and check the open circuit output voltage. This should be greater than 3500 volts peak to peak.

MONOPOLAR HANDSWITCH TEST

A handswitching instrument such as the Valleylab Model E2502 LectroSwitch must be plugged into the MONOPOLAR HANDSWITCH output of the generator and the 500 ohm wattmeter is connected between the MONOPOLAR PATIENT terminal and the electrode of the handswitching instrument. The generator is operated in a manner similar to that outlined previously and output levels are measured and verified to be within ten percent of those measured at the MONOPOLAR ACCESSORY output.

BIPOLAR TEST

For this test the generator is again keyed with a footswitch but with a 100 ohm wattmeter connected between BIPOLAR OUTPUT 1 and BIPOLAR OUTPUT 2.

Place the PURE/BLEND switch in PURE and set the CUT level at (10). Be sure that the FOOTSWITCH selector is in the BIPOLAR position and key the generator in CUT mode. Power output should be 90 + 15 W, -20 W. Set the CUT level (7) and verify that the power is 85 + 15, -20 W. Set the CUT level to (5) and verify that the power is 75 +15, -20 watts. Set the CUT level to (2) and verify that the power is 25 + 10, -15 watts.

Set the CUT level to (10), remove the 100 ohm load and check the open circuit voltage. This should be typically 625 volts peak to peak.

Reconnect the 100 ohm wattmeter, place the PURE/BLEND switch in BLEND, set the CUT level to (10) and key the generator in CUT mode. Power output should be 85 +15, -20 watts. Set the CUT level to (7) and verify that the power is 70 +15, -20 watts. Set the CUT level to (5) and verify that the power is 55 $\pm$ 15 watts. Set the CUT level to (2) and verify that the power is +10, -15 watts.

Set the COAG level to (10) and key the generator. The output power should be 25 +5, -10 watts. Set the COAG level to (7) and verify that the power is 20 +5, -10 watts. Set the COAG level to (5) and verify that the power is 15 $\pm$ 5 watts. Set the COAG level to (2) and verify that the power is 5 $\pm$ 3 watts.

Set the COAG level to (10), remove the 100 ohm load and check the open circuit voltage. This should be typically 1100 volts peak to peak.

RF LEAKAGE TEST

RF leakage currents from MONOPOLAR PATIENT terminal to ground are measured with a 40 pf capacitor connected from the "hot" ACTIVE terminal to ground. This simulates the stray capacitance of a ten foot active accessory cord found in actual operating conditions.

This capacitance resonates with the inductance of the leakage cancelling circuit to minimize RF leakage to the PATIENT terminal. Connect the 250mA RF ammeter from the MONOPOLAR PATIENT terminal to ground, set the CUT and COAG level controls to (10) and key the generator alternately from the MONOPOLAR HANDSWITCH terminals and from the footswitch in both cut and COAG modes and verify that the RF leakage current does not exceed 150mA RMS.

RF leakage currents from the MONOPOLAR HANDSWITCH and MONOPOLAR ACCESSORY terminals to ground are measured with the MONOPOLAR PATIENT terminal open. This is the condition that would exist if the patient plate cord were accidentally unplugged from the generator.

Connect the 250mA RF ammeter alternately from the MONOPOLAR HANDSWITCH and the MONOPOLAR ACCESSORY terminals to ground and while keying the corresponding output in both CUT and COAG modes verify that the RF leakage does not exceed 150mA RMS.

RF leakage currents from the BIPOLAR output terminals to ground are measured with a 40 pf capacitor connected from the open output to ground to simulate the condition where only one tine of a forceps is in contact with the tissue and the stray capacitance from the accessory cord to ground forms the leakage path.

Connect the 250 mA RF ammeter alternately from the BIPOLAR OUTPUT 1 and the BIPOLAR OUTPUT 2 to ground and while keying the generator in CUT and COAG modes verify that the RF leakage does not exceed 150mA RMS.

CROSS COUPLING TEST

The effects of capacitive and inductive coupling at the high frequencies involved will cause some unwanted RF output to be present at the non-activated outputs when the generator is keyed. The purpose of this test is to insure that this stray RF is within acceptable limits.

Power levels must be measured using a 500 ohm load for the MONOPOLAR outputs and a 100 ohm load for the BIPOLAR output.

Non-activated power is measured at each of three outputs with the appropriate load while keying each of the remaining two ouputs at maximum output in CUT and COAG modes and into both open and shorted loads. Power measured at the non-activated terminals must not exceed 20 watts for the MONOPOLAR output and 3 watts for the BIPOLAR output.

LINE REGULATION TEST

Connect the SSE2-L to a variable voltage transformer (Variac) and set the supply voltage to 220 V AC. Select PURE or BLEND mode and set the generator output to 200 watts into a 500 ohm load while keeping the supply voltage constant. Vary the supply voltage from 200 V AC to 260 V AC. The output should vary less than ± 25 watts.

Return supply voltage to 200 V AC and set COAG power to 75 watts. Vary supply voltage from 200 V AC to 260 V AC. Output power should vary less than ± 17 watts.

POWER SAG TEST

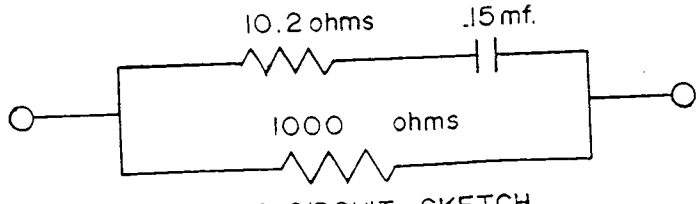
Connect the SSE2-L to a variable voltage transformer (Variac) and set the supply voltage to 220 V AC. Select the BLEND mode and set the CUT level to (7). Key the generator into a 500 ohm load wattmeter and note the power. Continue keying the generator for 60 seconds and again note the power. The final power after keying for 60 seconds should be at least 80% of the initial power. Select the COAG mode at a level of (7) and key the generator as described above, noting the final and initial power. The final power after 60 seconds should be at least 80% of the initial power.

COOLING FAN TEST

The cooling fan has one speed and will switch on when the cooler assembly reaches 160 F ± 10 F. The fan switches off at 140 F ± 10 F. To test the fan's operation, set the cut level to (10) and key the SSE2-L with no load. The fan should switch on within 180 seconds. If it does not, check out the thermal switch assembly before proceeding.

LINE FREQUENCY LEAKAGE CURRENT (50/60 Hz)

Potentially dangerous 50/60 Hz line leakage currents to ground are measured in this test. SSE2-L is left ON but NOT keyed. The current is measured indirectly by observing the voltage developed across a 10 K ohm resistor to ground from each front jack. A .15uf capacitor is connected across the 1K resistor to ground from each front jack. A .15uf capacitor is connected across the 1K resistor to remove any trace of high frequency noise generated by the multivibrator inside the unit. It has little effect on the actual 50/60 Hz leakage current. Leakage current is calculated from I=E/R where R=1,000 ohms and E is the voltage across the resistor. The maximum acceptable voltage across the 1K resistor for 0.2uA leakage is .0002 V (.2 millivolts). See INPUT CIRCUIT sketch below.



INPUT CIRCUIT SKETCH

NOTE: Because of the extreme difference in magnitude of the 60Hz leakage current and the 500 KHz signal (when keyed), it is very difficult to make a 60Hz leakage measurement with the unit keyed. When keyed, there can be as much as 4000 volts peak to peak of 500 KHz, as compared to .2 milli-volts of 60 Hz. This ratio (20,000,000:1) of voltages would necessitate the use of sophisticated measuring techniques. In actual use, the 60Hz leakage currents do not change significantly from the keyed to the unkeyed mode.

Third wire leakage current is measured by opening the green/yellow grounding wire at the receptacle inside the unit and connecting the 1K resistor from chassis to ground. The maximum voltage for 30uA leakage would be 0.03V (30 millivolts). Commercially available leakage testers may be used for this test.

The value of 30uA is valid for the detachable power cord supplied with the unit. Longer power cords or extension cords will increase the third wire leakage and are not recommended. With the SSE2-L turned OFF the third wire leakage should be 10uA. The line frequency sink leakage is the current that will pass into the patient leads when a 220 volt 60 Hz potential is applied between a patient lead and the chassis.

The voltage source should be 220 volt isolation transformer with a 240K ohm current limiting resistor in the secondary. The current is calculated from the voltage measured across a 10K ohm resistor in series with the 220 volt source and the "patient" or "active" jacks. This current should be 300uA.

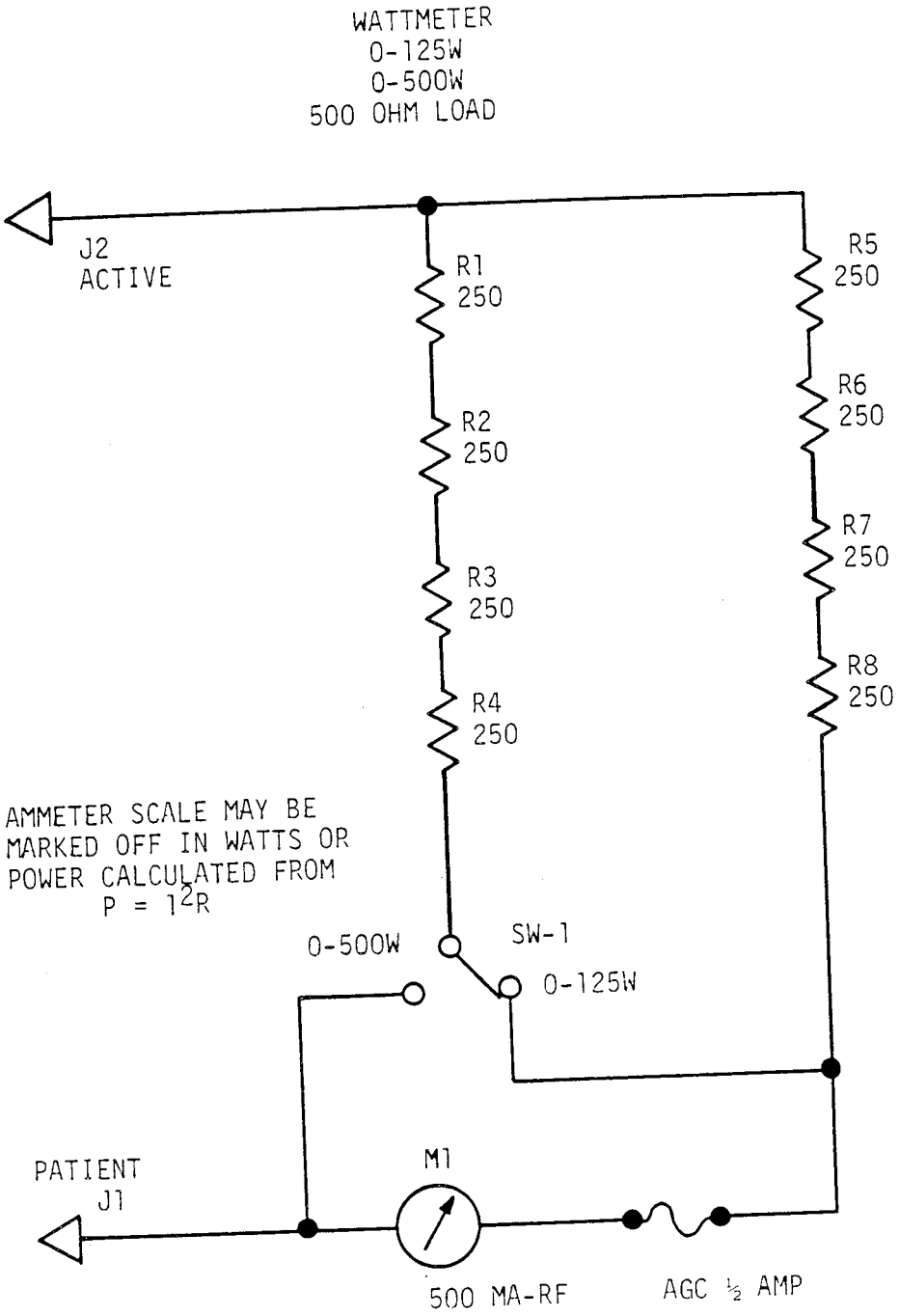
PREVENTIVE MAINTENANCE

It is recommended that the SSE2-L be inspected at least twice a year and the Acceptance Test be performed at that time to insure efficiency and continued patient safety.

Depending upon conditions in the hospital environment, it may be necessary to occasionally clean the interior of the unit using dry, pressurized air. Lint and dirt should not be allowed to build up on the high voltage terminals or on the cooling fan. The printed circuit boards should be examined for any sign of corrosion on the contact fingers and should be cleaned as necessary.

Any lowering of the generator's full output power may indicate one or more power transistors and/or fuses defective. Because of the redundant circuitry, the generator may continue to function almost normally with one or more power transistors out.

CAUTION: When replacing the generator cover, DO NOT use screws longer than 8/32" x 3/8" to mount feet or masterboard traces may short to ground.



PARTS LIST			PART NUMBER
R1-R8	250 OHM 50W	DALE RH-50 1%	234-003-003
M1	500 MA RF RMS	SIMPSON MOD 1339	218-001-000
SW-1	SPDT TOGGLE	ALCO MST-105D	243-001-000

FIGURE 7 WATTMETER CONSTRUCTION

SECTION 8

TROUBLE SHOOTING

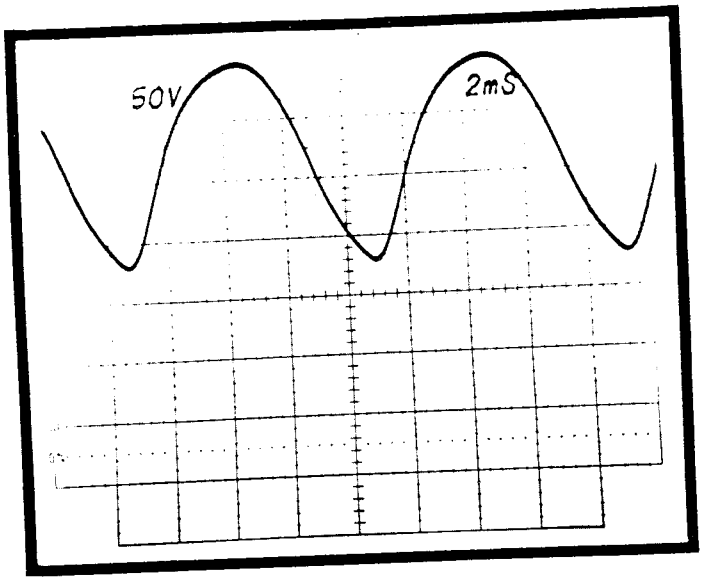
TROUBLE SYMPTOM	PROBABLE CAUSE	SOLUTION
A) Inoperative; ON/OFF Switch won't stay on or power up.	1) Excess current drain	1) Check for shorted CR1 (Fig. (30). Check for +200 VDC shorted to ground.
	2) Defective circuit breaker	2) Replace defective S1 (Fig. 29).
	3) Faulty soft start	3) Check Thermo-fuse F1. Check K1.
B) No ON/OFF light.	1) Bulb burnt out	1) Remove plastic rocker arm and replace bulb.
C) No hand keying from front panel jack. Keys OK with footswitch.	1) Isobloc oscillator not running.	1) Check A6Q1 and A6T1.
D) One handswitch input inoperative.	1) Isobloc board	1) Check A6P1, A6P2, A6P3 and A6P4.
E) No CUT. COAG OK.	1) Relay	1) Check relays A1K1 and A1K2.
F) No COAG. CUT OK.	1) Relay	1) Check relays A1K1 and A1K2
	2) Multiboard	2) Check A3U1, A3Q5 and A3Q7.
G) No BLEND. CUT and COAG OK.	1) PURE/BLEND switch	1) Check S2 (Fig. 29).
H) Low Power	1) Cooler assembly	1) Check A7Q2 - A7Q8 for shorts. Fuses A7F1 A7F14 opened.

I)	No output in any mode. Relays OK.	1) Multiboard	1) Check output at J2 Check signal at A3(A3Q2, A3Q3. Check +20V at J2 - P.
		2) Driver circuit	2) Check A7Q1, A4F1 A4R7.
J)	No CUT, COAG Audio when keyed.	1) Audio Oscillator	1) Check A2U9, A2Q5 A2LS1.
K)	No MONOPOLAR output. BIPOLAR OK.	1) Output board	1) Check A5K1 and A
L)	No BIPOLAR output. MONOPOLAR OK.	1) Output board	1) Check A5K1 and A
M)	Excess RF leakage current.	1) Output board	1) Check A5C1, C2, L L2, R1 and R2 for shorts.
		2) Isobloc board	2) Check A6T1 for sh
		3) Wiring short	3) Active or Patient wire shorted to chassis.
N)	Excess 50 Hz leakage.	1) Defective power transformer	1) Replace T1 (Fig. 3(
		2) Wiring fault	2) Check for broken ground wire.

