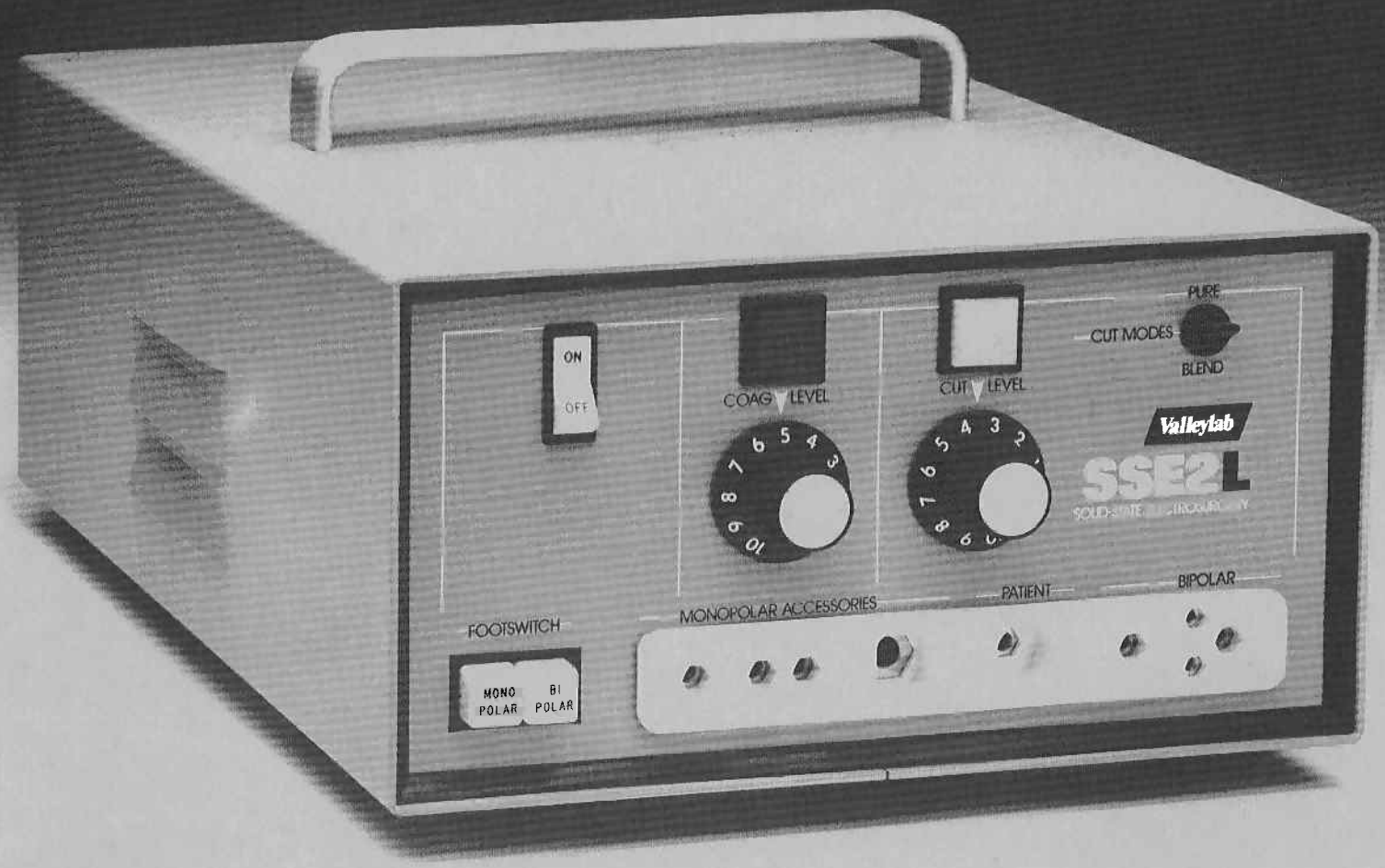

Valleylab

SSE2L SERVICE MANUAL

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SSE2L
SERVICE MANUAL

EFFECTIVITY: SERIAL NUMBERS LOH2126L AND ABOVE
AUGUST 1, 1980

VALLEYLAB PART NUMBER A 945 100 006 E

Table of Contents

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Section 1
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

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 cable is connected to the Generator chassis and insures that no dangerous currnets will flow from the cabinet of the unit in the event of an internal electrical failure.

It is the responsibility of the user to assure proper grounding of the power outlets furnishing power to the unit.

Undesirable 60 Hz leakage currents are also affected by the polarization of the input power to the unit and it is the responsibility of the user to insure that proper polarity is observed.

Frequent checking is urged both visually and with electrical testing instruments, of all electrical cables and wires associated with the unit.

INSTALLATION

The Valleylab SSE2-L Electrosurgical Generator is normally supplied for operation from 120 V AC. Operation from line voltages other than 120 V AC may be specified as an option. Generators are normally shipped with a standard hospital approved 3-prong connector. This connector meets all requirements for safe grounding. Other types of Explosion-Proof connectors commonly used in hospitals are available as options.

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.

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. Valleylab's exclusive Powerite circuitry tests for polarity and ground continuity at the wall outlet. Powerite is connected to the powerswitch and the unit will automatically shut off if there is a malfunction. 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 of OFF, then ON to reset it.

2. COAG Indicator. Indicator illuminates (blue) when coagulation current is selected by depressing pencil coagulation switch, by 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 0 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 CUT 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 current intensity. Selector dial is graduated from 0 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 manufacture, 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 one-prong plug of the patient plate cord.

11. Bipolar Receptacle. This 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 hand-switching 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 inaudible 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. The three-prong plug on the power cord connects to the properly grounded three-prong wall receptacle providing 120 V AC 60 Hz power. The plug is a U.L. approved hospital-grade model. Specific models of explosion-proof plugs are available through special order. Extension cords, three-prong to two-prong adapters ("cheaters") and extra length power cords should NOT be used. For units operating from 220V AC input, your Valleylab representative will install the appropriate plug.

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

16. Powerite Switch. In the "ON" position, the Powerite System continuously monitors the ground connection between the generator and the operating room's power system. The System will not function in the presence of an isolation transformer in the operating room. If isolated wiring is present, the switch should be in the "OFF" position. Switch should also be in the "OFF" position with 220 volt supply in the absence of a neutral conductor at ground potential.

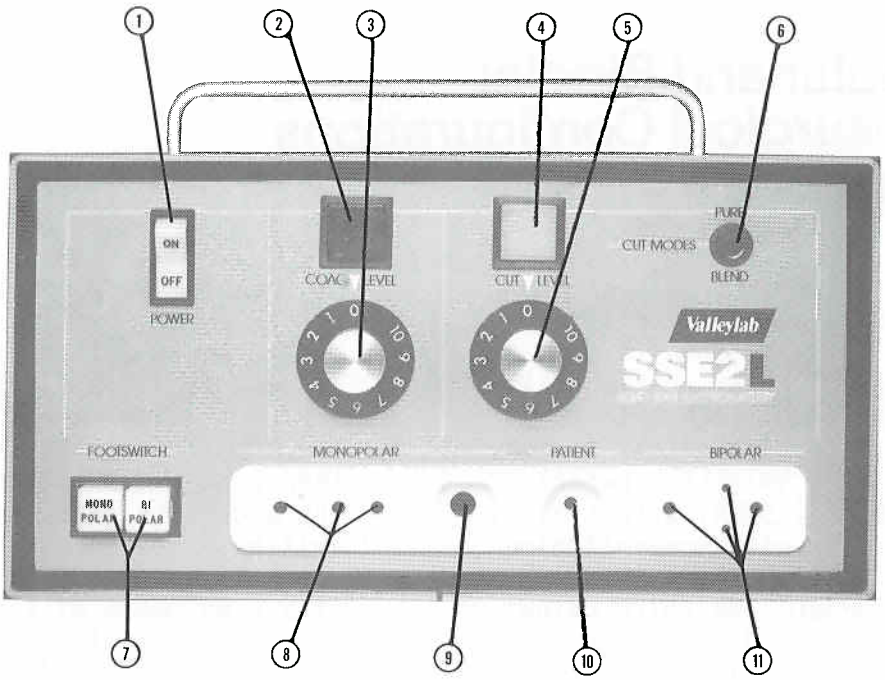


Figure 1 Front View

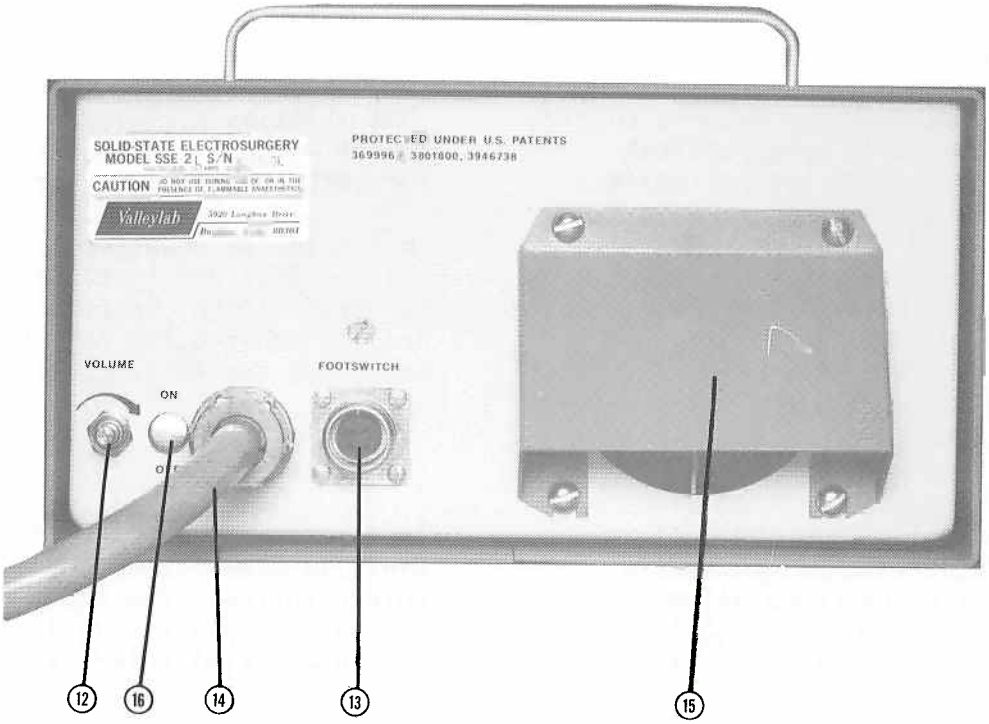


Figure 2 Rear View

Section 4
Monopolar and Bipolar Electrosurgical Configurations & 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 is designed for operating room use and is connected to the SSE2-L by means of a four-pin 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. The energy present in the SSE2-L switching circuits is about .002 millijoule. This is 1/5000 of the amount which is a conservative limit for safe open contact operation.

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:

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).