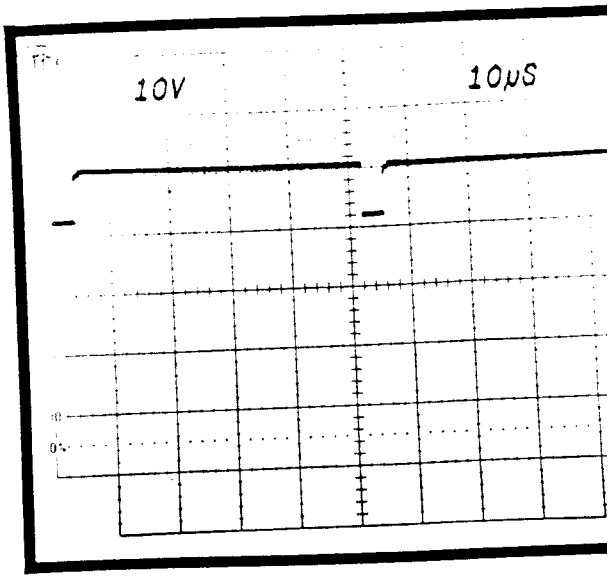
REM SYSTEM TROUBLESHOOTING

SYMPTOM LIST	PROBABLE CAUSE	CHECK SOLUTION
1. No RF output from SSE2-L.	REM BOARD	Ground inhibit (J1 · If the generator st won't key, the RE/ at fault. If generc does key, then che U3C, and D. J1 connections, VF (+12V +6V)

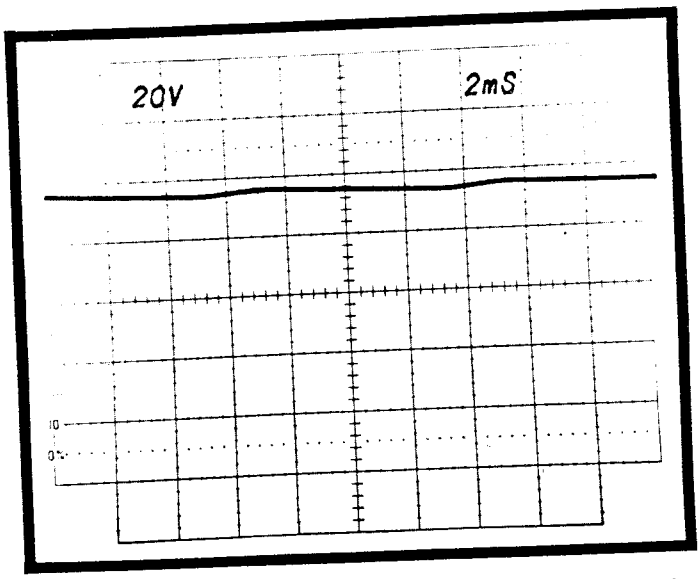
2.	No REM Audio or Visual alarm, but power output is inhibited.	REM BOARD	Check J1 connections VR1 U2A (+12V, +6V) U5C, U5D, R16, U1. T1 check R34,C26 for visual alarm.
3.	Generator doesn't inhibit on open circuit when improper impedance is across patient connector	REM BOARD	Check U4A, T2,L1 (tuning), U4B, U6, voltage at TP1-TP2.
4.	High Z trip level	REM BOARD	Check R20, and follow incorre check solution for symptom 3.
5.	Low Z trip level is incorrect	REM BOARD	Check U2B, R15 and follow check solution for symptom 3.
6.	Threshold shift when generator is keyed	REM BOARD	Check the shield can ground. U4, pin 1 output frequency U5A and B rise time 20 n sec.
7.	Low Hysteresis	REM BOARD	Check oscillation on supplies and noise on TP1 10 mV.
8.	Cohesive patient electrode connector does not activate cohesive REM mode or normal patient electrode connector does not activate normal (low impedance) REM mode.	REM BOARD	Check front panel switch and wiring, U3A and U3A on REM PCB.



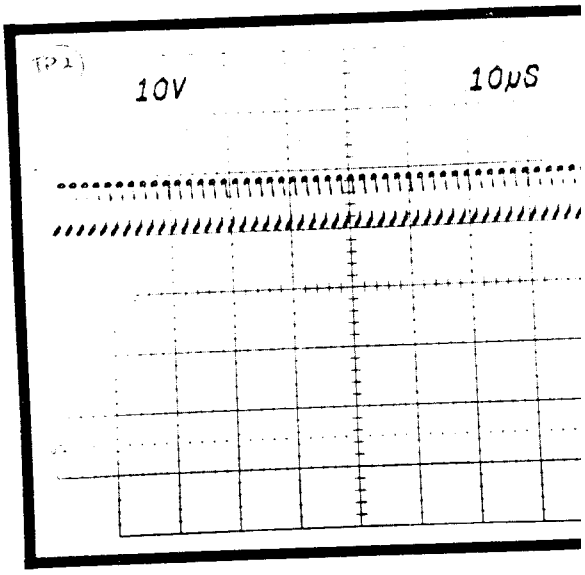
+200 V SUPPLY A3C4 CUT MODE, FULL OUTPUT