A delicate procedure which uses low power settings requires only a few square inches. The Valleylab permanent patient plate (Model E7001) and the disposable Lectroplate (Model E-7501) have more than sufficient area. Gelled foam pad electrodes of smaller size, such as Valleylab (Model E7502), have come into common usage and with proper adherance to manufacturers instructions can be an effective and safe method of providing the return connection.

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 cable is defective or 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 jacks. 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 fulgurate 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 output 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 or the BIPOLAR 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 usec nominally.
  Burst repetition 20 KHz ± 2 KHz.
- BLEND: 500 KHz ± 10 KHz sinusoid with increased amplitude bursts at 50 usec intervals.

Output Characteristics: (Typical values for control settings and load conditions specified. Power source is 120 V AC 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	2.1 ± .2
Blend	2440 V	250 ± 25 W	2.6 ± .2
Coag	4070 V	125 ± 15 W	7.6 ± .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	2.1 ± .2
Blend	640 V	85 + 15-20 W	2.2 ± .2
Coag	1100 V	25 + 5-10 W	7.5 ± .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 10 W for MONOPOLAR outputs and 3 W for BIPOLAR output. Non-activated power must be measured into a 500 ohm load for MONOPOLAR outputs and a 100 ohm load for BIPOLAR output.

Output Isolation:
Line frequency source leakage current ≤ 0.2uA rms
Line frequency sink leakage current ≤ 150uA rms (1)
RF patient leakage ≤ 150mA rms
Line ground leakage current (50/60 Hertz)
Unit off: ≤ 10uA rms
Unit on: ≤ 30uA rms
If ground is disconnected unit automatically switches off. Reset by switching on.

Cooling:
Two speed fan switches 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 20dBA (Approximately, fan on low speed)
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:	0.6 Amperes	Idle:	0.3 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 if specified.

Line Regulation:
For settings used for most electrosurgical procedures, i.e., settings which produce 0-200 watts in cut and blend and 0-75 watts in coag, with line voltages varying between 100 and 130 volts, power will not vary by more than ± 20 watts in cut and blend, and ± 12 watts in coag.

Weight: 32.5 pounds (14.7 kilograms)

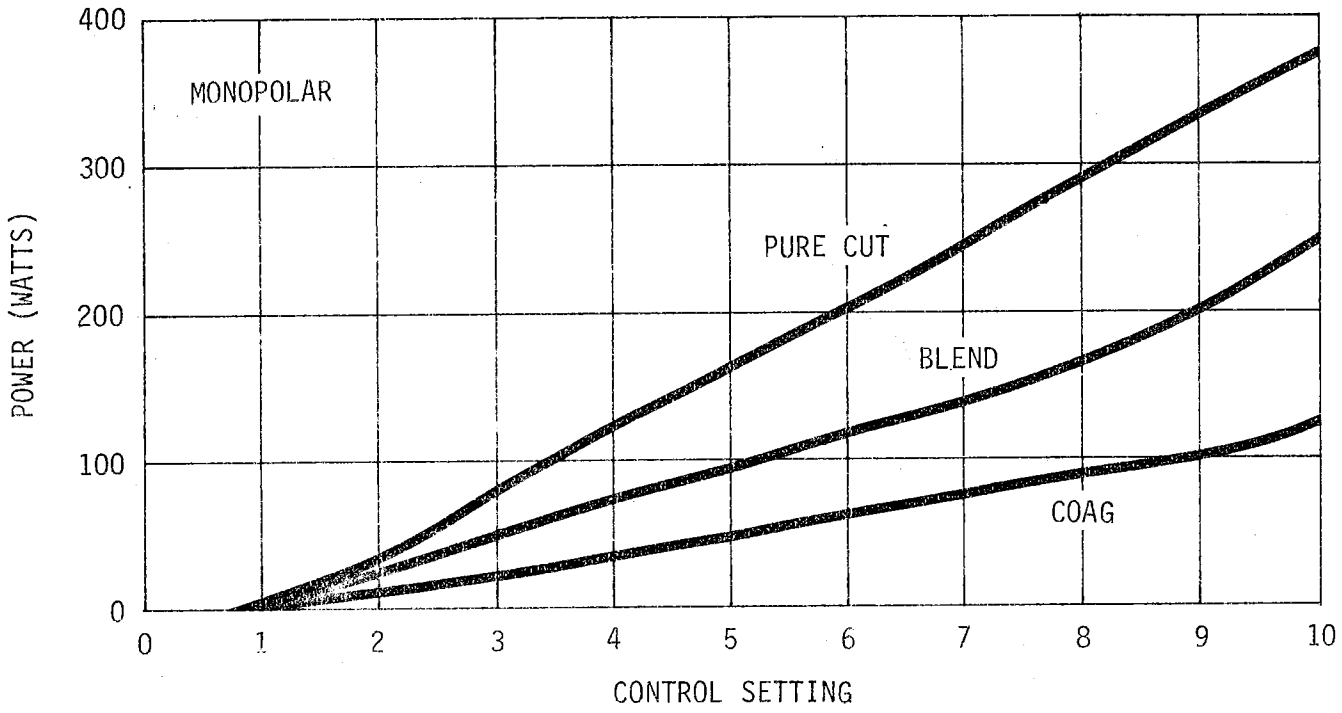
Size: 7.6 inches high (19.3 centimeters high)
11.6 inches wide (29.5 centimeters wide)
16.6 inches long (42.2 centimeters long)

Note:
(1) Line frequency sink current is that current which flows from an external voltage source of 120 V AC 60 Hz applied to all front panel terminals in parallel 100 K ohms in series with 120 V AC source for safety.

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.



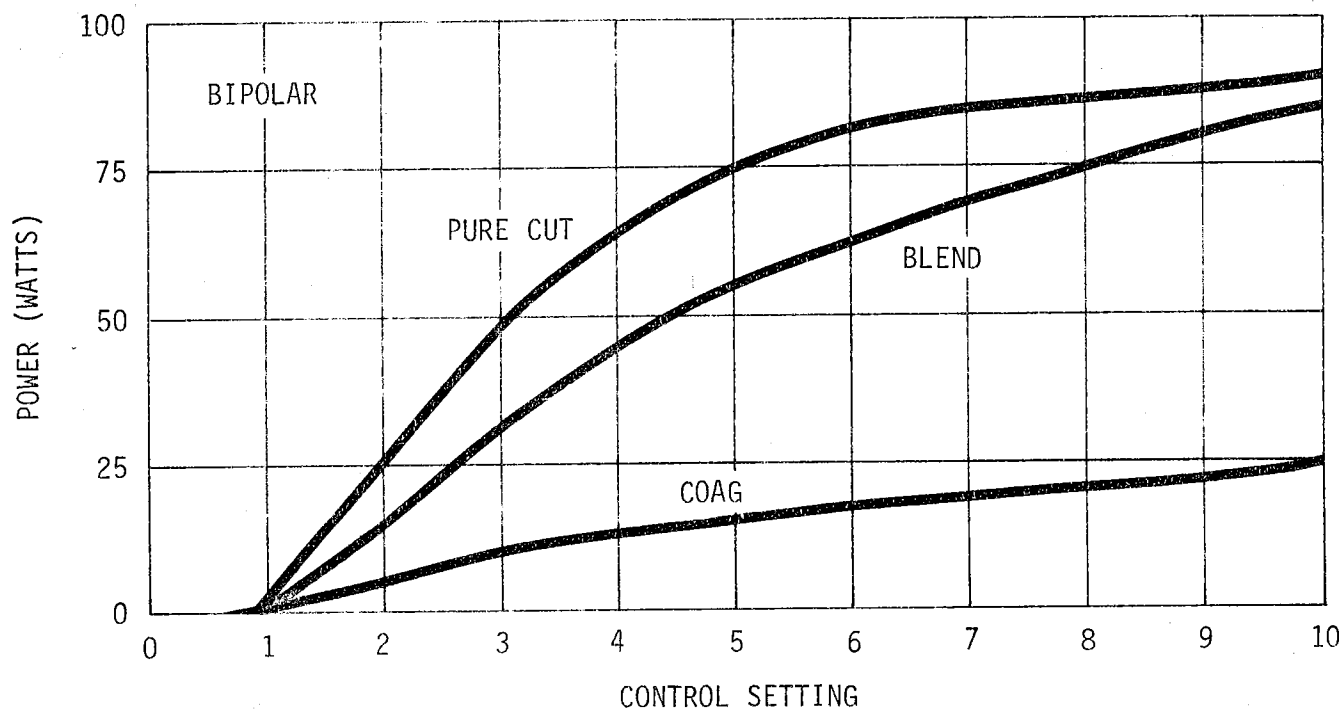
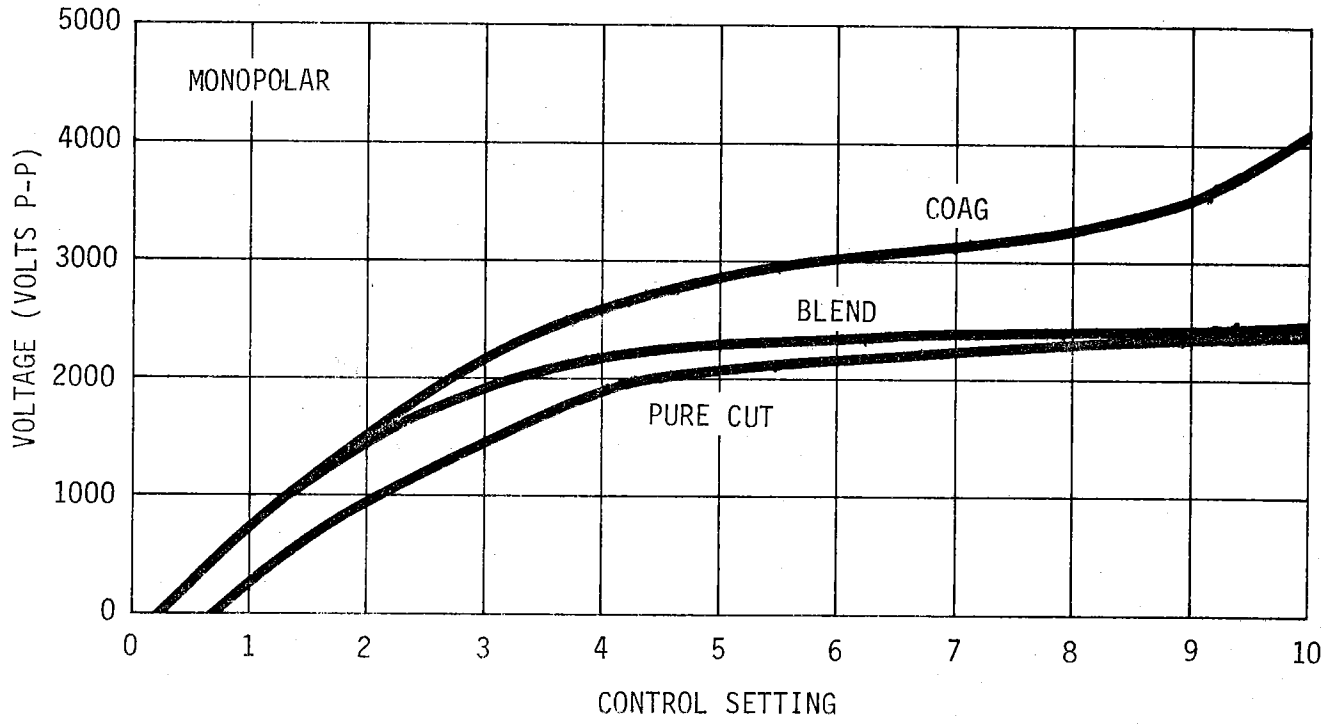