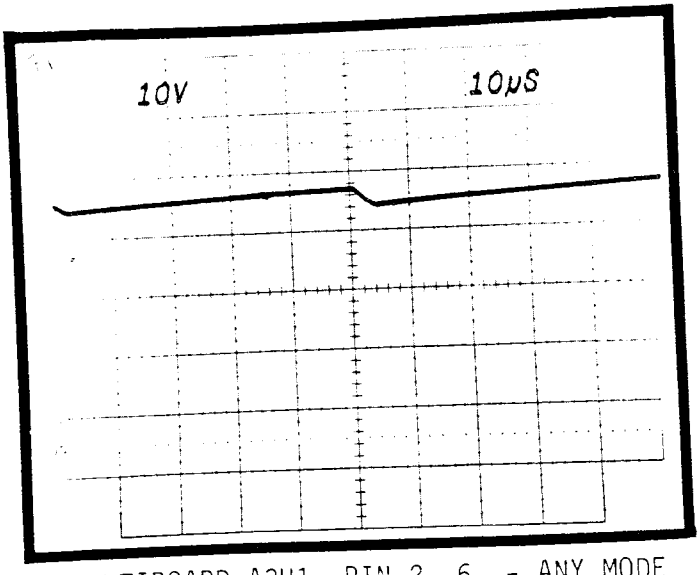
MULTIBOARD A3U1, PIN 3 - ANY MODE



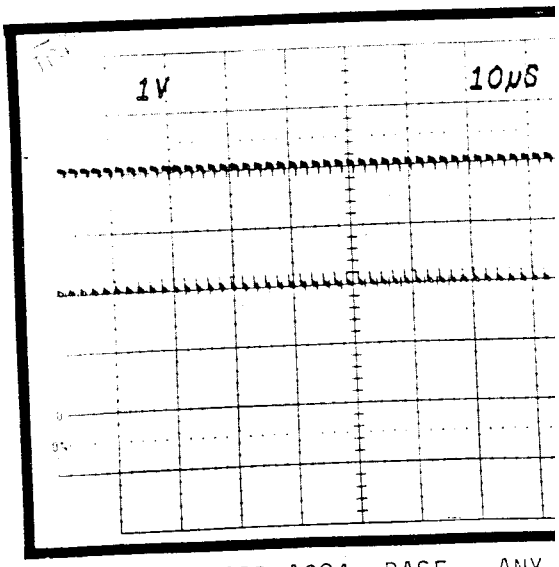
+35 V SUPPLY A3C1 CUT MODE, FULL OUTPUT



MULTIBOARD A3Q2, COLLECTOR - AN

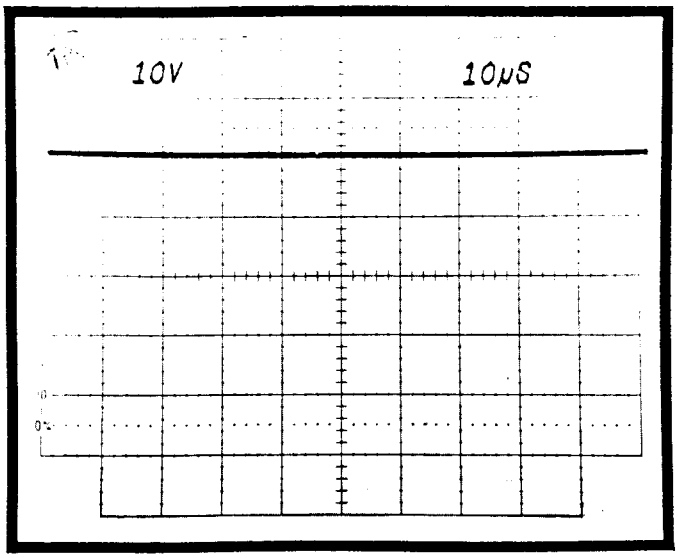


MULTIBOARD A3U1, PIN 2, 6 - ANY MODE

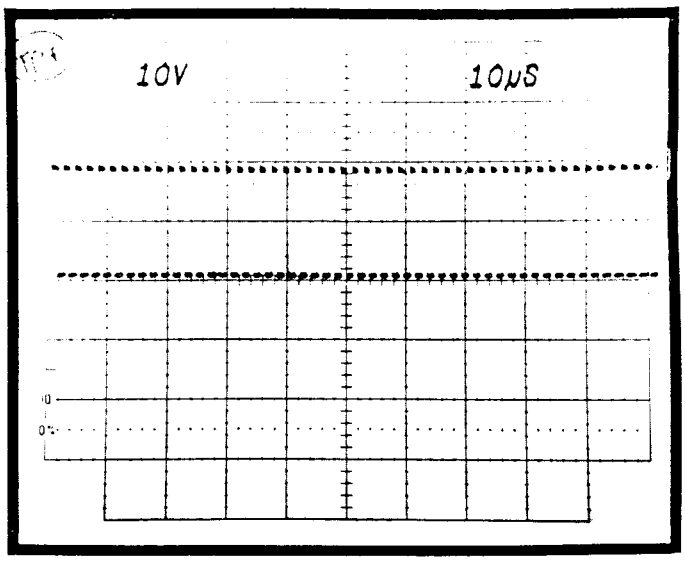


MULTIBOARD A3Q4, BASE - ANY

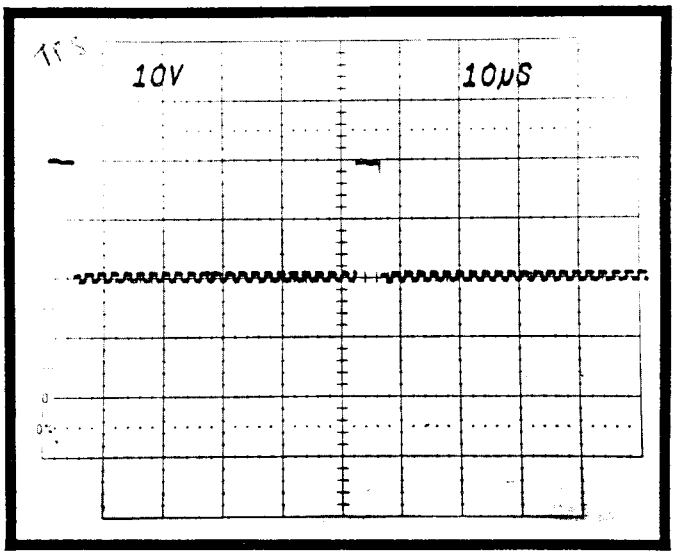
FIGURE 8 SSE2-L WAVEFORM CHART



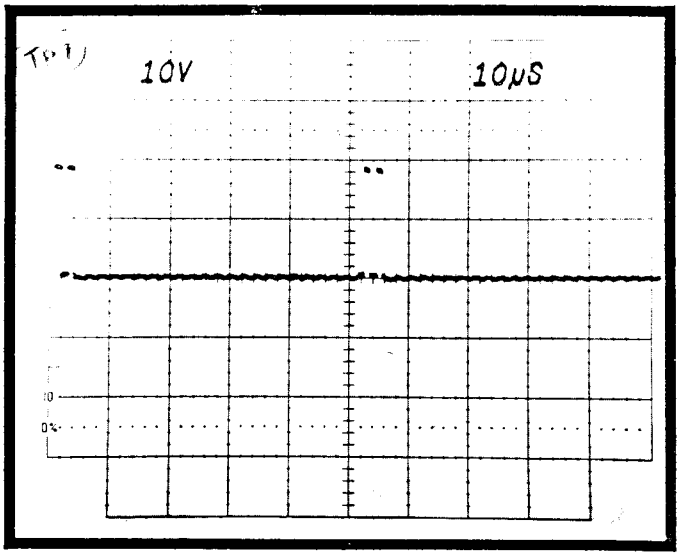
MULTIBOARD A3Q7, COLLECTOR - CUT MODE



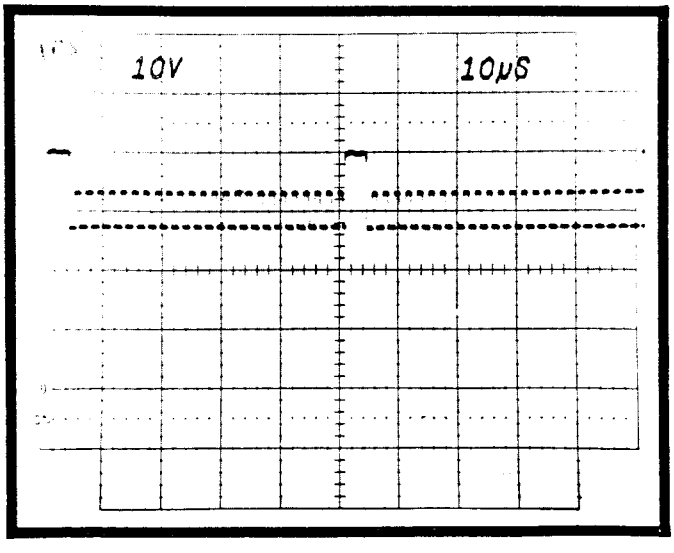
MULTIBOARD P3-F - CUT MODE



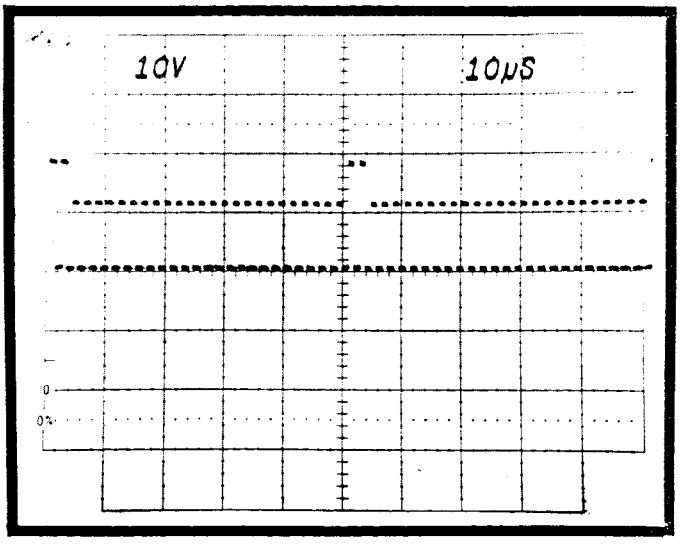
MULTIBOARD A3Q7, COLLECTOR - COAG MODE



MULTIBOARD P3-D - COAG MODE

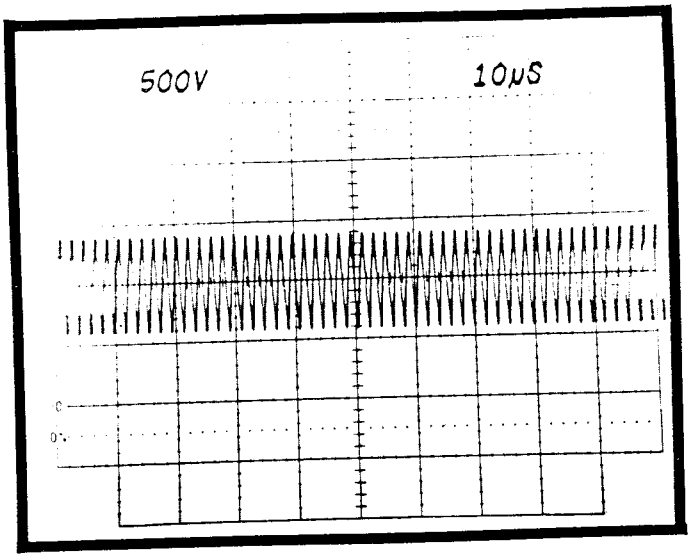


MULTIBOARD A3Q7, COLLECTOR - BLEND MODE

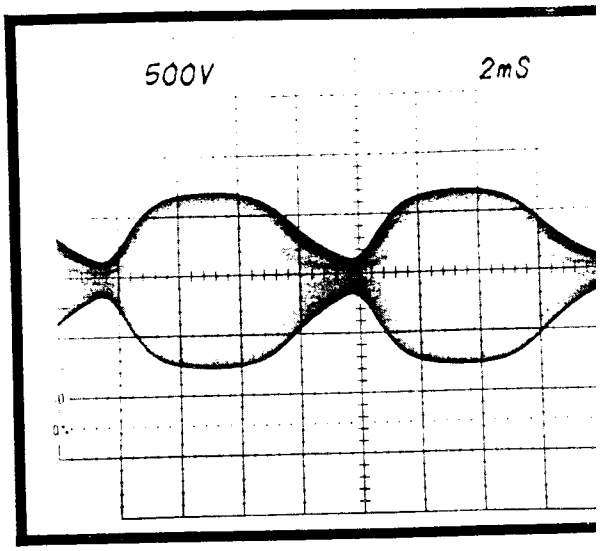


MULTIBOARD P3-F - BLEND MODE

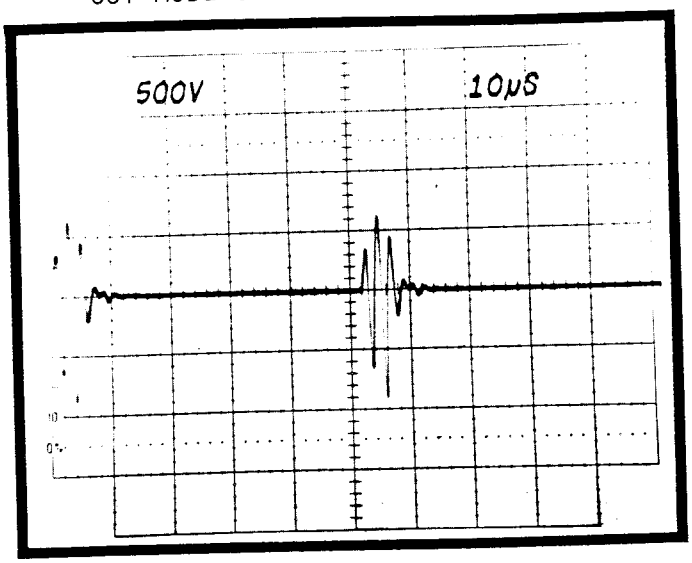
FIGURE 8 CONTINUED



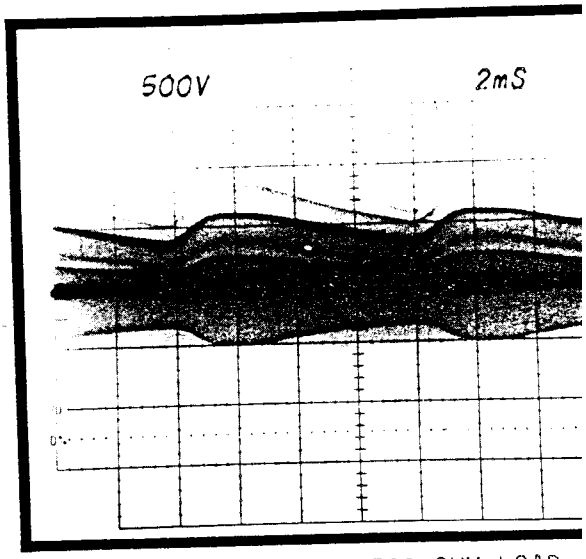
MONOPOLAR OUTPUT 500 OHM LOAD
CUT MODE CONTROL SETTING "5"



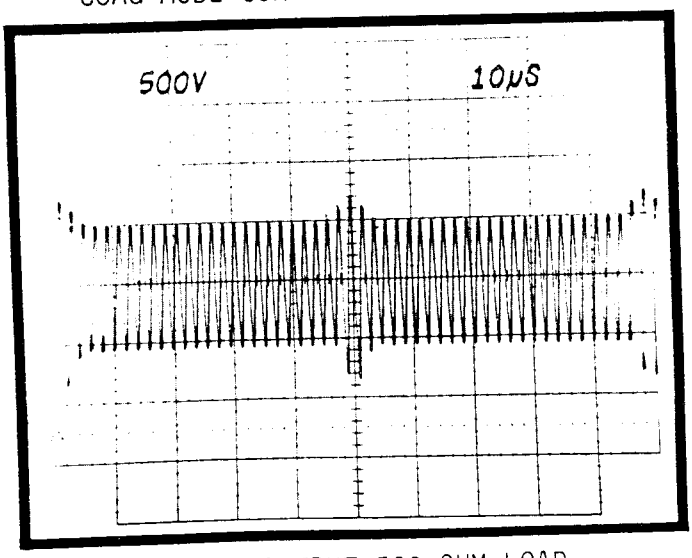
MONOPOLAR OUTPUT 500 OHM LOAD
CUT MODE CONTROL SETTING "10"



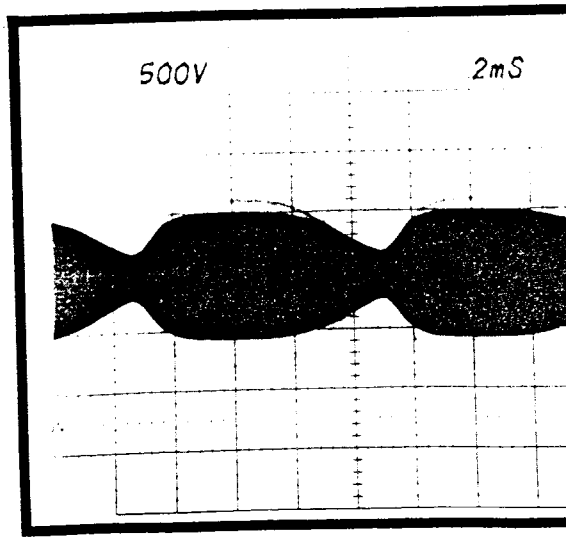
MONOPOLAR OUTPUT 500 OHM LOAD
COAG MODE CONTROL SETTING "5"



MONOPOLAR OUTPUT 500 OHM LOAD
COAG MODE CONTROL SETTING "10"



MONOPOLAR OUTPUT 500 OHM LOAD
BLEND MODE CONTROL SETTING "5"



MONOPOLAR OUTPUT 500 OHM LOAD
BLEND MODE CONTROL SETTING "1

FIGURE 8 CONTINUED

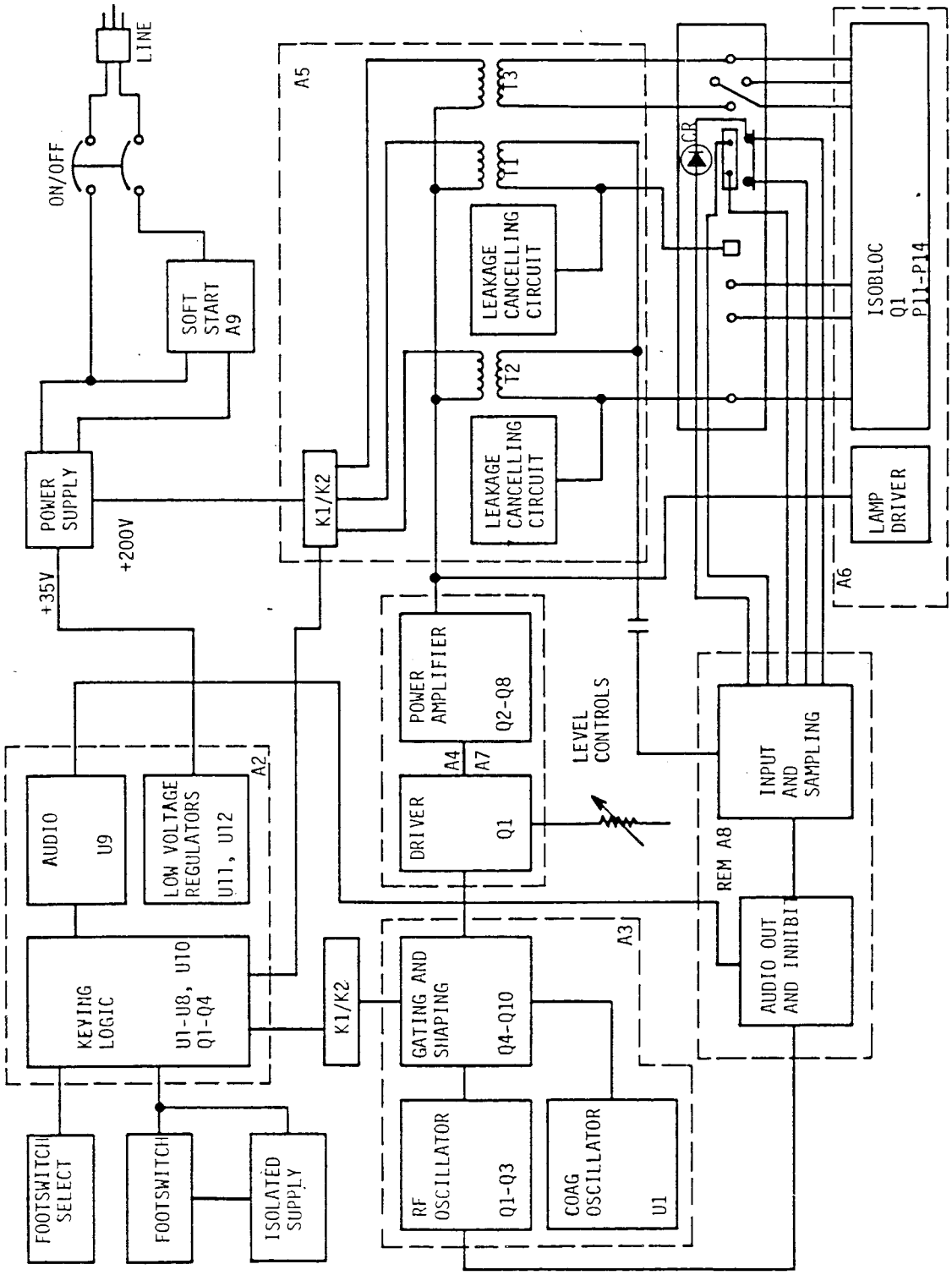


FIGURE 9 SSE2-L BLOCK DIAGRAM

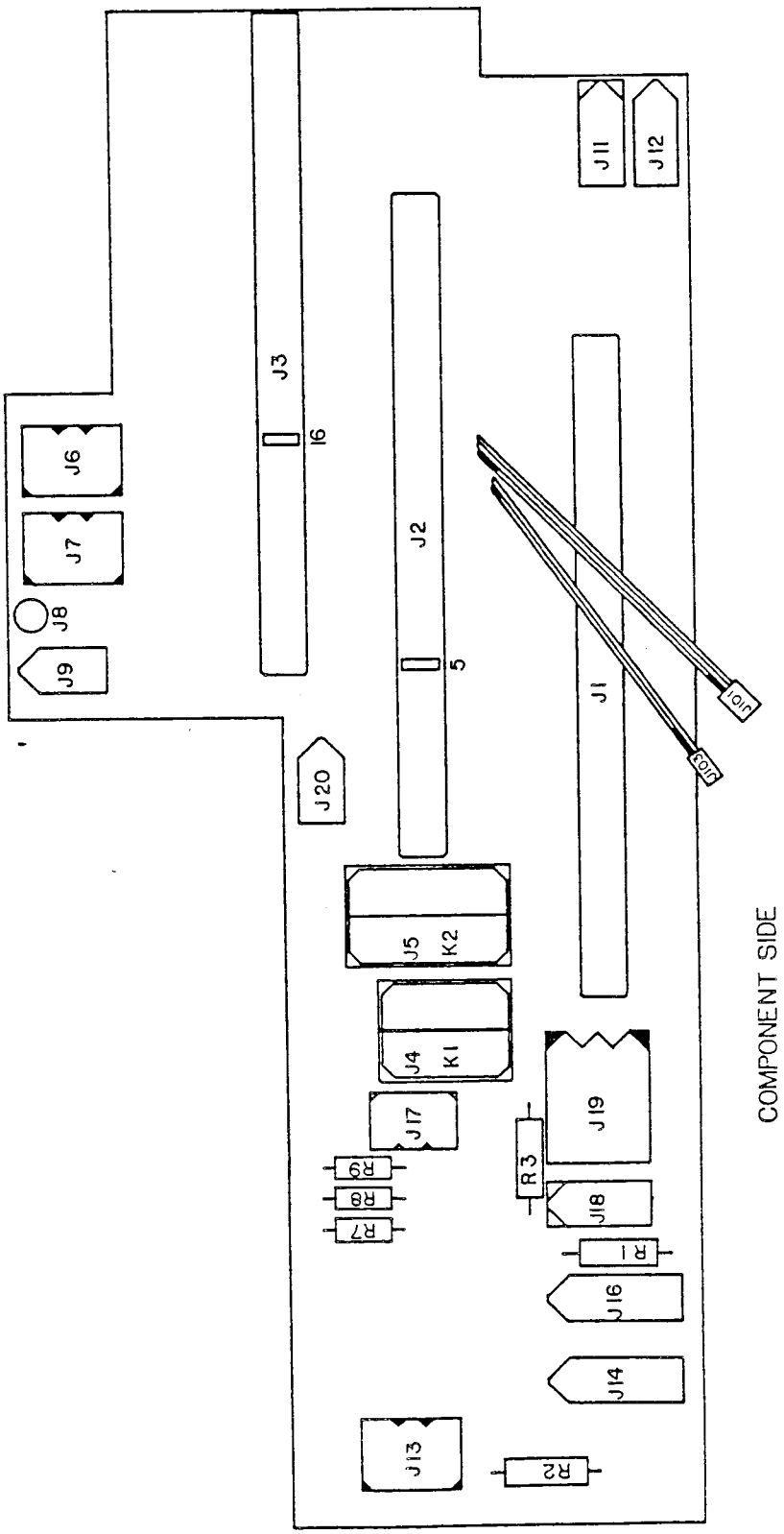


FIGURE 10 MASTER BOARD (A1)

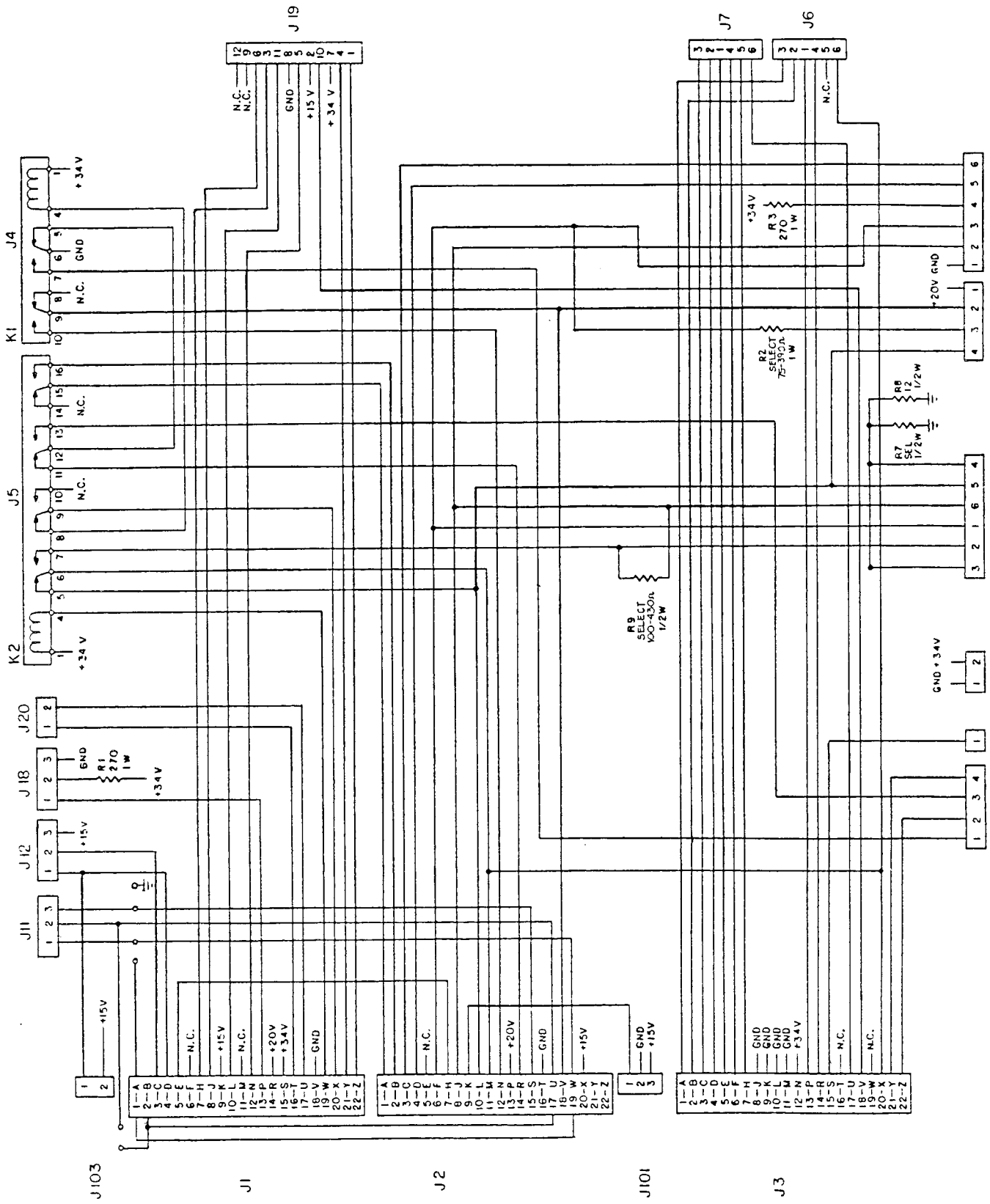


FIGURE 11 MASTERBOARD SCHEMATIC (A1)