Figure 3 Typical Output Power vs Control Settings



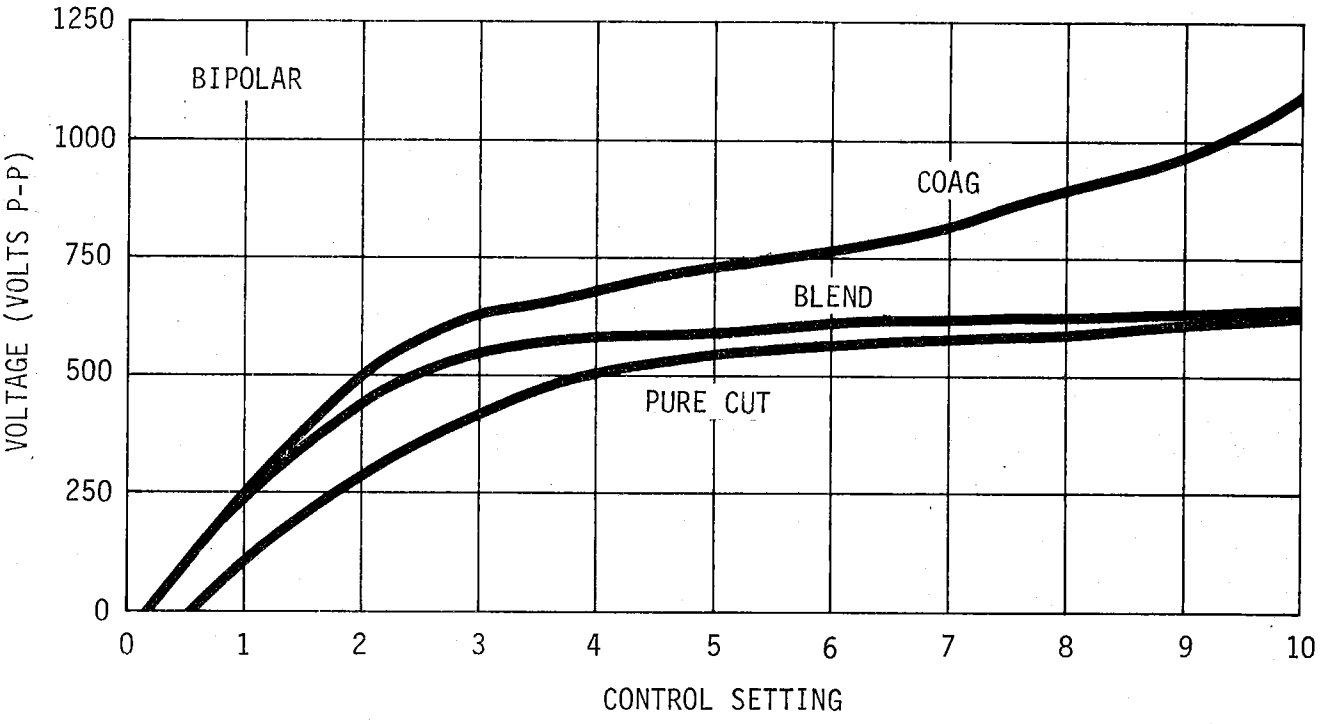
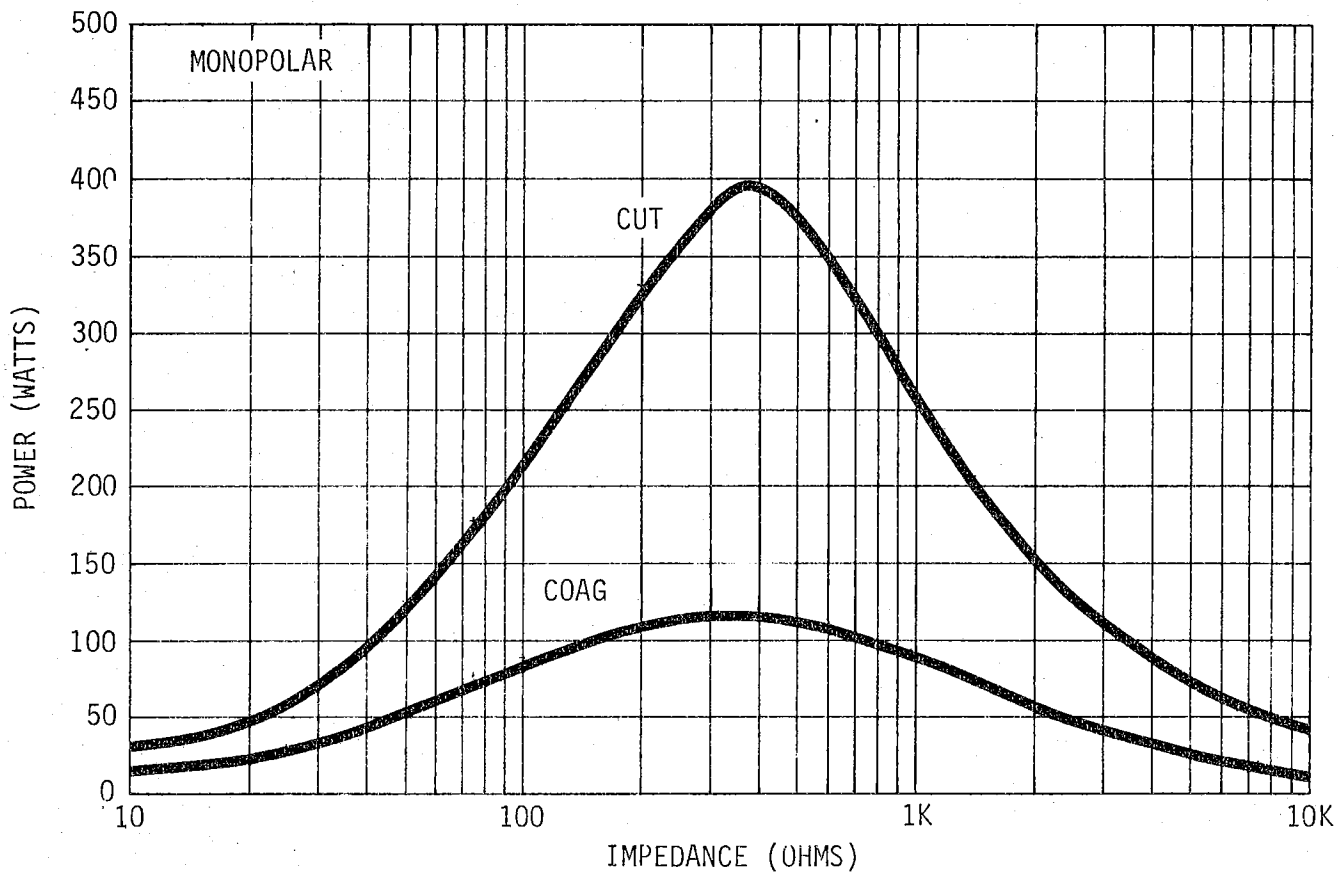


Figure 4 Typical Output Voltage vs Control Settings



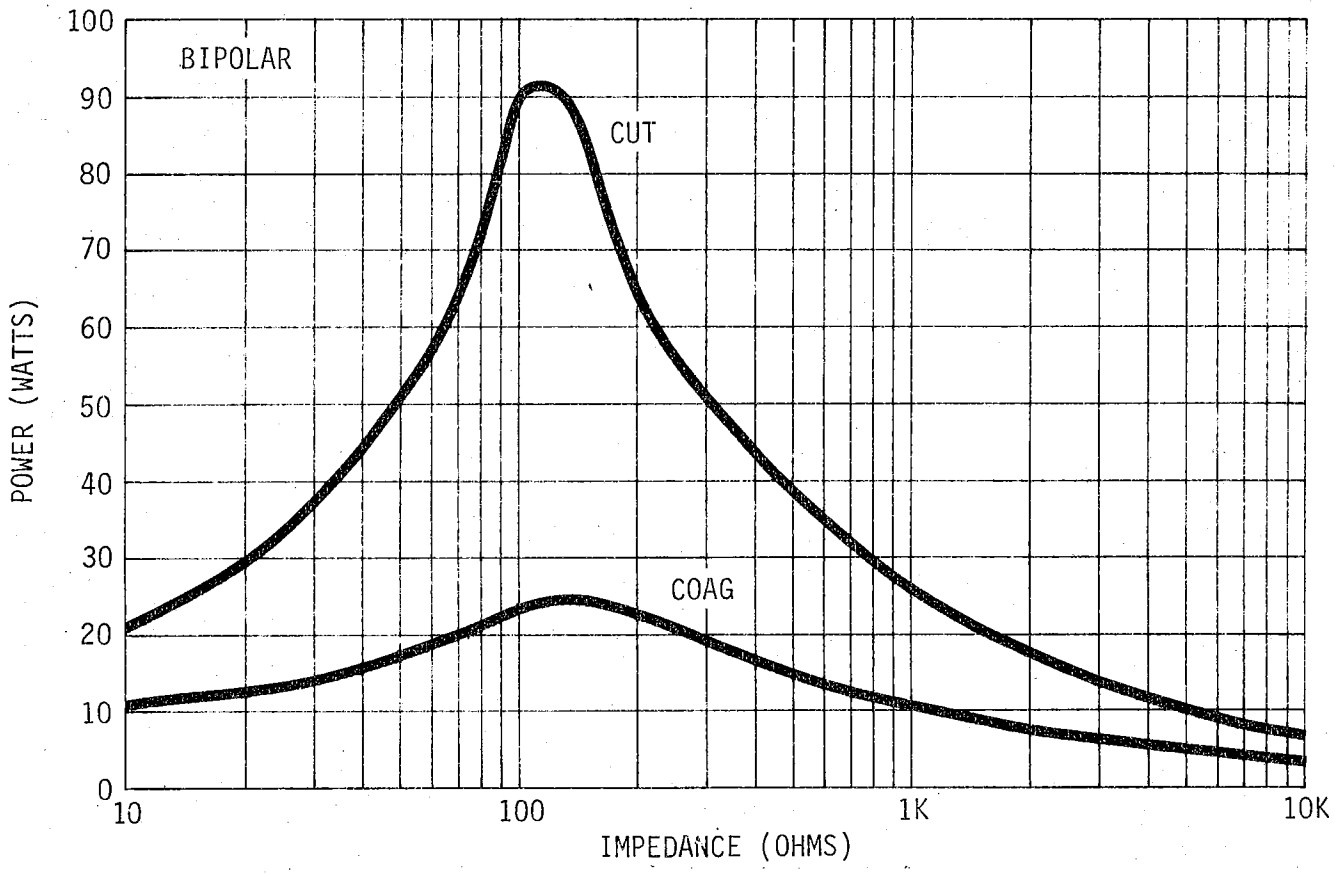
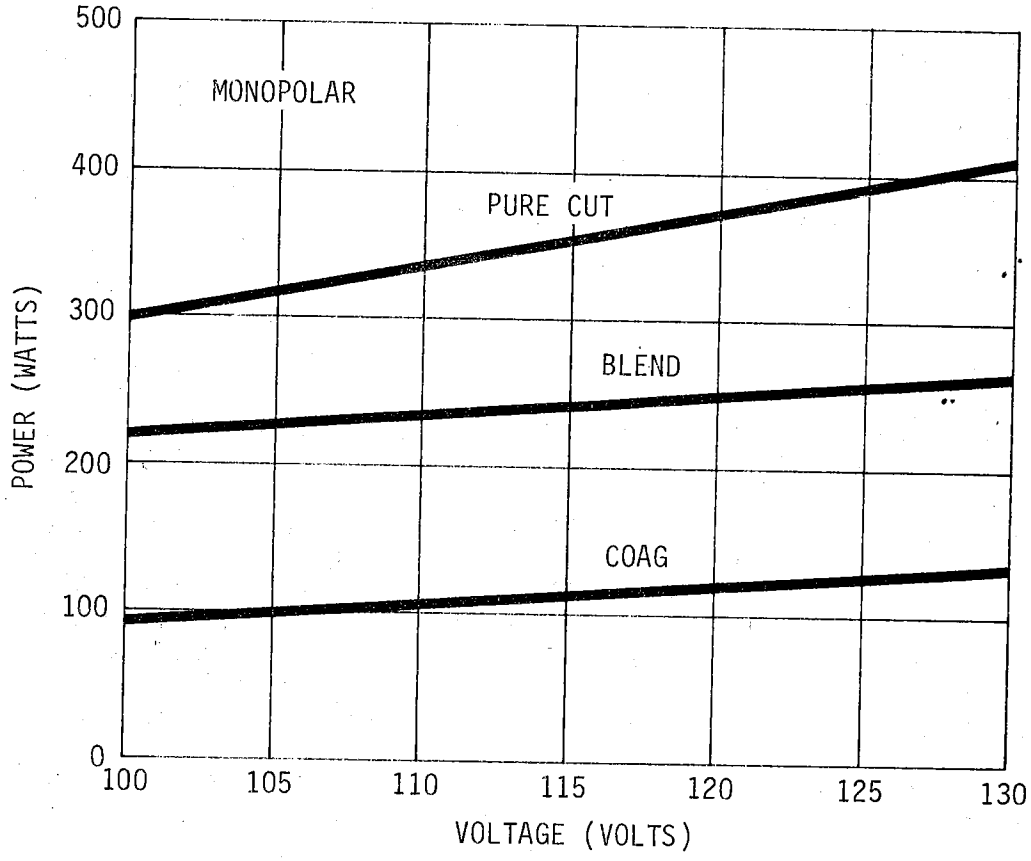


Figure 5 Typical Maximum Output Power vs Load Impedance



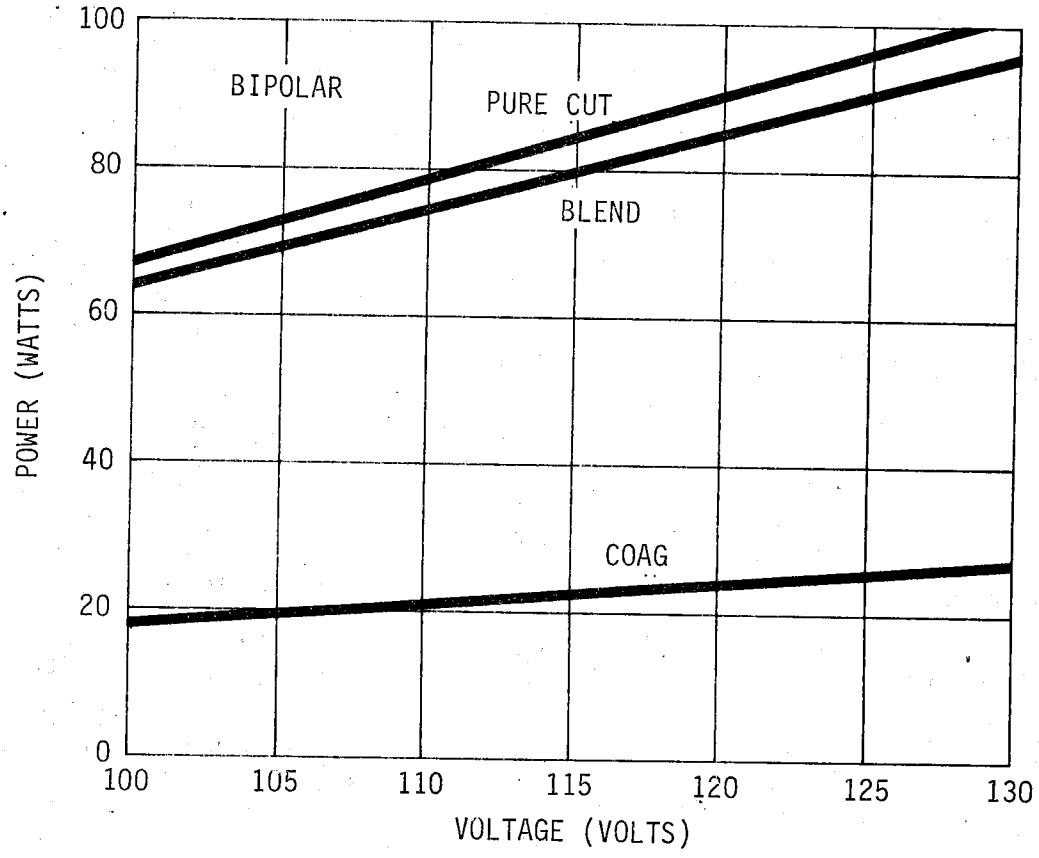


Figure 6 Typical Maximum Output Power vs Supply Voltage

Section 6
Circuit Description

The SSE2-L consists of a power supply section, an RF oscillator, gating and shaping circuitry, a driver section, a power amplifier and three output circuits, only one of which will be energized at a time. Additionally there is logic circuitry to decode keying inputs, an Isobloc circuit, an audio alert and a lamp driver circuit.

POWER SUPPLY (A8, A2)

This section generatres the necessary voltages for equipment operation. The unregulated +200V output is capable of 1KW and is lightly filtered by A1C2. The unregulated +35V output is well filtered by A1C3 and from this the +20V and +15V regulated outputs are derived by A2U11 and A2U12 respectively. The power supply is protected by A1CB1 which also serves as the on-off switch.

RF OSCILLATOR (A3)

Transistors Q1 and Q2 form a type of emitter coupled multivibrator whose free-running frequency is determined by C1, C2, C3 and associated resistors. In the COAG mode, C2 is switched into the circuit to lower the frequency and place the operating frequency nearer the resonant peak of A4T1 and A5T1. This enables the generator to develop higher peak voltages necessary for coagulating. In the PURE CUT and BLEND mode the free-running frequency is 500 ± 10KHz and in COAG lowers to 450 ± 10KHz.

GATING & SHAPING CIRCUITRY (A3)

The signal from the collector of Q2 is inverted by Q3 and applied to phase-splitter Q4. The collector load resistor of Q4 (R21) is connected to the +20 volt supply in one of three ways to furnish the different waveforms. In the PURE CUT mode, the top of R21 is connected to + 20V through contacts of the PURE/BLEND switch and K1 pins 9 and 10 and allows a CW signal to pass on through Q6 and Q8 and be amplified by the DRIVER and OUTPUT stages. In the BLEND mode the top of R21 is returned to an intermediate voltage through the contacts of K1-9 and 10 and the PURE/BLEND switch. This allows a reduced level of CW signal to pass on to Q6 and Q8. At the same time, the COAG oscillator U1 causes the top of R21 to be periodically pulled to the full +20V supply through Q7. This action adds higher amplitude pulses to the already generated CW signal and results in a BLEND waveform. In the COAG mode, the contacts of K1 do not activate. Instead the top of R21 is pulled up to the +20V supply by U1 and Q7 at the coag rep-rate (20KHz). The RF oscillator consisting of Q1 and Q2 runs only when the unit is keyed ON due to the action of Q10. Coag oscillator U1 runs continuously. When either mode is keyed on, Q5 is disabled and allows the coag rep-rate signal to be applied to Q7. In the PURE mode, the coag signal is also applied to Q7 but has no effect because Q7 is bypassed by the contact of K1-9 and 10 and the PURE/BLEND switch. The inverted signal from the emitter of Q4 is applied to the base of Q9 and is used to remove the stored base-charge in A7Q1 and allow it to switch faster with less power dissipation.

DRIVER CIRCUIT (A4, A7)

One output of the shaping circuitry is passed through the level controls to the base of A7Q1. A turn-off drive is passed directly to A7Q1 to handle the large amounts of stored charge present in this type of transistor during conduction. A second input to this stage is through A4R8 and A4R16. This path creates a voltage on the emitter of A7Q1 which is proportional to the unregulated +35V supply, and thus to the power line voltage. It is in this way that the SSE2-L is compensated for power line voltage fluctuations. The driver stage is a tuned amplifier which is transformer coupled and matched to the loading of the output stage.

POWER AMPLIFIER (A7)

This stage increases the power level of the signals to the level required for surgery. It is a tuned amplifier which is transformer coupled for load impedance matching. Q2 through Q8 are parallel connected (with individual emitter resistors for even current sharing.) A feedback path is included through A1 R4 and C1 for stability. The power amplifier is driven at one of two frequencies. (See operation of the RF oscillator section.) At the lower frequency there is a correspondence between drive and resonance, and the highest open circuit voltages are developed for adequate coagulation performance. Conversely, during pure cutting operation, the stage is driven slightly off resonance to limit the open-circuit voltage.

OUTPUT SECTION (A5)

The SSE2-L features three individually activated output circuits for operation in MONOPOLAR HANDSWITCH mode, MONOPOLAR ACCESSORY mode or BIPOLAR mode. A typical output circuit consists of a transformer, DC blocking capacitors in the secondary, and in the MONOPOLAR circuit a leakage canceling circuit from the ACTIVE secondary to ground. The primaries of the three transformers are commoned together at one end and are connected to the Collector terminal of the output transistor array. The +200V power supply is commutated by K3 and K4 to one of the open primary leads depending on which output is selected.