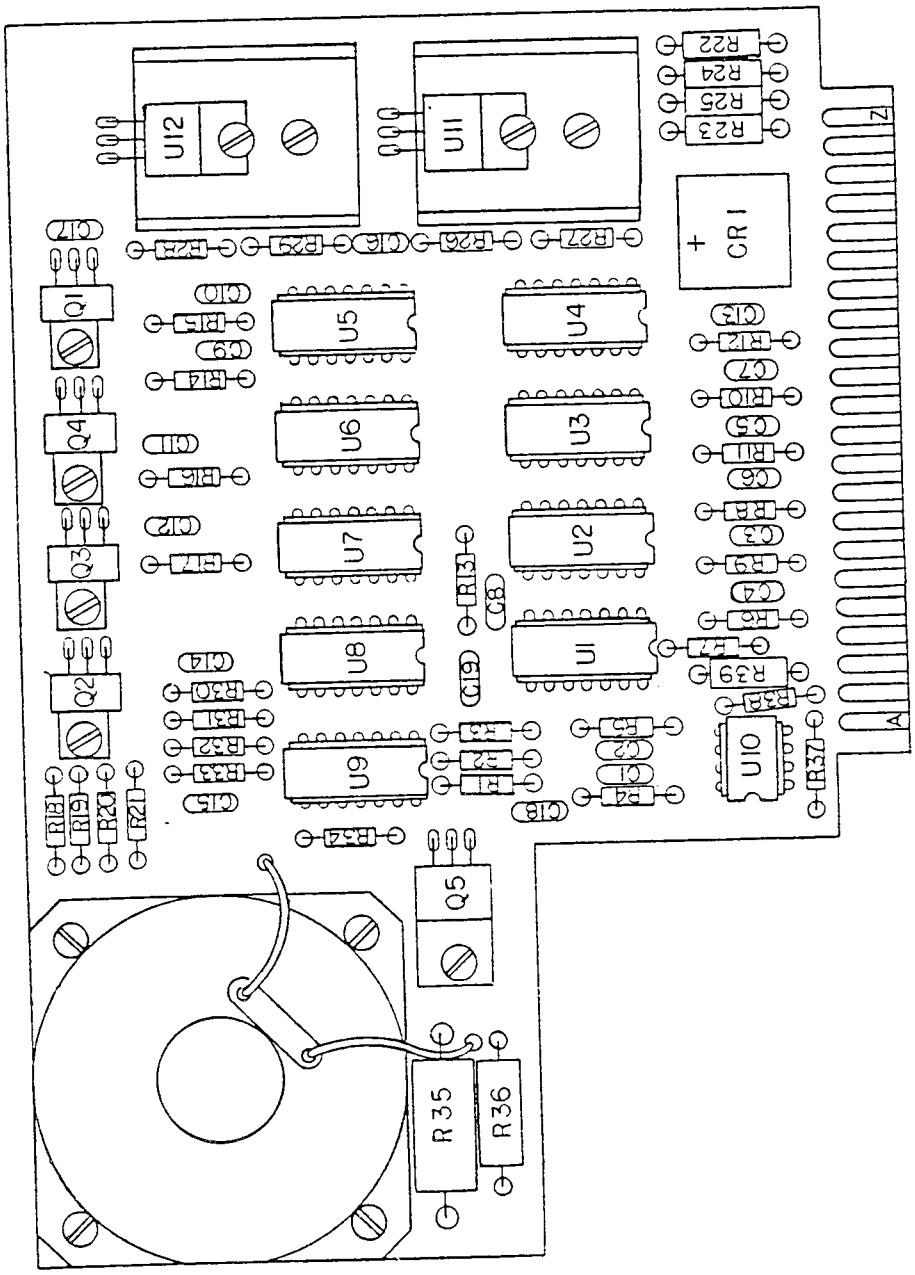


FIGURE 12 LOGIC BOARD (A2)

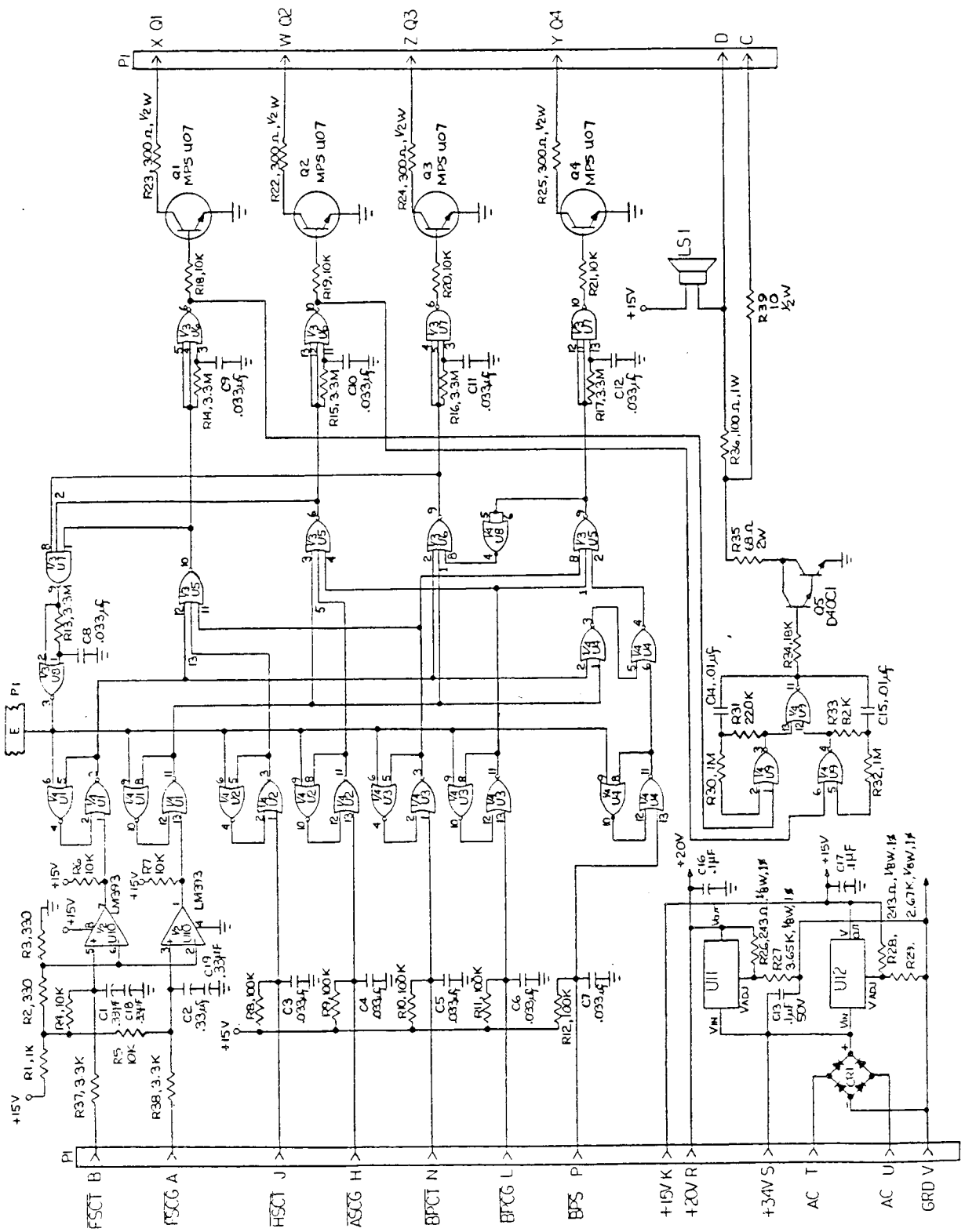


FIGURE 13 LOGIC BOARD SCHEMATIC (A2)

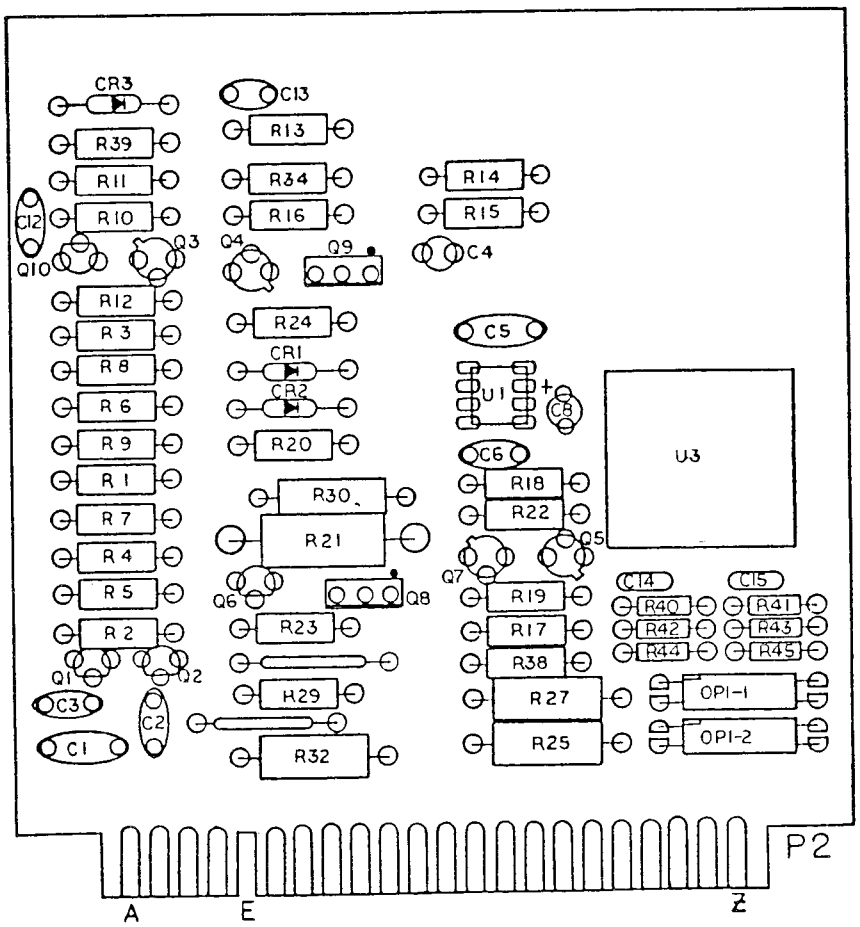


FIGURE 14 MULTIVIBRATOR BOARD (A3)

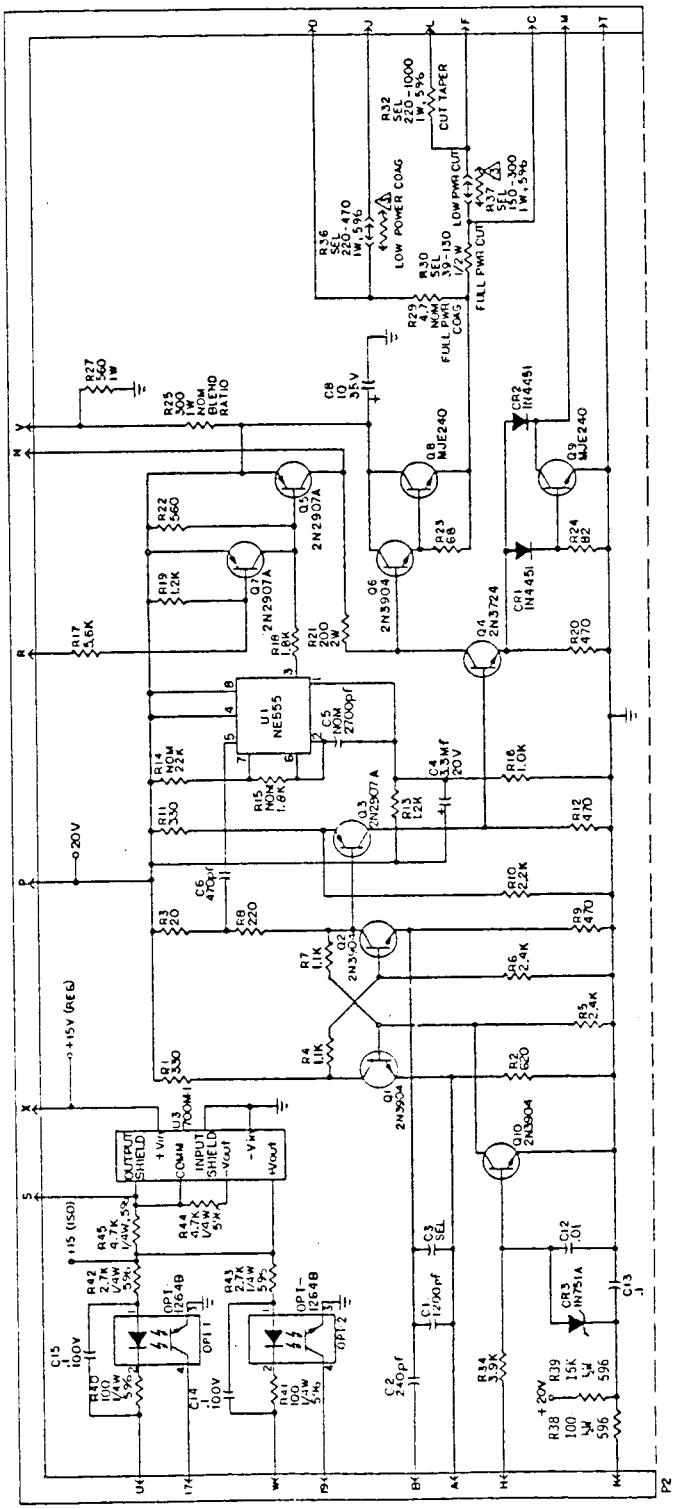


FIGURE 15 MULTIVIBRATOR BOARD SCHEMATIC (A3)

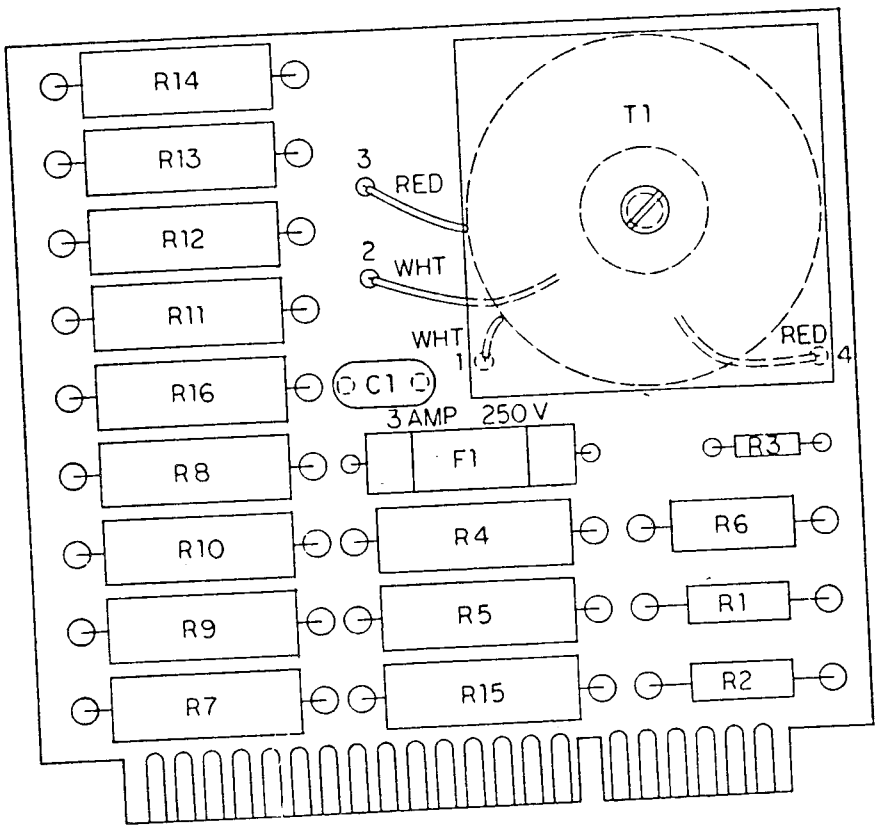


FIGURE 16 LIMIT RESISTOR BOARD (A4)