KEYING LOGIC (A2)

The keying logic accepts inputs from the footswitch directly on $\overline{\text{FSCT}}$ and $\overline{\text{FSCG}}$ and from the handswitch inputs via the Isobloc circuit on $\overline{\text{HSCT}}$, $\overline{\text{HSCG}}$, $\overline{\text{BPCT}}$ and $\overline{\text{BPCG}}$. $\overline{\text{BPS}}$ is set by the FOOTSWITCH selector on the front of the unit. U1, U2, U3 and U4 form a mutually exclusive gating array which allows only one logic input to be activated at a time. Outputs Q1 and Q2 energize CUT and COAG relays A1 K1 and A1 K2 respectively. Outputs Q3 and Q4 energize power relays A5 K3 and A5 K4. Delays created by R13 C8, R14 C9, R15 C10, R16 C11, and R17 C12 assure that A5K3 and A5 K4 "cold switch" to prevent contact burning.

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 P11, P12, P13, and P14. CR1 C5 and CR2 C6 rectify and filter the energy transferred through T1. When the anode of the 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 $\overline{\text{HSCT}}$ 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.

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.

POWERITE CIRCUIT (A3)

A "high" signal at pins 1 and 2 of U2 on the multiboard in the Powerite circuit causes U2's output at pins 10 and 11 to be high. This fires SCR1 which turns A1 CB1 off by applying a voltage across pins 5 and 6. A high signal can be seen at pins 1 and 2 of U2 in either of two ways: If the hot and neutral leads are somehow reversed a voltage is impressed across R26 and A1 R1; or if the third wire ground is disconnected, chassis capacitance coupling also impresses a voltage across these two resistors. In either case pins 1 and 2 of U2 go high and the sequence described in the previous paragraph commences.

The Powerite circuit may be disabled through a rear panel switch if the generator is to be used in an isolated power supply system. In a line isolated power system, the concept of hot and neutral power wires does not exist as each power-carrying wire may have no reference to ground. If the SSE2-L is used in an electrically isolated operating room and the Powerite switch is on, the unit will not turn on. In most 240 volt, two-phase systems there is no neutral current carrying conductor and the Powerite must be switched off.

Section 7
Testing Procedure

OPERATIONAL TESTING--
GENERATOR OUTPUT

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.

When the ON/OFF Pushbutton is depressed, the ON lamp should light with normal brilliance. A dim glow of the ON lamp usually indicates a heavy current drain from the +200 and the +35 volt supplies. This condition generally indicates faulty power supply components.

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 (0), 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 forcep 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 an 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 waveforms 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 pinpoint 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 -- POWERITE CIRCUIT

During normal operation with a 120 volt AC single phase power supply, the POWERITE circuit is left ON. The POWERITE circuit will turn the breaker/power switch to OFF in the event that the line cord ground wire is interrupted or if the power line polarity becomes reversed. The POWERITE circuit may be easily tested using a 3-pin to 2-pin line cord adapter. Plug the power cord into the adapter. Then, without connecting the grounding wire to ground, attempt to turn the SSE2-L ON. The POWERITE circuit should recognize the broken ground and promptly return the switch to OFF. Next, reverse the 2-pin adapter in the power receptacle and ground the grounding wire. This will simulate a wiring error in the power source in which the hot lead has been reversed with neutral. The POWERITE circuit should detect this condition and turn the SSE2-L OFF. The POWERITE disable switch may be tested by turning it to OFF during either of the above conditions. The SSE2-L should remain ON even though the wiring fault is present.

The POWERITE circuit can only be used with single phase 120 volt or 220 volt supplies. For use with two phase or isolated supplies, the POWERITE must remain OFF.

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, and the POWERITE OFF.

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. 0-140 VAC Variac
(For 220 V SSE2-L a 0-280 VAC Variac is required.)

NOTE on Acceptance Test Procedure: In testing RF type equipment, proper test procedures must be adhered to in order to have a reasonable chance 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 inductive coupling may cause order-of-magnitude errors in the observed values.

CHASSIS GROUND INTEGRITY

Check for the existence of a low impedance connection between the generator chassis and the 3rd wire ground 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 12.5 amperes at 120 V AC, turn the unit ON and key it in the CUT mode. Insure that it starts to function at 90 V AC or lower. The presence of an audible tone and appearance of the 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.

OUTPUT POWER LEVELS

Monopolar output power 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 120 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 120 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 100 to 130 V AC, the output is regulated and varies less than ±20 watts in CUT and ± 12 watts in COAG.

PURE CUT LEVELS

In this procedure the generator is

operated into a 500 ohm wattmeter capable of dissipating the full power of the generator (400W). The wattmeter is connected between the MONOPOLAR PATIENT terminal and the MONOPOLAR ACCESSORY terminal. The generator is keyed from the rear panel with a footswitch such as the Valleylab E6008 or E6004. 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 ± 25 watts RMS. Set the CUT level to (7) and verify that the power is 245 ± 30 watts. Set the CUT level to (5) and verify that the power is 160 ± 30 watts. Set the CUT level to (2) and verify that the power is 35 ± 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 power output does not meet the requirements of the preceding paragraphs it will be necessary to tune it up to the proper levels as follows:

Connect a frequency counter to the collector of A3 Q3 on the multiboard and select the value for A3 C3 which will give a carrier frequency of 500 ± 10 KHz. Set the COAG level to (0) and key the unit in COAG mode. Note that the frequency is 450 ± 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 is 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 to (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 ± 15 watts. Set the CUT level to (2) and verify that the power is 15 +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 ± 5 watts. Set the COAG level to (2) and verify that the power is 5 ± 3 watts.

Set the COAG level to (10), remove the 100 ohm load and check the open circuit voltage. This should be typically 11000 volts peak to peak.

RF LEAKAGE TEST

RF leakage currents from MONOPOLAR PATIENT terminal to ground are measured with 40 pf 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 at 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 40 pf 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 outputs 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 10 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 120 V AC (or 220 V AC, as appropriate).

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 100 V AC to 130 V AC (or 200 V AC to 260 V AC). The output should vary less than ± 20 watts.

Return supply voltage to 120 V AC and set COAG power to 75 watts. Vary supply voltage from 100 V AC to 130 V AC (or 200 V AC to 260 V AC). Output power should vary less than ± 12 watts.

POWER SAG TEST

Connect the SSE2-L to a variable voltage transformer (Variac) and set the supply voltage to 120 V AC (or 220 V AC, as appropriate). Select the BLEND mods 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 two speeds and will increase to a high speed when the cooler assembly reaches 160°F ± 10°F. The fan switches back to low speed at 140°F ± 10°F. If the fan is working properly at low speed, a distinct flow of air can be felt coming from the blue cowling at the back of the chassis. To test the high speed mode, set the CUT level to (10) and key the SSE2-L with no load. The fan should switch to high speed within 180 seconds..If it does not, check out the thermal switch assembly before proceeding.

LINE FREQUENCY LEAKAGE CURRENT (50/60 Hz)

Potentially dangerous 50/60Hz line leakage currents to ground are measured in this test. The Powerite circuit must be switched OFF and the SSE2-L left ON but NOT keyed. The current is measured indirectly by observing the voltage developed across a 10K 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 50/60Hz 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.

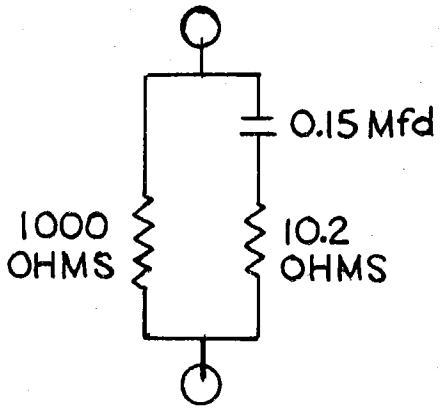
NOTE: Because of the extreme difference in magnitude of the 60Hz leakage current and the 500 KHz signal (when keyed), it is very difficult to make a 60Hz leakage measurement with the unit keyed. When keyed, there can be as much as 4000 volts peak to peak of 500 KHz, as compared to .2 millivolts of 60Hz.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

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

The value of 30uA is valid for factory installed 10 foot 16/3 AWG line cords. 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 120 volt 60Hz potential is applied between a patient lead and the chassis.

The voltage source should be a 120 volt isolation transformer with a 120K ohm current limiting resistor in the secondary. The current is calculated from the voltage measured across a 10K ohm resistor in series with the 120 volt source and the "patient" or "active" jacks. This current should be <100uA.



INPUT CIRCUIT

PREVENTIVE MAINTENANCE

In order to insure safe and dependable operation, the SSE2-L should be periodically checked to see that it meets minimum specifications.

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 signs of corrosion on the contact fingers and

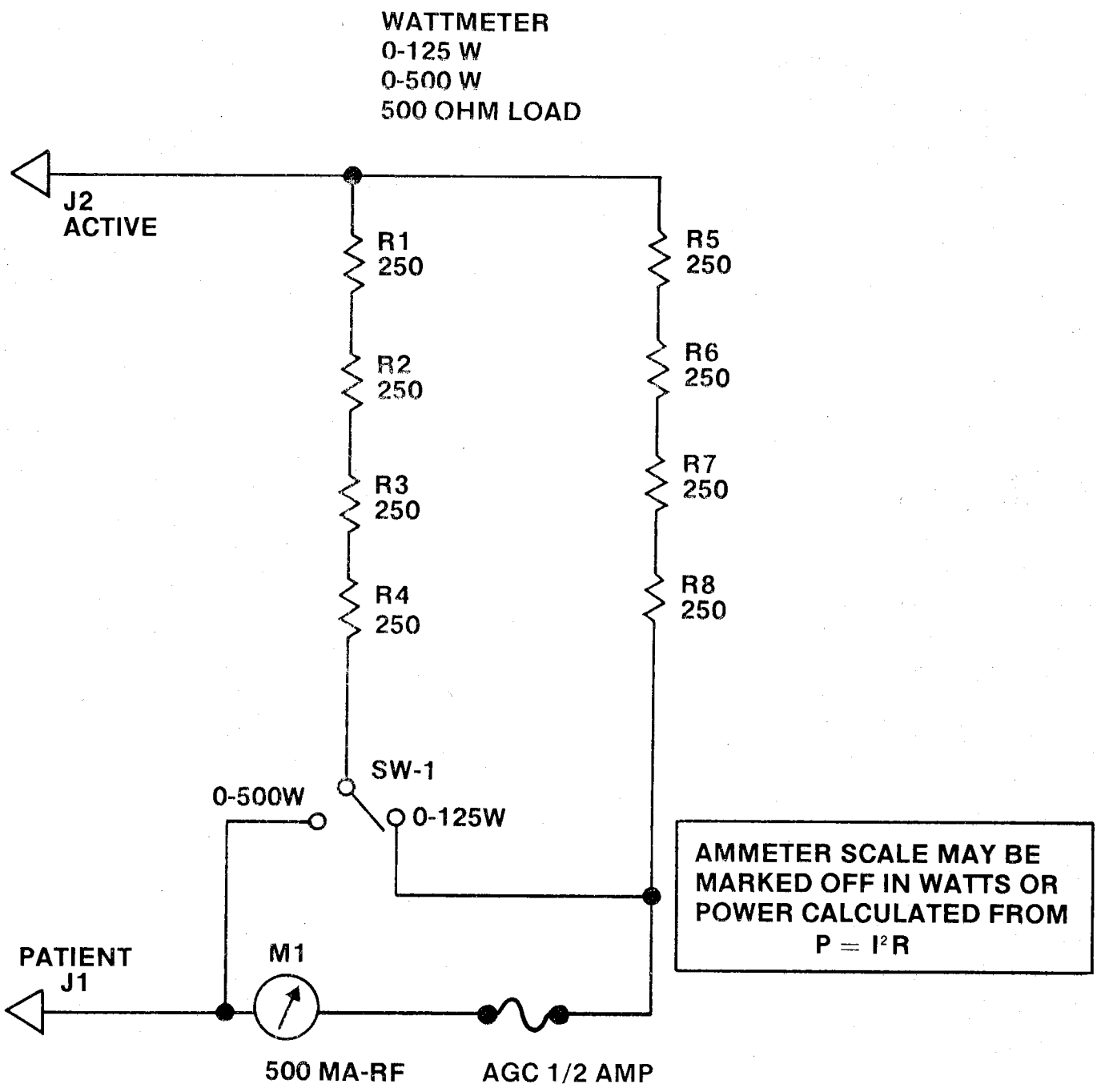
should be cleaned as necessary.

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.

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 efficacy and continued patient safety.

NOTE: To change ON/OFF lamp, turn the switch OFF. Use pliers to pull rocker of switch straight out. Grain-of-wheat lamp is held in by spring-clips. Carefully replace the lamp bulb and replace rocker by snapping into place.

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



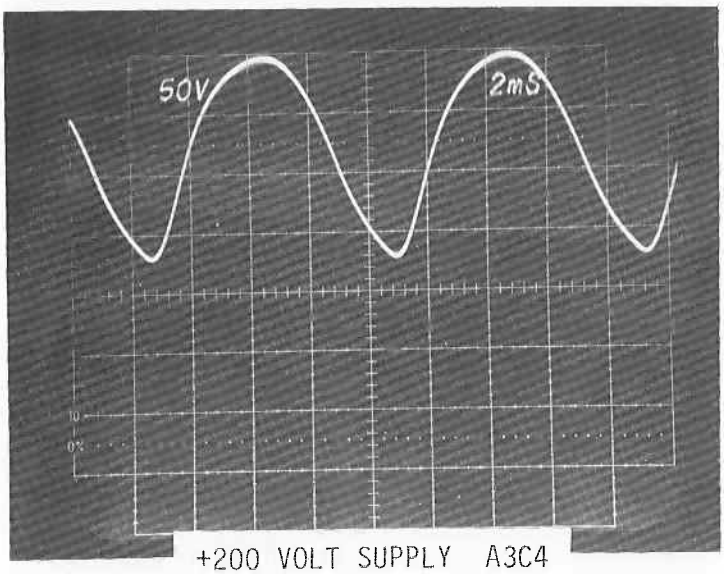
PARTS LIST			PART NUMBERS
R1-R8	250 OHM 50W	DALE RH-50 1%	234 003 003
M1	500 MA RF RMS	SIMPSON MOD 1339	218001
SW-1	SPDT TOGGLE	ALCO MST-105D	243001

Figure 7 Wattmeter Construction

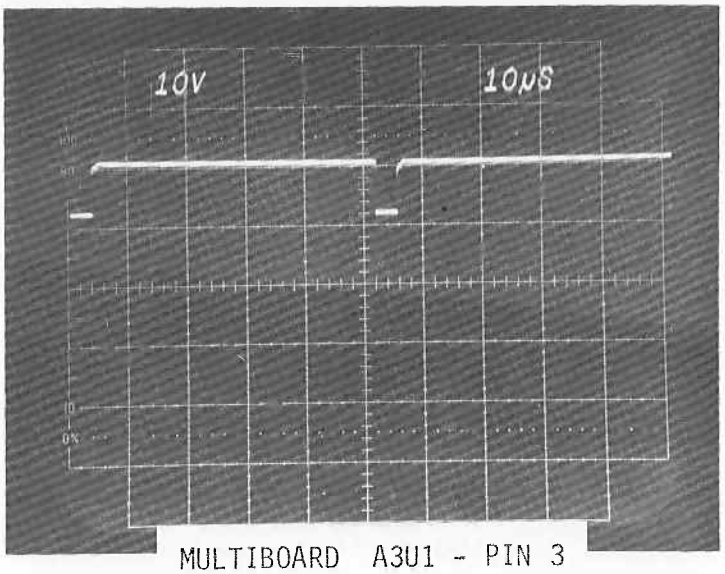
Section 8
Troubleshooting

TROUBLE SYMPTOM	PROBABLE CAUSE	SOLUTION
A) Inoperative; ON/OFF Switch wont stay on.	1) Faulty power line wiring	1) Normal operation of the Powerite circuit. Correct the wiring fault.
	2) Excess current drain	2) Check for shorted A1CR1. Check for +200 VDC shorted to ground.
	3) Faulty Powerite circuit	3) Check for defective A3SCR1 or A3U2.
	4) Defective circuit breaker	4) Replace defective A1CB1.
B) No ON/OFF light.	1) Bulb burnt out.	1) Remove plastic rocker arm and replace bulb.
	2) A1R4 burnt out.	2) Replace A1R4 390 ohm 3 1/4 watt resistor.
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 A1S1.
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 - J. Check signal at A3Q1, A3Q2, A3Q3. Check +20V supply at J2 - P.

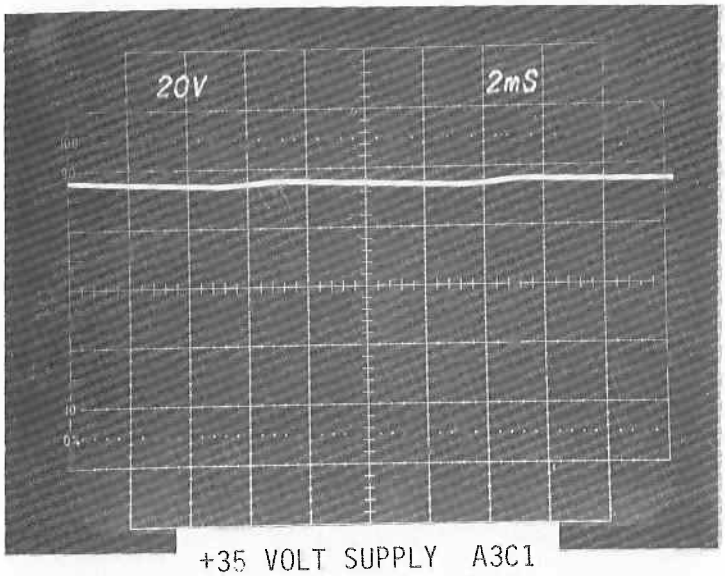
I) Cont'd	2) Driver circuit	2) Check A7Q1, A4F1 and A4R7.
J) No audio when keyed.	1) Audio oscillator	1) Check A2U9, A2Q5 and A2LS1.
K) No MONOPOLAR output. BIPOLAR OK	1) Output board	1) Check A5K1 and A5K2
L) No BIPOLAR output. MONOPOLAR OK.	1) Output board	1) Check A5K1 and A5K2.
M) Excess RF leakage current	1) Output board	1) Check A5C1, C2, L1, L2, R1 and R2 for shorts.
	2) Isobloc board	2) Check A6T1 for short.
	3) Wiring short	3) Active or Patient wire shorted to chassis.
N) Excess 60 Hz leakage	1) Defective power transformer.	1) Replace A1T1.
	2) Wiring fault	2) Check for broken ground wire or hot and neutral wires reversed.



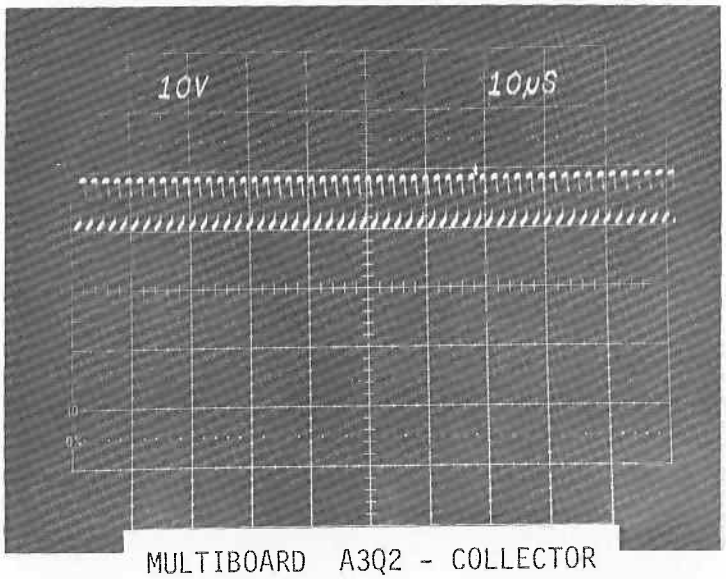
+200 VOLT SUPPLY A3C4
CUT MODE FULL OUTPUT



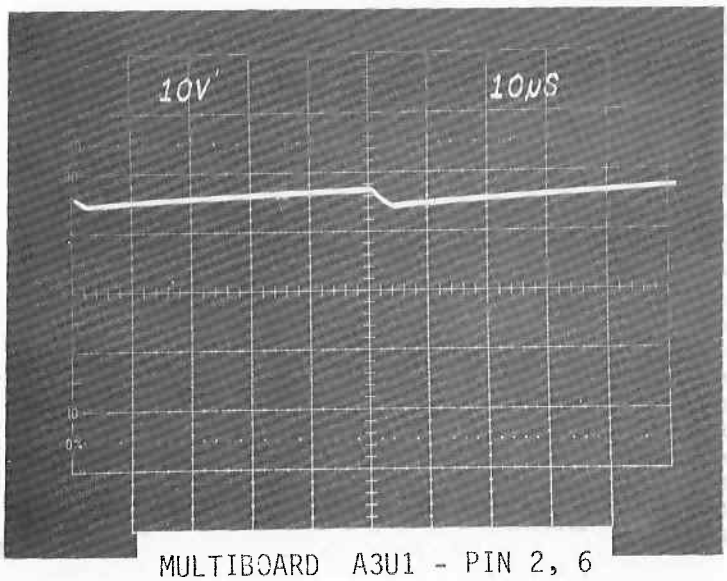
MULTIBOARD A3U1 - PIN 3
ANY MODE



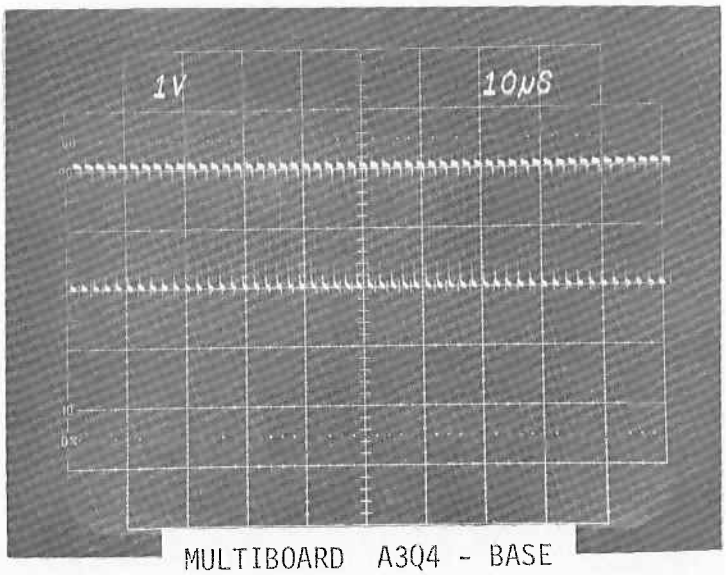
+35 VOLT SUPPLY A3C1
CUT MODE FULL OUTPUT