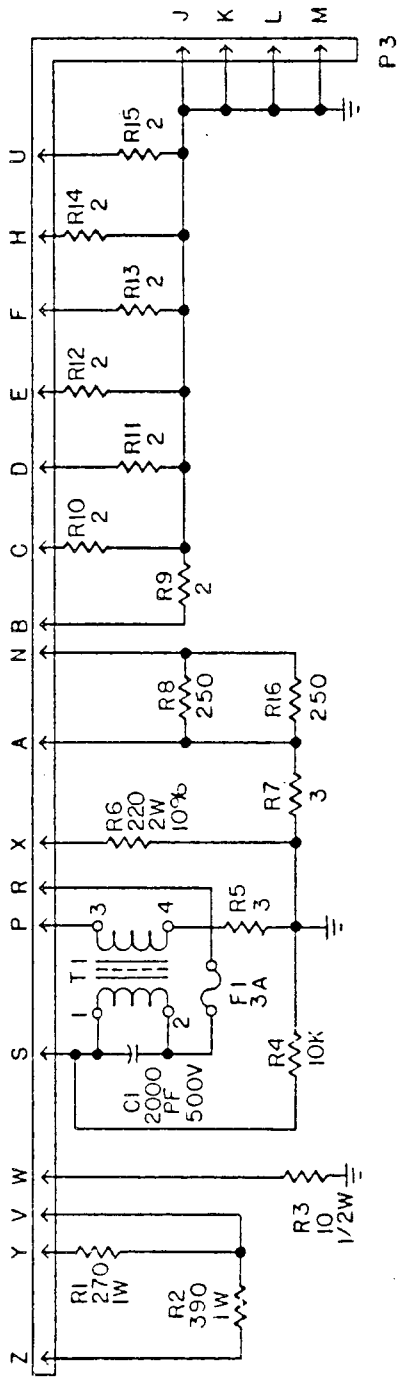


FIGURE 17 LIMIT RESISTOR BOARD SCHEMATIC (A4)

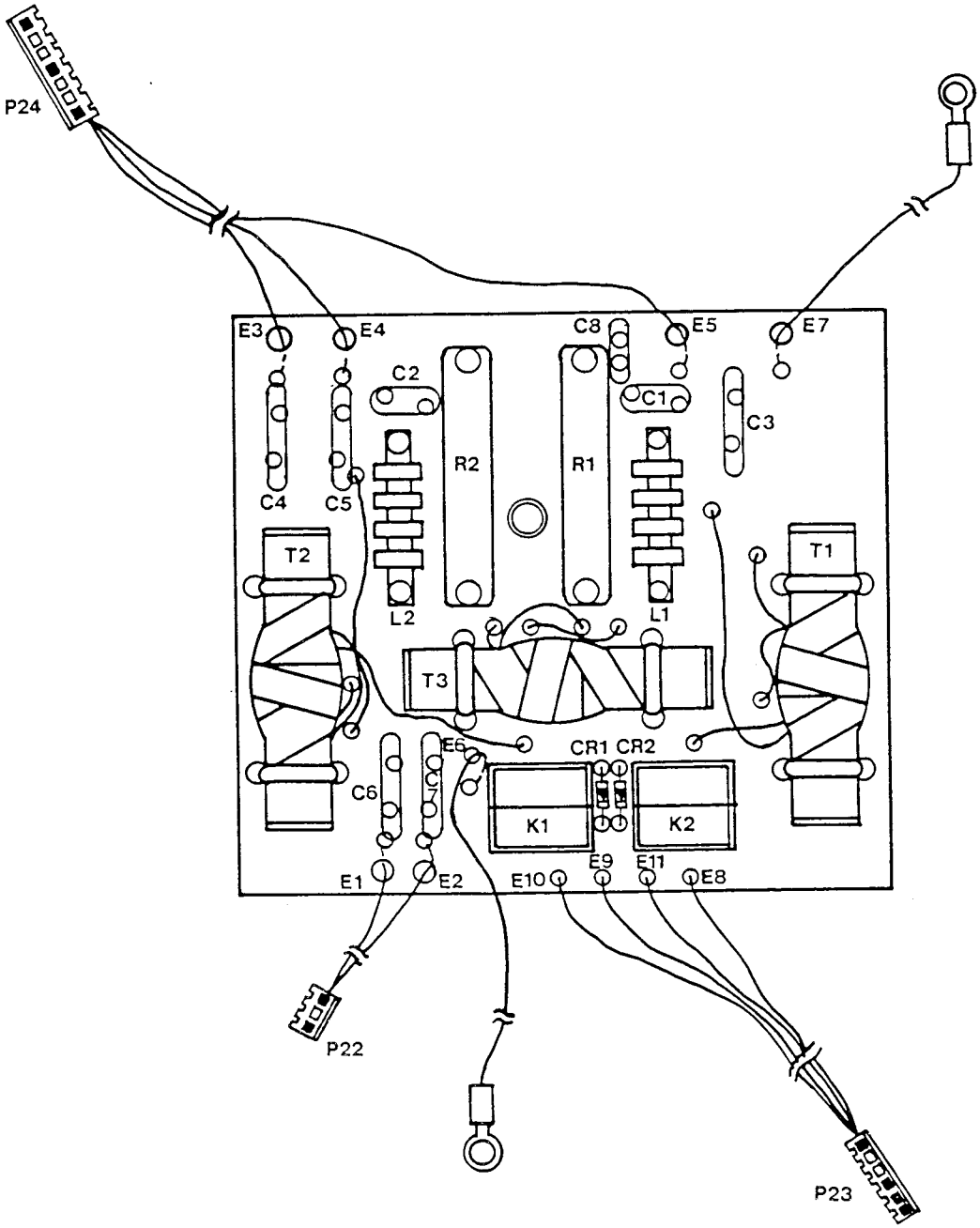


FIGURE 18 OUTPUT BOARD (A5)

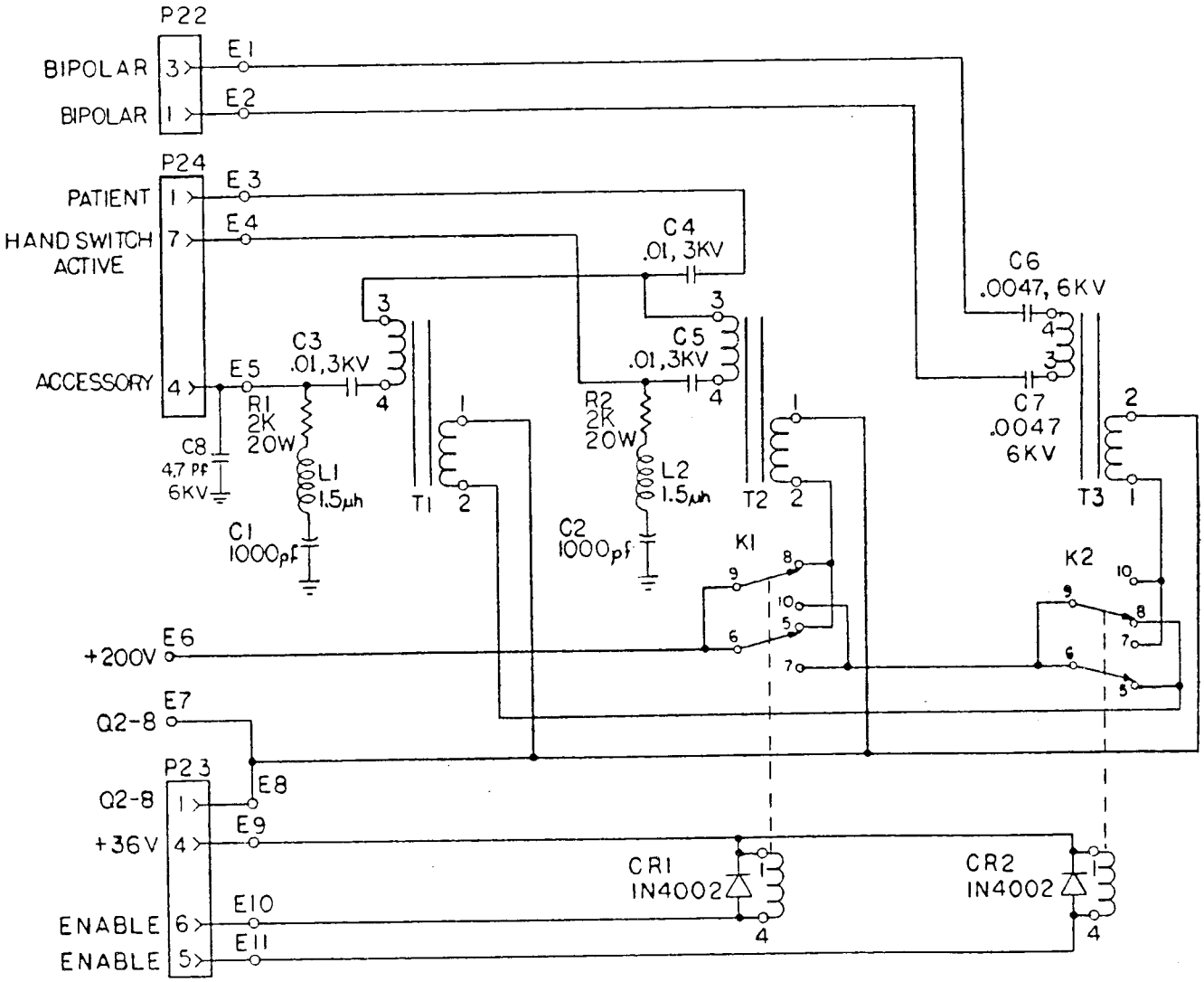


FIGURE 19 OUTPUT BOARD SCHEMATIC (A5)

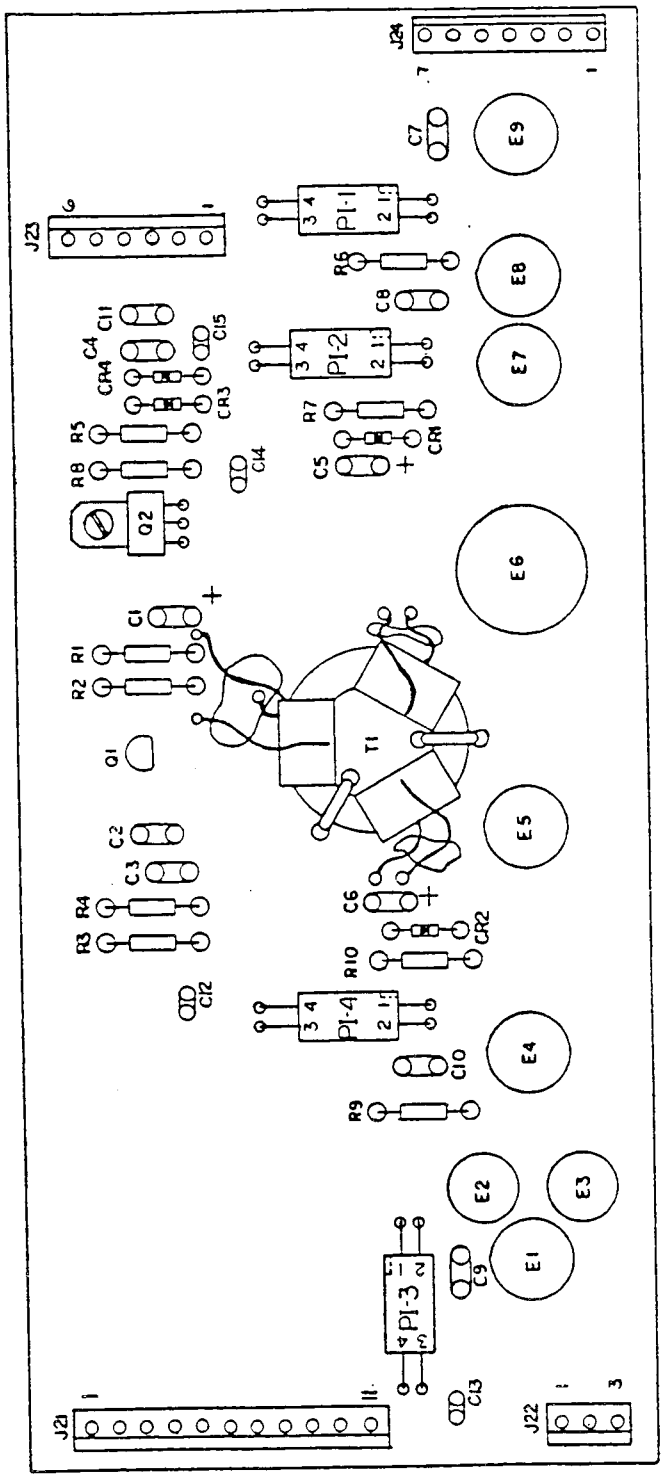
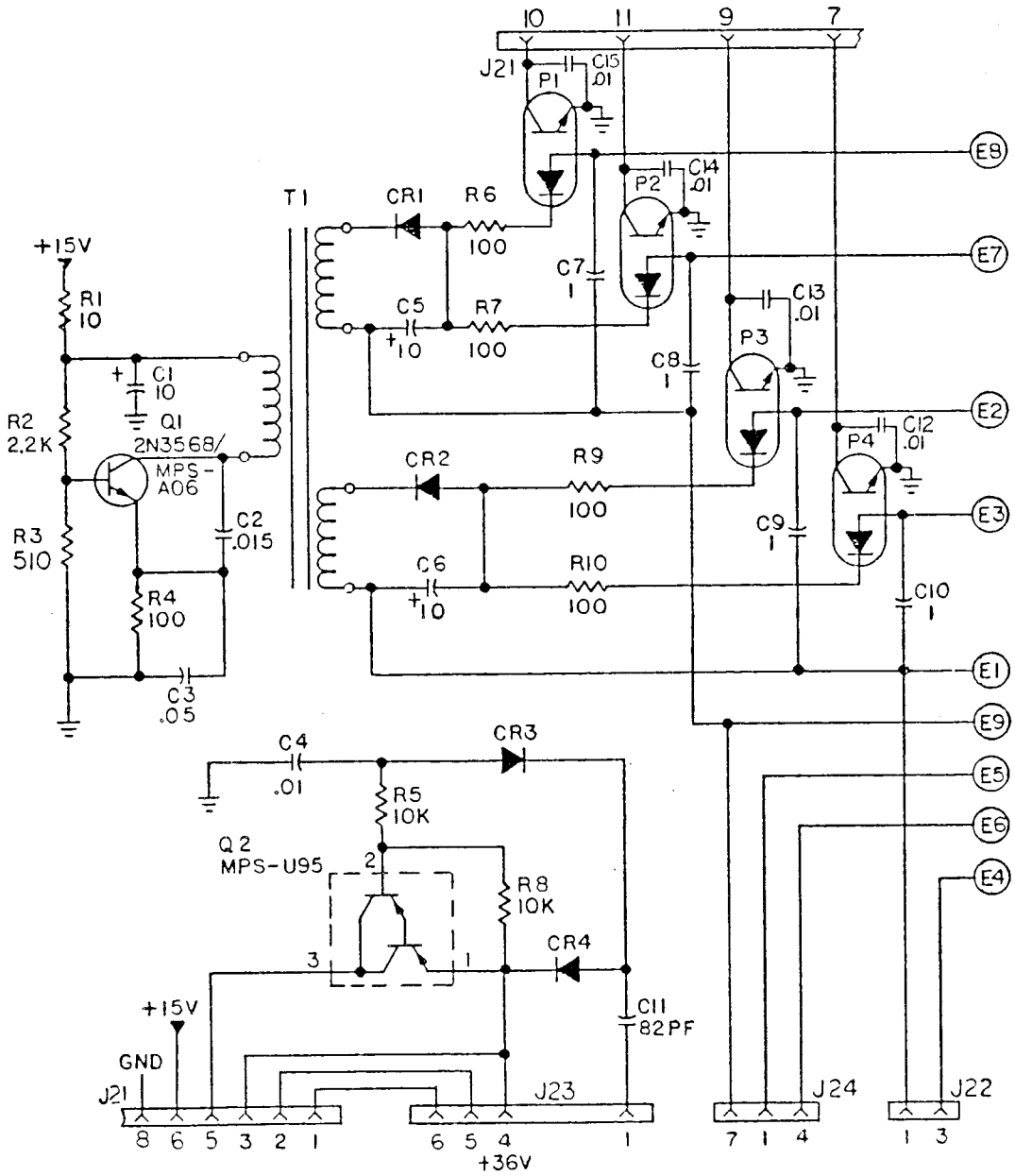


FIGURE 20 ISOBLOC BOARD (A6)



4 ALL PHOTOISOLATORS ARE OPI-1264B
3. ALL DIODES ARE IN4148
2. ALL CAPACITORS ARE IN MICROFARADS
1. ALL RESISTORS ARE IN OHMS, 1/4W, 5%
NOTES-UNLESS OTHERWISE NOTED:

FIGURE 21 ISOBLOC BOARD SCHEMATIC (A6)

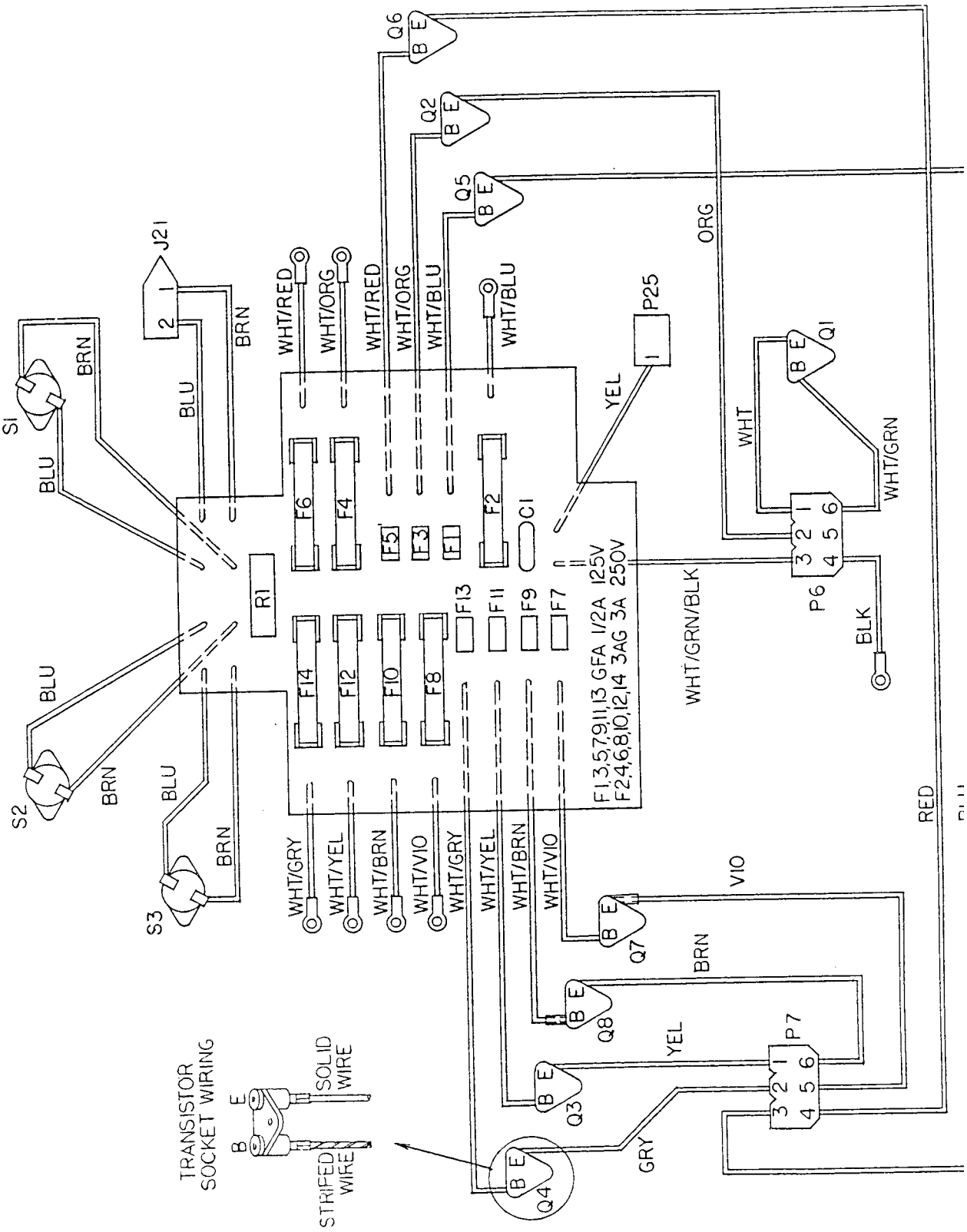


FIGURE 22 FUSE BOARD (A7)

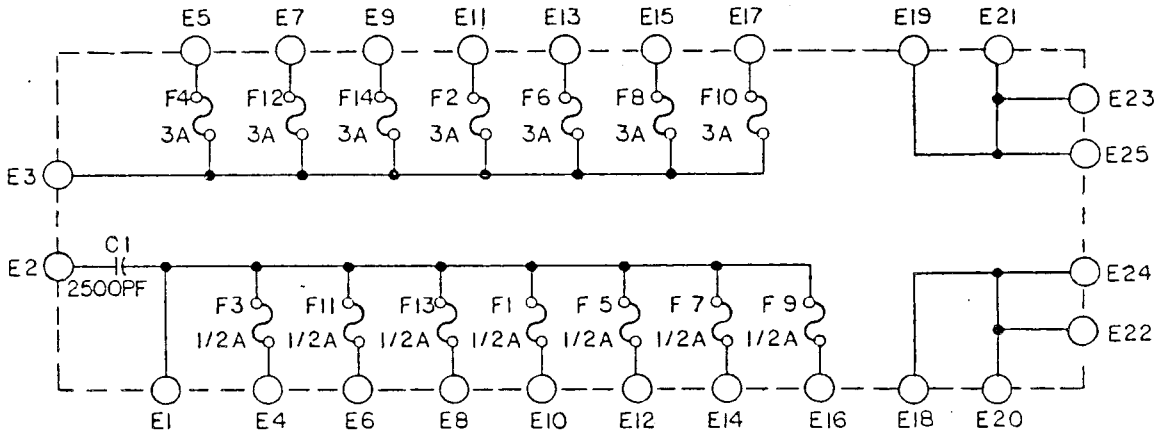


FIGURE 23 FUSE BOARD SCHEMATIC (A7)

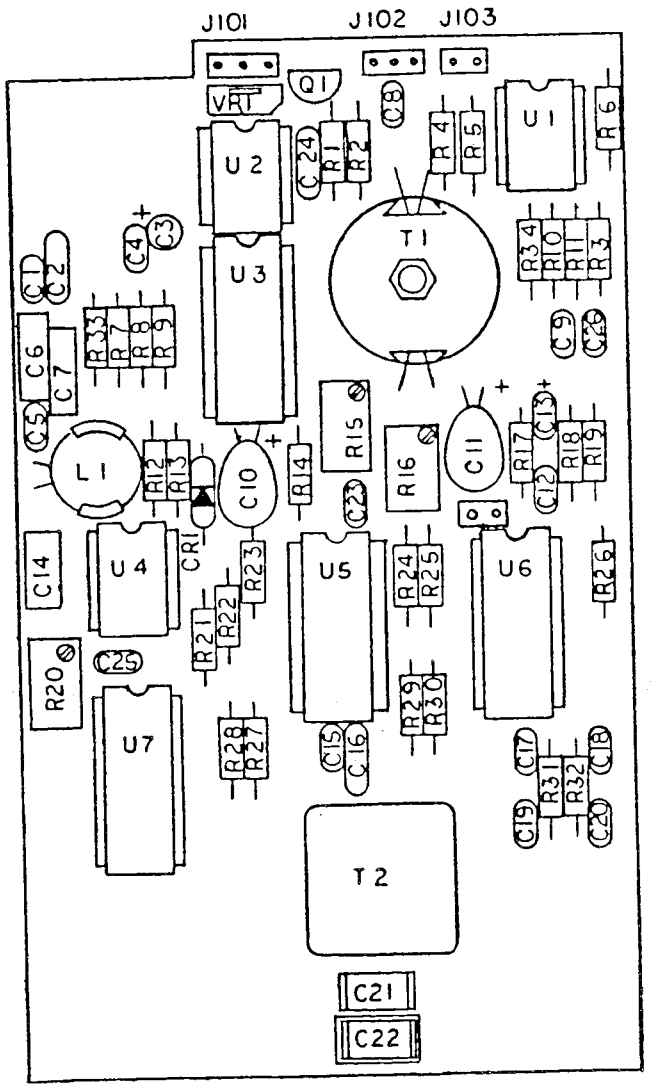


FIGURE 24 REM BOARD (A8)

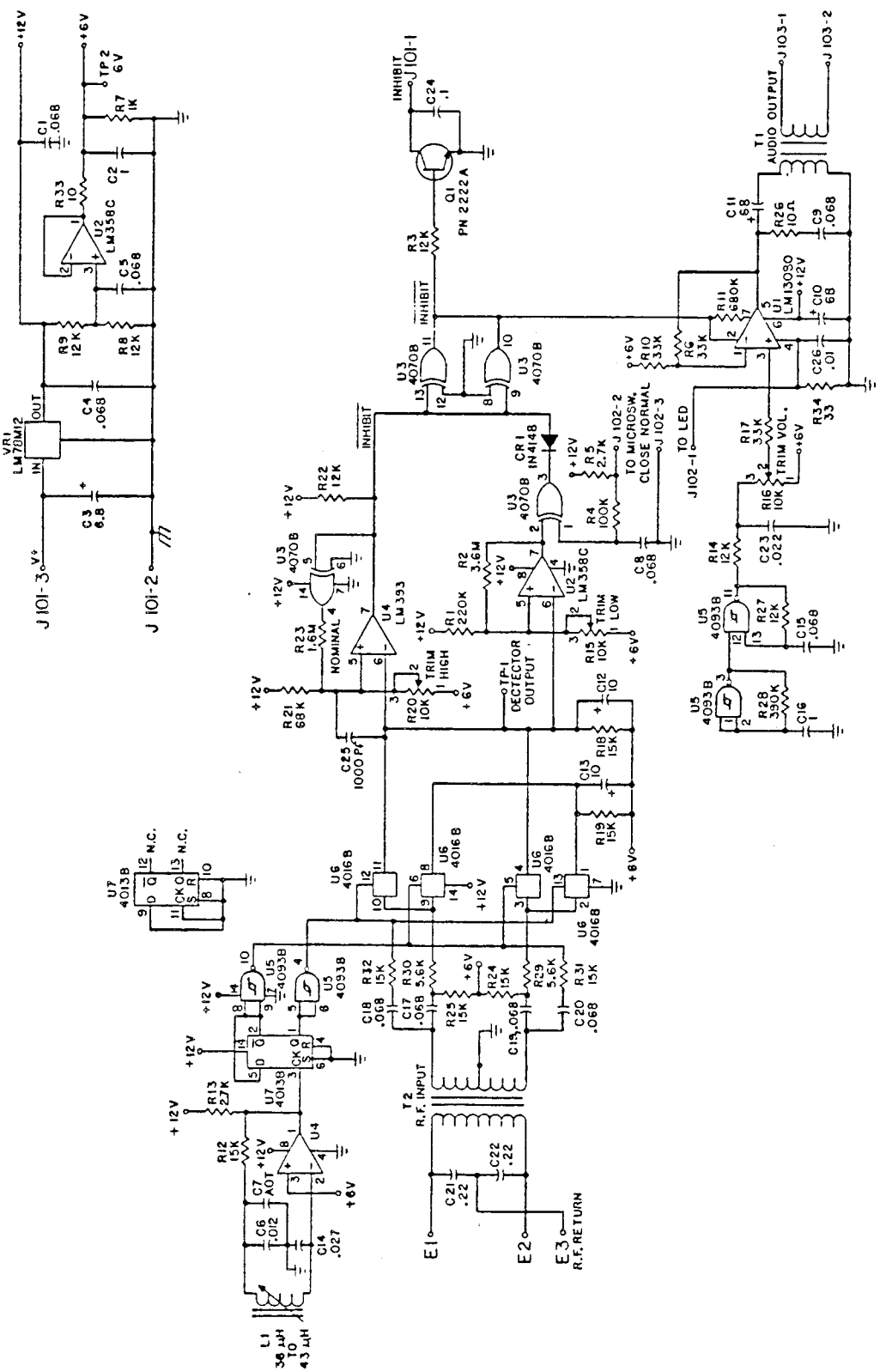


FIGURE 25 REM SCHEMATIC (A8)

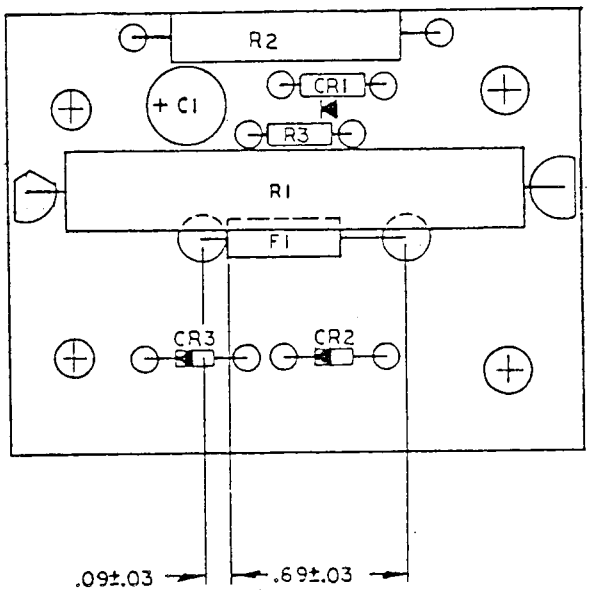


FIGURE 26 SOFT START ASSY (A9)

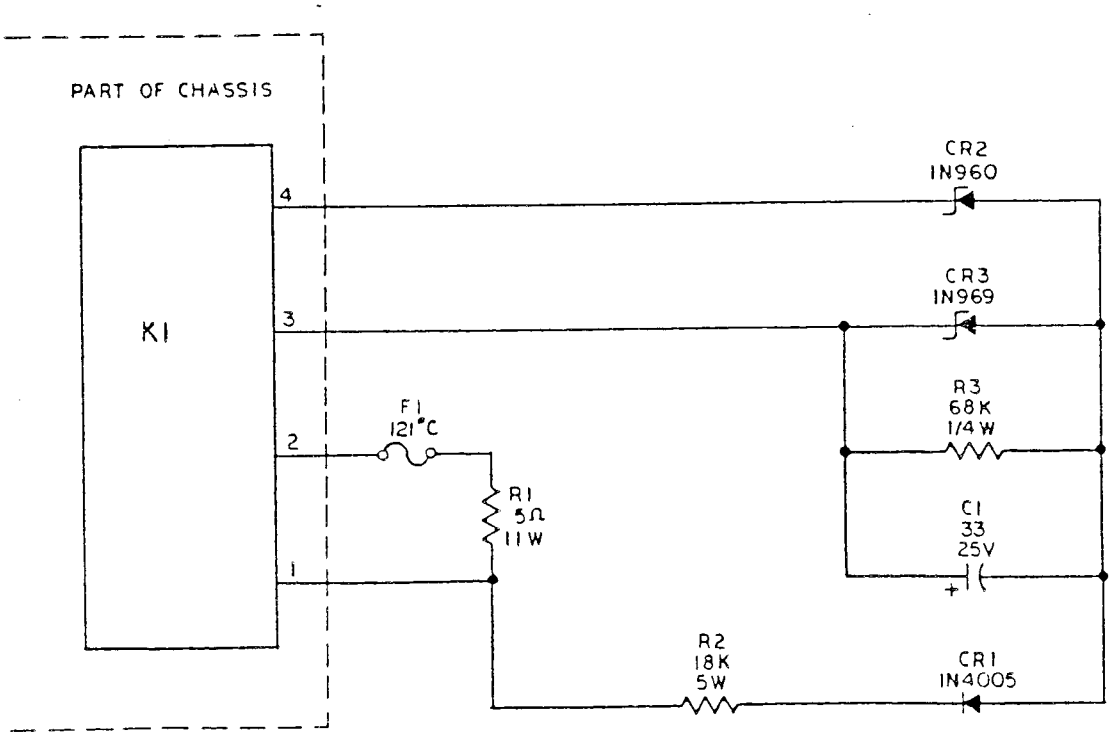


FIGURE 27 SOFT START SCHEMATIC (A9)