MULTIBOARD A3Q2 - COLLECTOR
ANY MODE

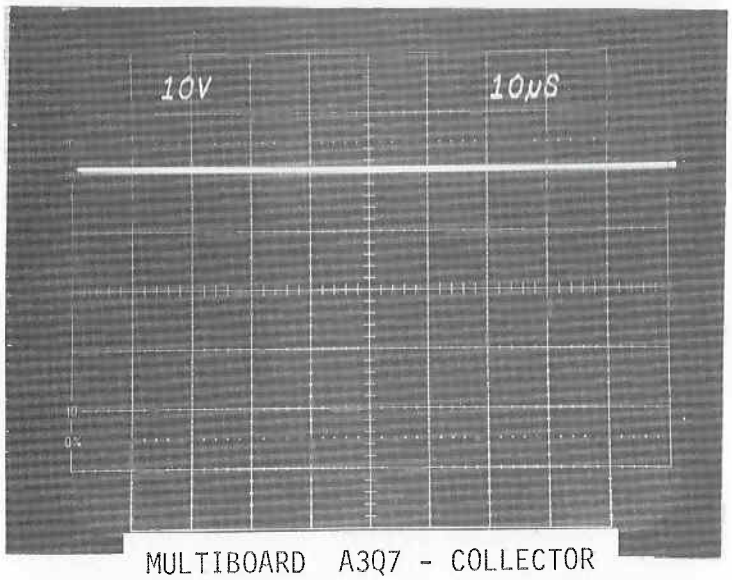


MULTIBOARD A3U1 - PIN 2, 6
ANY MODE

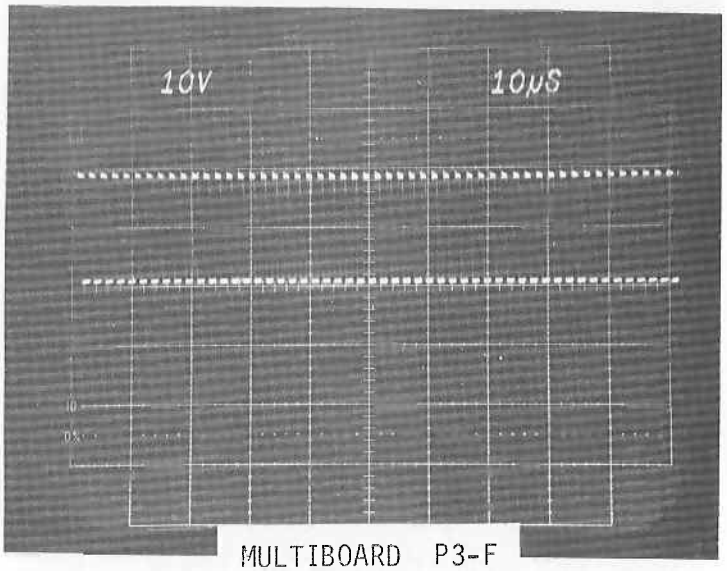


MULTIBOARD A3Q4 - BASE
ANY MODE

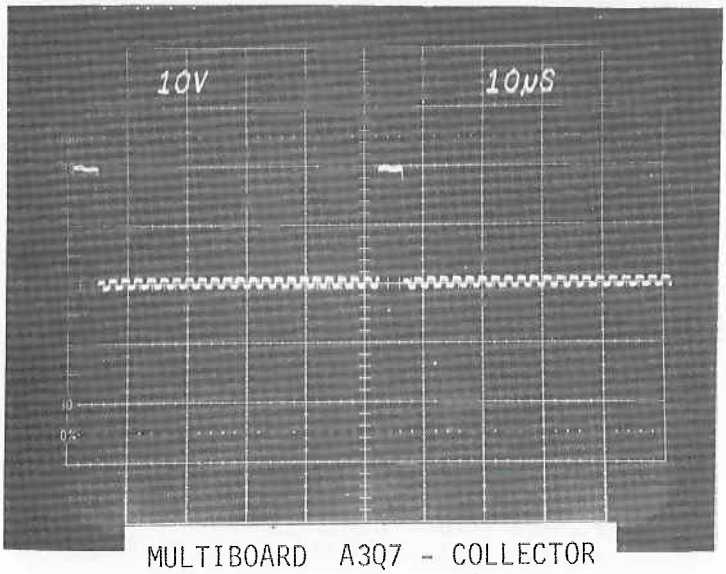
Figure 8 SSE2-L Waveform Chart



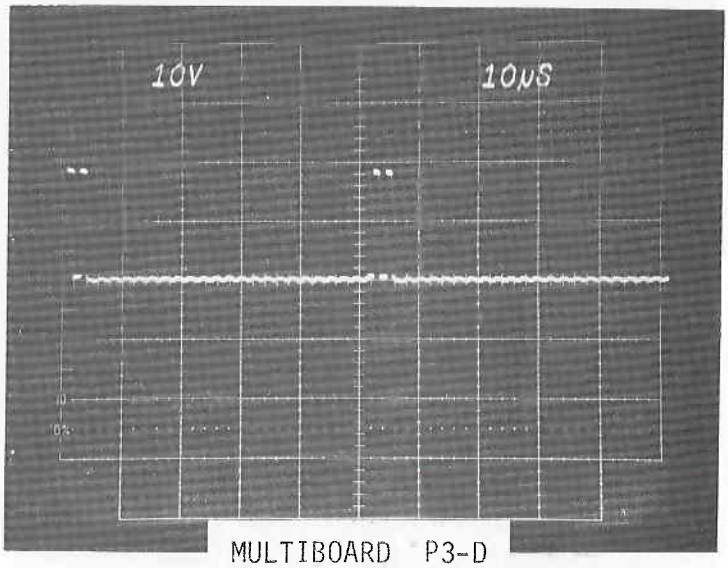
MULTIBOARD A3Q7 - COLLECTOR
CUT MODE



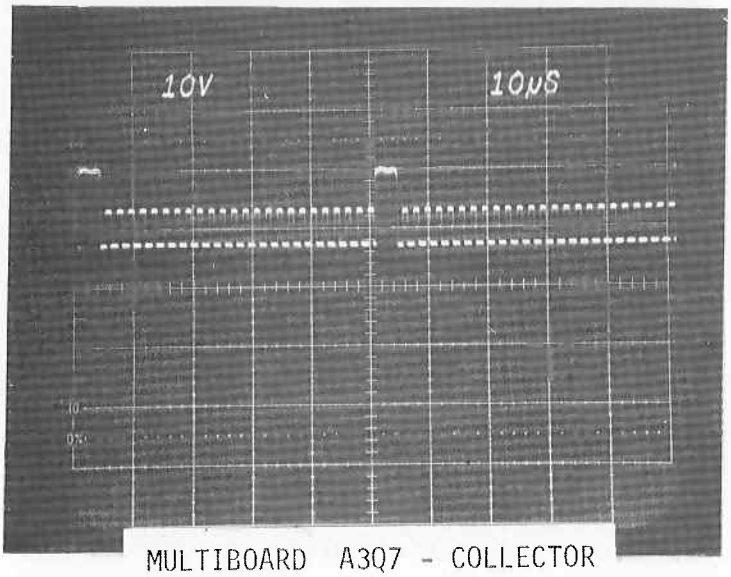
MULTIBOARD P3-F
CUT MODE



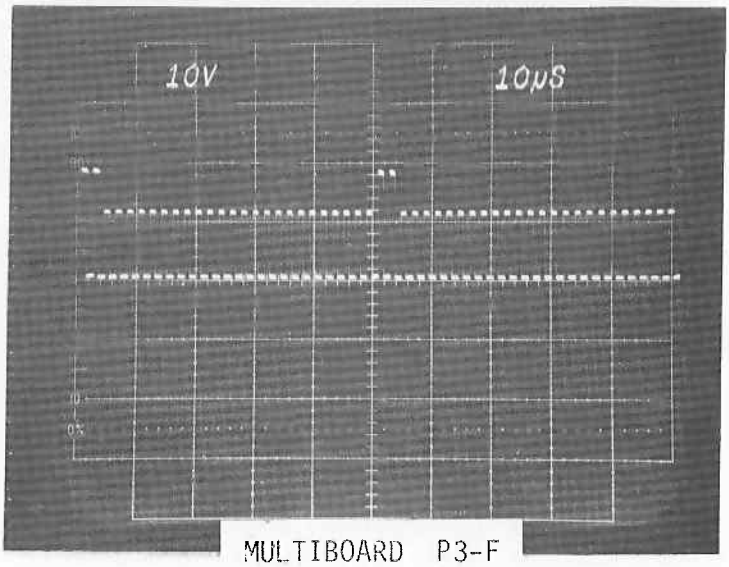
MULTIBOARD A3Q7 - COLLECTOR
COAG MODE



MULTIBOARD P3-D
COAG MODE

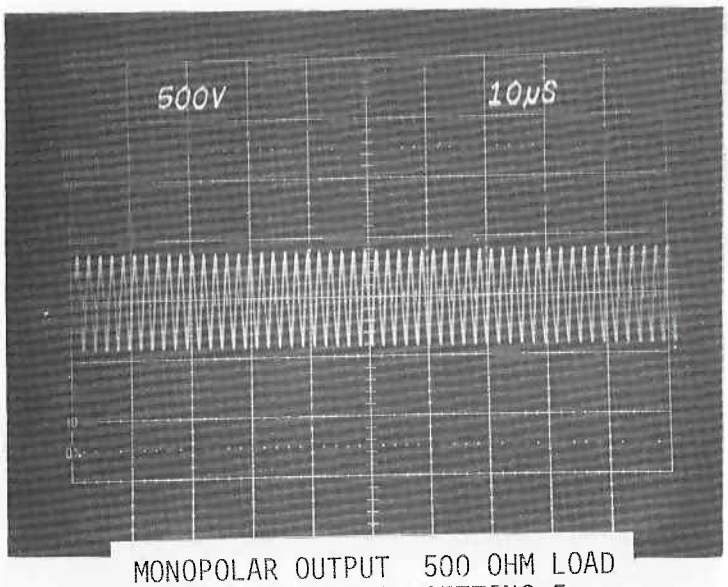


MULTIBOARD A3Q7 - COLLECTOR