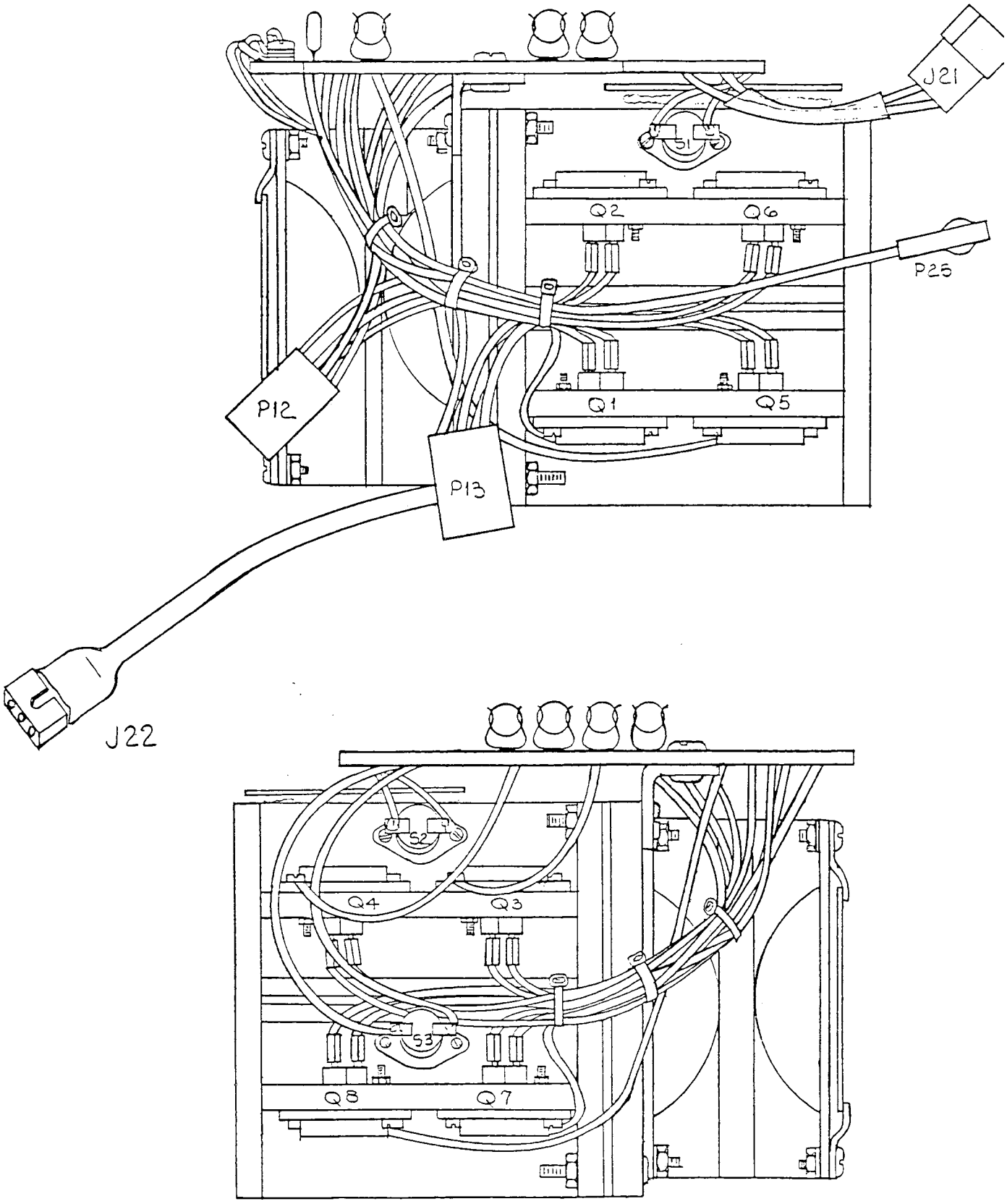
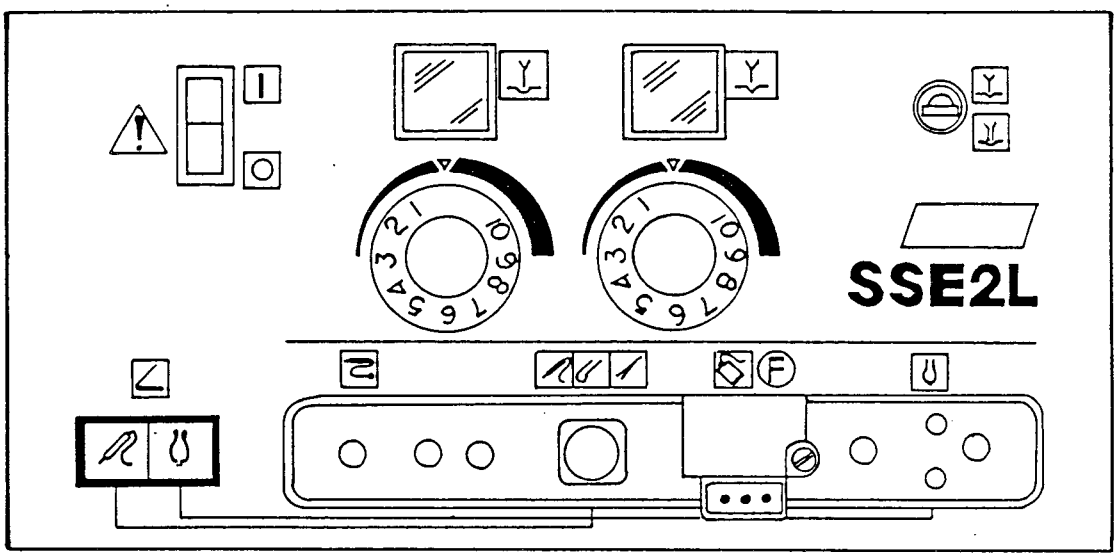


FIGURE 28 COOLER ASSEMBLY



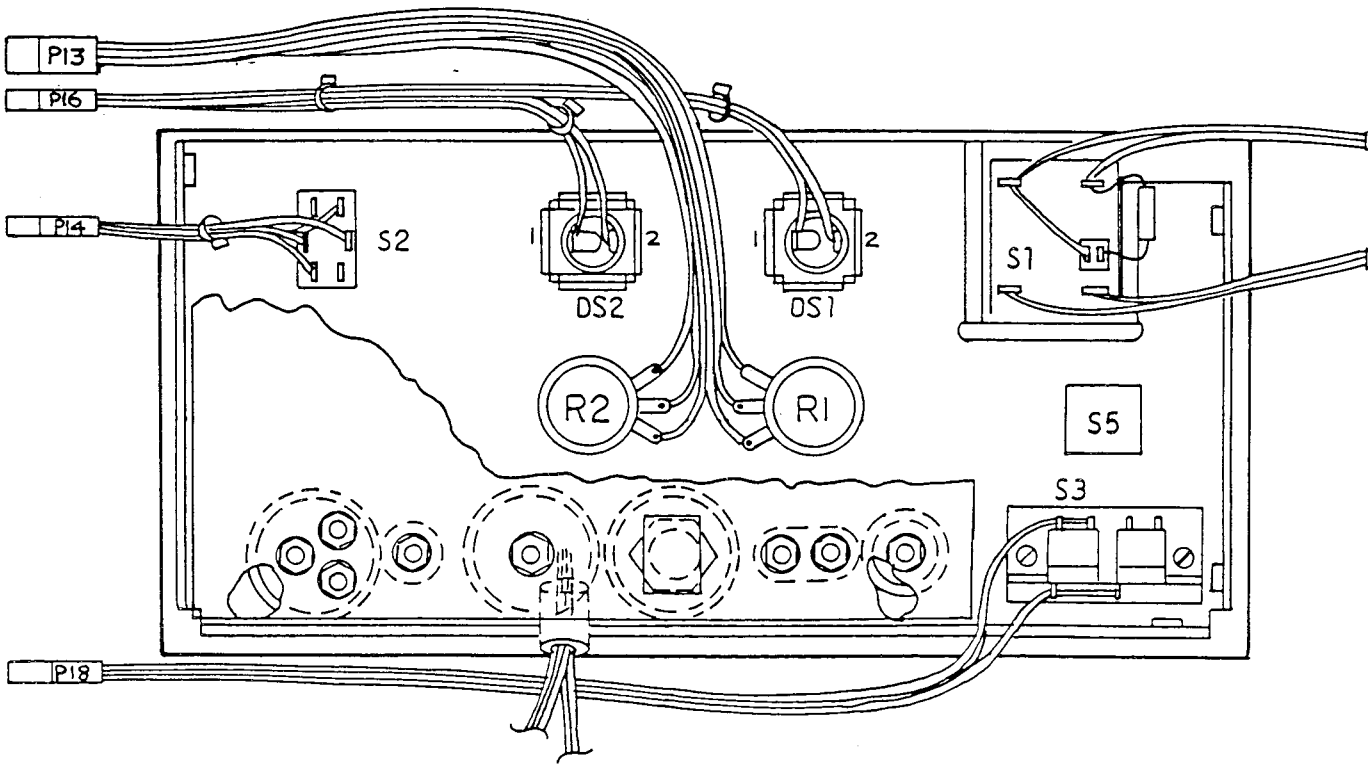


FIGURE 29 FRONT PANEL ASSEMBLY

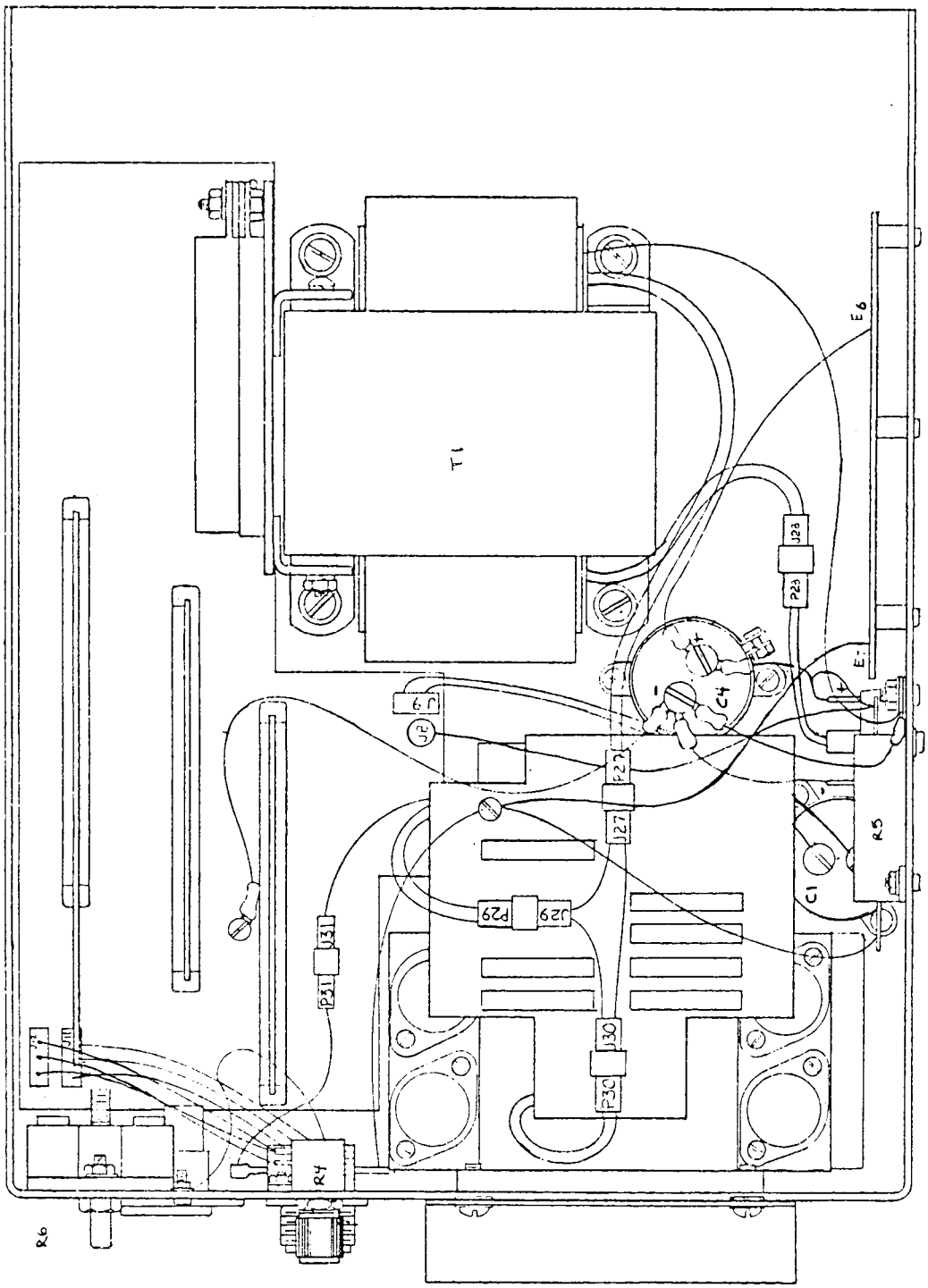
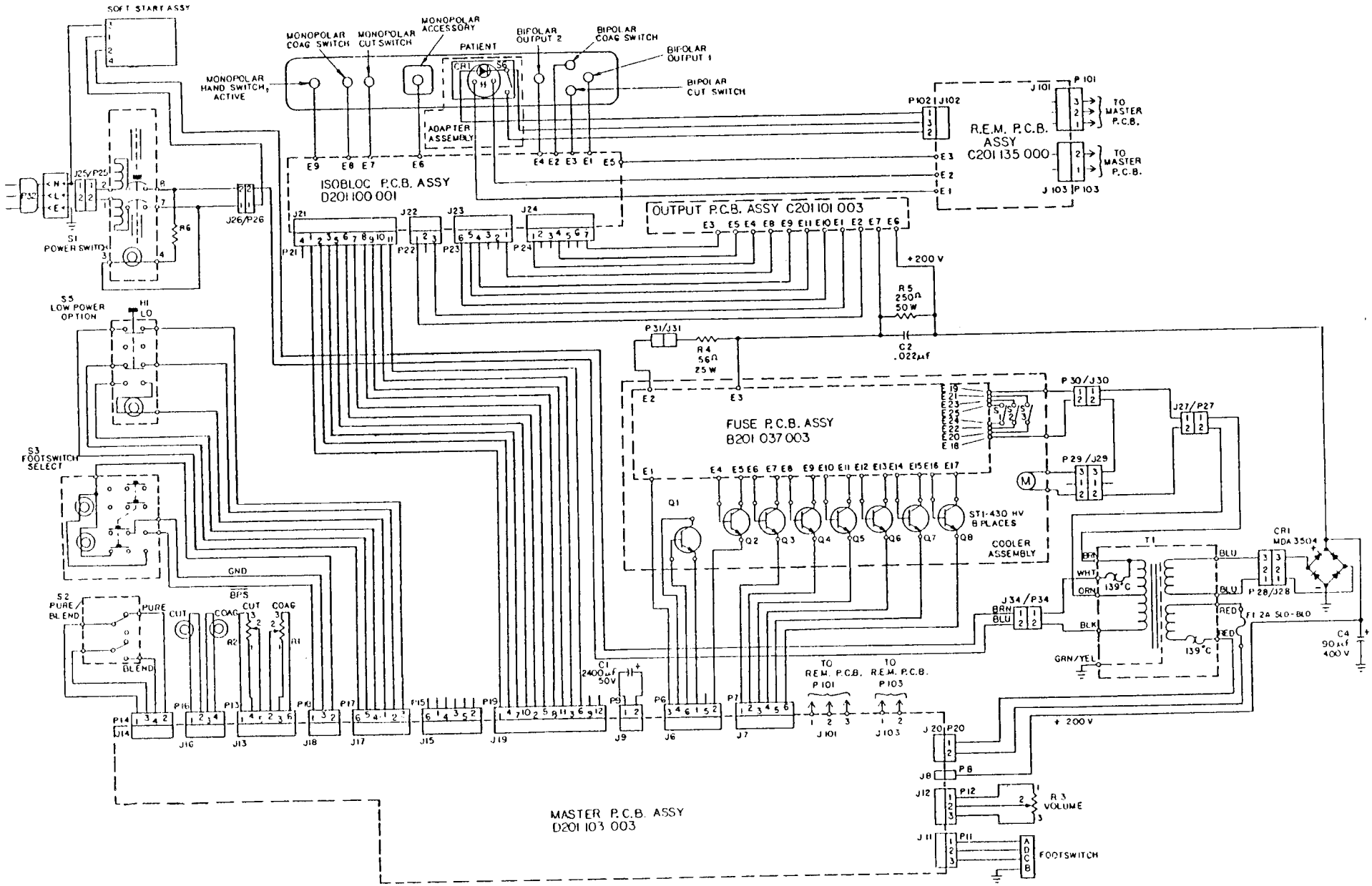


FIGURE 30 CHASSIS ASSEMBLY


SOFT START ASSY
MONOPOLAR COAG SWITCH
MONOPOLAR CUT SWITCH
MONOPOLAR ACCESSORY
PATIENT
BIPOLAR OUTPUT 2
BIPOLAR COAG SWITCH
BIPOLAR OUTPUT 1
BIPOLAR CUT SWITCH
MONOPOLAR HAND SWITCH, ACTIVE
ADAPTER ASSEMBLY
ISOBLOC P.C.B. ASSY D201100001
R.E.M. P.C.B. ASSY C201135000
TO MASTER P.C.B.
OUTPUT P.C.B. ASSY C201101003
+200 V
R5 250Ω 50W
C2 .022μf
R4 56Ω 25W
S1 POWER SWITCH
S5 LOW POWER OPTION
S3 FOOTSWITCH SELECT
S2 PURE/BLEND
FUSE P.C.B. ASSY B201037003
STI-430 HV 8 PLACES
COOLER ASSEMBLY
T1
CR1 MDA 3504
F1 2A SLO-BLO
C4 90μf 400 V
C1 2400μf 50V
R2
R1
R3 VOLUME
FOOTSWITCH
MASTER P.C.B. ASSY D201103003

SECTION 9

PARTS LIST

MASTER BOARD (A1) 201 103 003

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1, 3	RES. CARBON 270 ohm 5% 1W	234 022 049
R2	RES. CARBON SELECT 5% 1W	234 022 SELECT
R7	RES. CARBON SELECT 5% ½W	234 014 SELECT
R9	RES. CARBON SELECT 5% ½W	234 014 SELECT
R8	RES. CARBON 12 ohm 5% ½W	234 014 031

ASSY LOGIC BOARD (A2) 201 102 000

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1	RES. CARBON 1K ohm 5% ¼W	234 024 063
R2, R3	RES. CARBON 330 ohm 5% ¼W	234 024 051
R4,5,6,7,18,19,20,21	RES. CARBON 10K ohm 5% ¼W	234 624 087
R8,9,10,11,12	RES. CARBON 100K ohm 5% ¼W	234 624 111
R22,23,24,25	RES. CARBON 300 ohm 5% ½W	234 014 094
R26,R28	RES. FILM 243 ohm 1% 1/8W	234 201 230
R27	RES. FILM 3.65K ohm 1% 1/8W	234 201 343
R29	RES. FILM 2.67K ohm 1% 1/8W	234 201 330
R30,32, 13,14,15,16,17	RES. CARBON 1M ohm 5% ¼W	234 624 135
R31	RES. CARBON 220K ohm 5% ¼W	234 624 119
R33	RES. CARBON 82K ohm 5% ¼W	234 624 109
R34	RES. CARBON 18K ohm 5% ¼W	234 024 093
R35	RES. CARBON 68 ohm 5% 2W	234 001 003
R36	RES. CARBON 100 ohm 10% 1W	234 004 027
R37, R38	RES. CARBON 3.3K ohm 5% ¼W	234 624 075
R39	RES. CARBON 10 ohm 5% ½W	234 014 068
CAPACITORS		
C1, C2, C18, C19	CAP; MONO .33 uf 20% 50V	204 118 011
C3,4,5,6,7	CAP; MONO .033 uf 15% 50V	204 118 004
C13,16,17,8,9,10,11,12	CAP; MONO .1 uf 20% 50V	204 200 111
C14, C15	CAP; CER. .01 uf 20 % 100 V	204 049 001

ASSY LOGIC BOARD (A2) (CONTD) 201 102 000

INTEGRATED CIRCUITS

U1,2,3,4,8	IC 4001 B	210 210 001
U5, U6	IC 4025B	210 210 025
U7	IC 4023	210 002 000
U10	IC LM393N	210 300 011
U11, U12	IC LM317T	210 400 001
U9	IC 4011	210 003 000

DIODES

CR1	RECTIFIER VS247	239 006 000

TRANSISTORS

Q1,2,3,4	TRANS. MPS-U07	239 054 000
Q5	TRANS. D40C1	239 037 001

MISCELLANEOUS

LS1	SPEAKER 8 ohm 2" sq	241 003 001

MULTIVIBRATOR BOARD (A3) 201 108 003

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMB
RESISTORS		
R1,11	RES. 330 ohm 5% ½W	234 014 036
R2	RES. 620 ohm 5% ½W	234 014 040
R3	RES. 20 ohm 5% ½W	234 014 074
R4, R7	RES. 1.1K 5% ½W	234 014 022
R5, R6	RES. 2.4K 5% ½W	234 014 018
R8	RES. 220 ohm 5% ½W	234 014 034
R9, 12, 20	RES. 470 ohm 5% ½W	234 014 038
R10	RES. 2.2K 5% ½W	234 014 103
R13, R19	RES. 1.2K 5% ½W	234 014 041
R14	RES. SELECT 5% ½W	234 014 SEL
R15,R18	RES. 1.8K 5% ½W R15 NOMINAL	234 014 042
R16	RES. 1.0K 5% ½W	234 014 001
R17	RES. 5.6K 5% ½W	234 014 014
R21	RES. 200 ohm 5% 2W (TYPE OMITE 995)	234 001 034
R22	RES. 560 ohm 5% ½W	234 014 039
R23	RES. 68 ohm 5% ½W	234 014 032
R24	RES. 82 ohm 5% ½W	234 014 033

MULITIVIBRATOR BOARD (A3) (CONTD) 201 108 003

RESISTORS

R25	RES.SELECT 5% 1W	234 022 SELECT
R27	RES. 560 ohm 5% 1W	234 022 057
R29	RES. CARBON 4.7 ohm NOM. 5% ½W	234 014 SELECT
R30	RES. SELECT 5% 1W	234 022 SELECT
R32	RES. SELECT 5% 1W	234 022 SELECT
R34	RES. 3.9K 5% ½W	234 014 011
R38	RES.100 ohm 5% ½W	234 014 088
R39	RES. 15K 5% ½W	234 014 004
R40,41	RES. 100 ohm 5% ¼W	234 024 039
R42,43	RES. 2.7K, 5% ¼W	234 024 073
R44,45	RES. 4.7K, 5% ¼W	234 024 079

CAPACITORS

C1	CAP. MICA 1200pf 5% 500V	204 105 028
C2	CAP. 240pf 5% 500V	204 105 011
C3	CAP. MICA SELECT 5%	204 105 SELECT
C4	CAP. TANT 3.3uf 20% 35V	204 104 045
C5	CAP. 2700pf 5% 500V NOM.	204 105 036
C6	CAP. 470pf 5% 100V MIN.	204 106 027
C8	CAP. TANT 10uf, 20% 35V	204 104 048
C12	CAP. 01uf 20% 100V	204 049 001
C13	CAP. MONO 0.1uf 20% 100V	204 200 111

INTEGRATED CIRCUITS

U1	IC LM555CN	210 006 000
U3	IC 700M-1	210 600 000

DIODES

CR1, CR2	DIODE 1N4451	239 050 000
CR3	DIODE 1N751A, 5.1V ZENER	239 600 011

TRANSISTORS

Q1,2,6,10	TRANS. 2N3904	239 015 000
Q3,5,7	TRANS. 2N2907A	239 016 000
Q4	TRANS. 2N3724	239 052 000
Q8, Q9	TRANS. MJE240	239 039 000

MISCELLANEOUS

OP1-1, OP1-2	OPT-ISOLATOR OP1-1264B	239 750 019

LIMIT RESISTOR BOARD (A4)

201 109 000

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1	RES. 270 ohm 5% 1W	234 022 049
R2	RES. 390 ohm 5% 1W	234 022 053
R3	RES. 10 ohm NOM. 5% ½W	234 014 068
R4	RES. 10K ohm 5% 8W	234 000 012
R5, R7	RES. 3 ohm 5% 8W	234 000 004
R6	RES. 220 ohm 10% 2W	234 002 002
R8, R16	RES. 250 ohm 5% 8W	234 000 018
R9,10,11,12,13,14,15	RES. 2 ohm 5% 8W	234 000 003
CAPACITORS		
C1	CAP. 2000pf 5% 500V	204 105 033
MISCELLANEOUS		
T1	TOROID ASSY- DRIVER	202 188 000
F1	FUSE 3amp 250V 3AG3	215 019 021

OUTPUT BOARD (A5)

201 101 003

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBE
RESISTORS		
R1, R2	RES. 2K 5% 20W	234 023 029
CAPACITORS		
C1,C2	CAP. .001uf 6KV	204 025 041
C3,4,5	CAP. .01uf 3KV	204 113 063
C6,7	CAP. CER. .0047uf 20% 6KV	204 025 050
C8	CAP. 4.7pf 6KV	204 025 002
DIODES		
CR1, CR2	DIODE-IN4002	239 091 002
MISCELLANEOUS		
K1, K2	RELAY A2420-70-4 HUS	230 005 005
L1, L2	INDUCTOR, 1.5mH	251 029 011
T1, T2	TRANSFORMER	202 700 052
T3	TRANSFORMER	202 700 053

ISOBLOC BOARD (A6) 201 100 001

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1	RES. 10 ohm 5% ¼W	234 024 015
R2	RES. 2.2K ohm 5% ¼W	234 024 071
R3	RES. 510 ohm 5% ¼W	234 024 056
R4,6,7,9,10	RES. 100 ohm 5% ¼W	234 624 039
R8, 5	RES. 10K ohm 5% ¼W	234 024 087
CAPACITOR		
C1,5,6	CAP. TANT 10uf 10% 20V	204 055 002
C2	CAP. MONO .015uf 20 % 50V	204 118 002
C3	CAP. CER .047uf 15% 50V	204 200 107
C4	CAP. CER .01uf 20% 100V	204 049 001
C7,8,9,10	CAP. MONO 1uf 20% 50V	204 121 082
C11	CAP. CER 82pf 10% 1000V	204 079 025
C12,13,14,15	CAP. MONO. .01uf 10% 100V	204 200 037
DIODES		
CR1,2,3,4	DIODE IN4148	239 014 000
TRANSISTORS		
Q1	TRANS. 2N3568	239 017 000
	TRANS. MPS-A06 (ALTERNATE)	239 093 002
Q2	TRANS. MPSU95	239 078 000
MISCELLANEOUS		
P1-1,-2,-3,-4	PHOTO-ISOLATOR OPI-1264B	239 750 019
T1	TOROID ASSY	202 224 000

ASSY FUSE BOARD (A7) 201 037 003

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
CAPACITORS		
C1	CAP 2500pf 5% 1000V	204 300 106
MISCELLANEOUS		
F1,3,5,7,9,11,13	FUSE ½A 125V GFA	215 017 012
F2,4,6,8,10,12,14	FUSE 3A 250V 3AG	215 005 005
S1,2,3	THERMOSTAT	240 001 004

PRINTED CIRCUIT ASSEMBLY REM (A8) 201 135 010

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
TRANSFORMERS		
T1	TRANSFORMER, AUDIO OUTPUT	202 900 016
T2	TRANSFORMER, R.F. INPUT	202 900 017
L1	COIL, OSCILLATOR	202 900 020
CAPACITORS		
C24	CAP. MONO. .1uf 20% 100V	204 121 048
C12, 13	CAP. TANT. 10uf 20% 25V	204 102 028
C3	CAP. TANT. 6.8uf 10% 35V	204 104 011
C23	CAP. MONO. .022uf 20% 50V	204 121 070
C2, 16, 24	CAP. MONO. 1.0uf 20% 50V	204 121 082
C10,11	CAP. TANT. 68uf 20% 16V	204 600 012
C1,4,5,8,15,17,18,19,20	CAP. MONO. .068uf 15% 50V	204 200 109
C21,22	CAP. POLY. .22uf 10% 250V	204 400 120
C6	CAP. POLY. .012uf 5% 50V	204 400 100
C14	CAP. POLY. .027uf 5% 50V	204 400 101
C25	CAP. MONO. 100V 1000pf	204 200 025
C7	CAP. POLY. .0033uf 5% 250V	204 400 077
C26	CAP. CER. .01uf 20% 100V	204 049 001
C9	CAP. MONO. 1uf, 20% 50V	204 121 082
INTEGRATED CIRCUITS		
U6	IC 4016B	210 210 016
U7	IC 4013B	210 027 000
U5	IC 4093B	210 250 093
U3	IC 4070B	210 210 070
U4	IC, LM393N	210 300 011
U2	IC LM358AN	210 300 013
VR1	IC LM78M 12 CP	210 300 055
U1	IC LM1308O N	210 400 005
RESISTORS		
R34	RES. 33ohm, 5%, ¼W	234 024 027
R26, R33	RES. 10, 5%, ¼W	234 024 015
R4	RES. 100K 5%, ¼W	234 024 111
R7	RES. 1K, 5%, ¼W	234 024 063
R5, 13	RES. 2.7K, 5%, ¼W	234 024 073
R29, 30	RES. 5.6K 5%, ¼W	234 024 081
R3,8,9,14,22,27	RES. 12K, 5%, ¼W	234 024 089
R12,18,19,24,25,31,32	RES. 15K 5%, ¼W	234 024 091
R6,10,17	RES. 33K 5%, ¼W	234 024 099
R21	RES, 68K 5%, ¼W	234 024 107
R1	RES. 220K 5%, ¼W	234 024 119
R28	RES. 390K 5%, ¼W	234 024 125
R11	RES. 680K 5%, ¼W	234 024 131
R2	RES. 3.6M 5% ¼W	234 024 147
R15, 16, 20	RES. 10K, TRIM	236 200 079
R23	RES. 1.6M NOM. 5% ¼W	234 024 140

REM BOARD (CONTD)		201 135 010
SEMI CONDUCTORS		
CR1	DIODE, IN 4148	239 014 000
Q1	TRANS. SWITCHING PN-2222A	239 100 011
SOFT START BOARD (A9)		201 129 000
RESISTORS		
R1	RES. 5 ohm 5% 11W	234 018 008
R2	RES. 18K 5% 5W	234 027 130
R3	RES 68K 5% ¼W	234 024 107
CAPACITORS		
C1	CAP. ELECT. 33uf 25V	204 500 060
DIODES		
CR1	DIODE IN4005	239 091 005
CR2	DIODE IN960, ZENER	239 600 040
CR3	DIODE IN969, ZENER	239 600 041
MISCELLANEOUS		
F1	FUSE, THERMAL CUT/OFF 121°C	215 100 010
COOLER ASSEMBLY		202 205 002
	HEATSINK ASSEMBLY	202 203 002
	FAN ASSEMBLY	202 700 846
	FUSEBOARD ASSEMBLY	201 037 003
CHASSIS ASSEMBLY		200 500 075
REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1,2	POTENTIOMETER 250 ohm, 2¼W	236 003 005
R4	POTENTIOMETER 100 ohm, 2W	236 006 000
R6	WIREWOUND 56 ohm, 25W	234 020 002
R5	WIREWOUND 250 ohm, 50W	234 003 003

CHASSIS ASSEMBLY (CONTD)

CAPACITORS

C1	CAP. ELECT. 2400uf, 50V	204 500 025
C4	CAP. ELECT 90uf, 400V	204 119 132

MISCELLANEOUS (FRONT PANEL)

DS1	COAG INDICATOR ASSEMBLY	202 700 047
DS2	CUT INDICATOR ASSEMBLY	202 700 059
RL1, 2	LAMP - CUT/COAG INDICATOR	215 000 000
	PANEL JACK ASSEMBLY	202 700 887
	KNOB	223 320 036
RL3	LAMP-POWER SWITCH	215 021 028

DIODES

CR1	RECTIFIER MDA3504	239 700 003

SWITCHES

S1	POWER SWITCH ASSY	202 700 852
S2	PURE/BLEND SWITCH ASSY	202 700 049
S3	FOOTSWITCH SELECT ASSY	202 700 853

TRANSFORMERS

T1	POWER TRANSFORMER	251 200 018

MISCELLANEOUS (REAR PANEL)

	FOOTSWITCH CONNECTOR	208 071 000
	POWER CORD ASSEMBLY	202 400 211
	AIR DEFLECTOR	222 499 000
	SOLID STATE RELAY	230 007 000

Valleylab, Inc. ("Manufacturer") warrants each product manufactured by it to be free from defects in material and workmanship under normal use and service. Manufacturer's obligation under this warranty is limited to the repair or replacement, at its option, of any product, or part thereof, which has been returned to it or its Distributor within the applicable time period shown below after delivery of the product to the original purchaser, and which examination discloses, to Manufacturer's satisfaction, that the product is defective. This warranty does not appply to any product, or part thereof, which has been repaired or altered outside of Manufacturer's factory in a way so as, in Manufacturer's judgement, to affect its stability or reliability, or which has been subjected to misuse, negligence or accident.

The warranty periods for Manufacturer's products are as follows:

ELECTROSURGICAL GENERATORS AND PERMANENT ACCESSORIES

SURGISTAT B	ONE YEAR
SSE2-K	ONE YEAR
SSE2-L	ONE YEAR
SSE3	ONE YEAR
SSE3-B	ONE YEAR
MOUNTING FIXTURES, ALL MODELS	ONE YEAR
FOOTSWITCHES, ALL MODELS	ONE YEAR

DISPOSABLE PRODUCTS

LECTROHESIVE TM	SHELF LIFE ONLY, AS STATED ON PACKAGING
STERILE DISPOSABLES	STERILITY ONLY, AS STATED ON PACKAGING

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