BLEND MODE

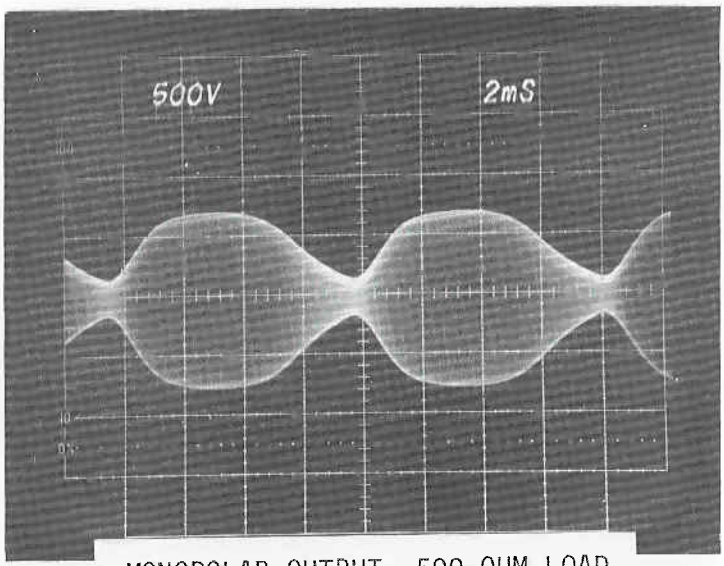


MULTIBOARD P3-F
BLEND MODE

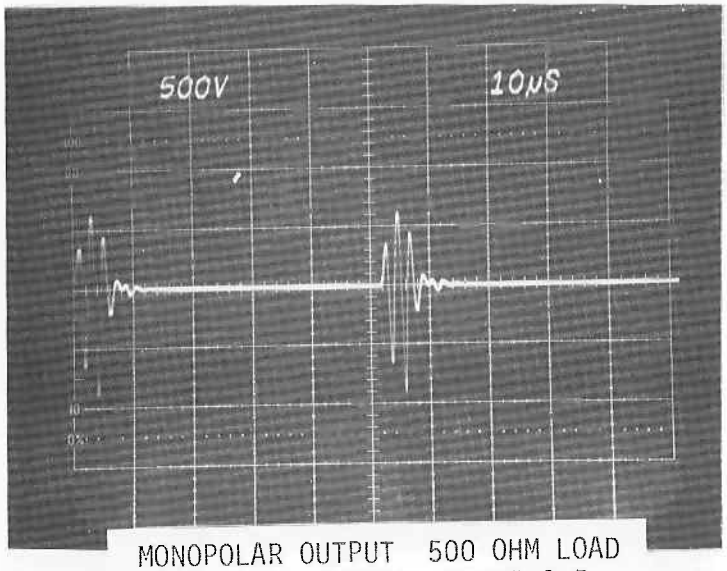
Figure 8 continued



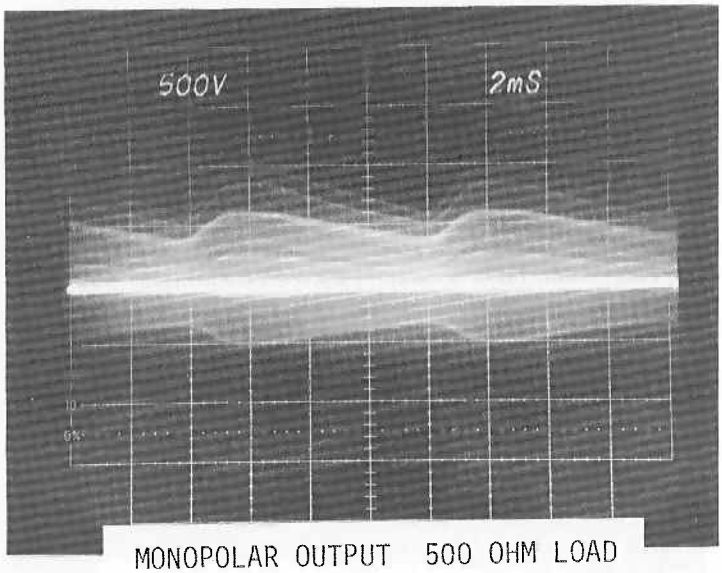
MONOPOLAR OUTPUT 500 OHM LOAD
CUT MODE CONTROL SETTING 5



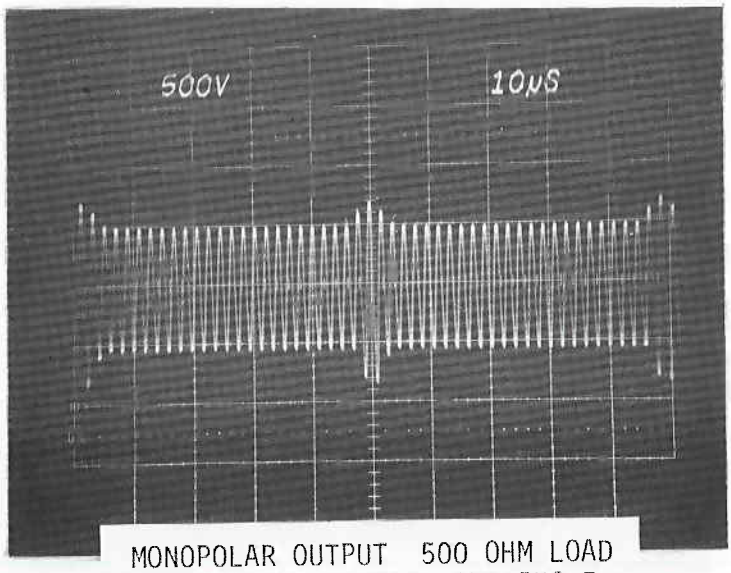
MONOPOLAR OUTPUT 500 OHM LOAD
CUT MODE CONTROL SETTING 10



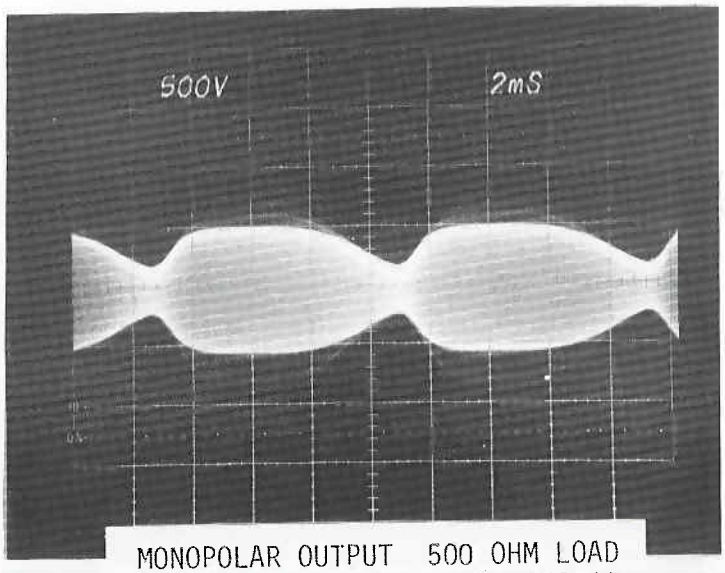
MONOPOLAR OUTPUT 500 OHM LOAD
COAG MODE CONTROL SETTING 5



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 10

Figure 8 continued

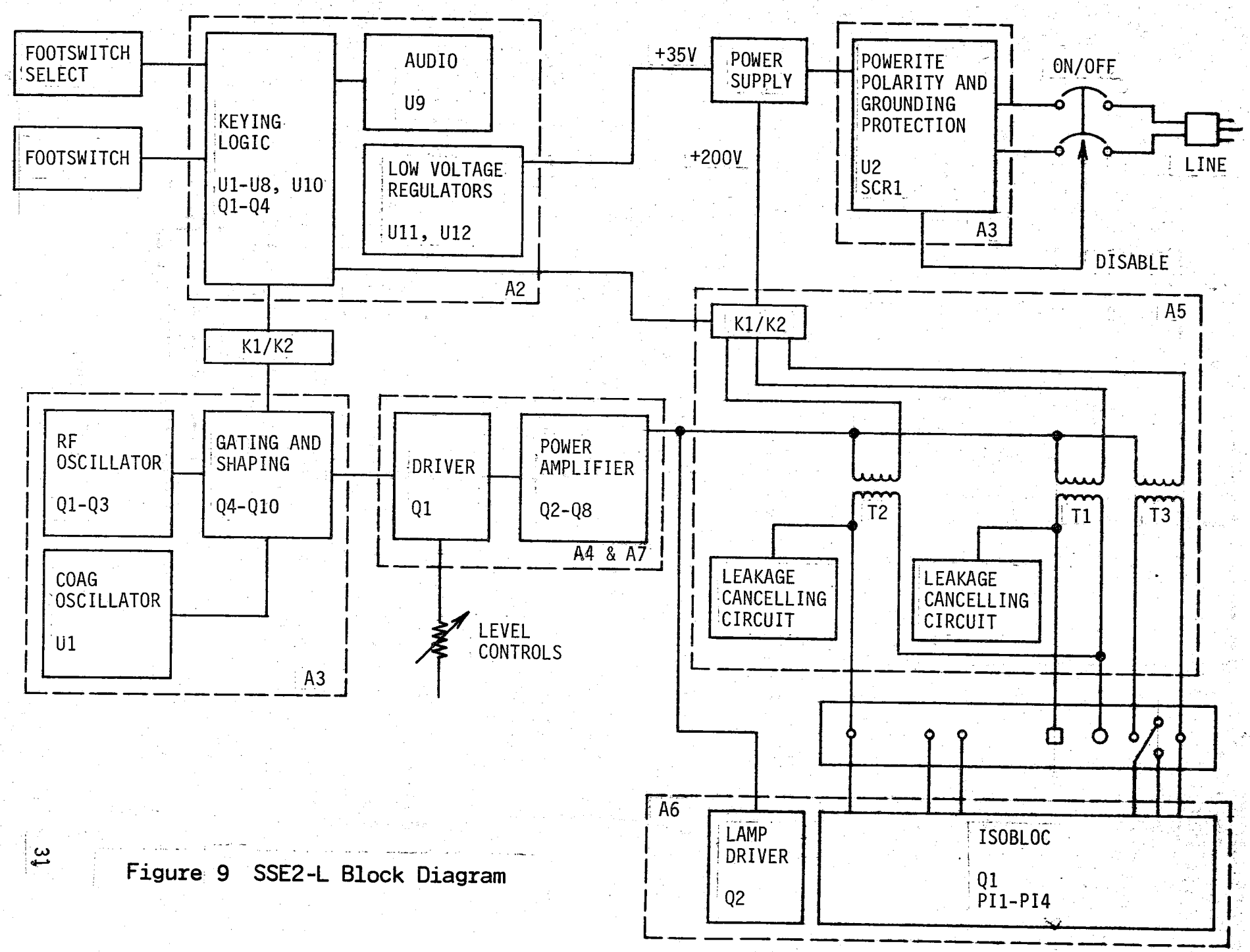


Figure 9 SSE2-L Block Diagram

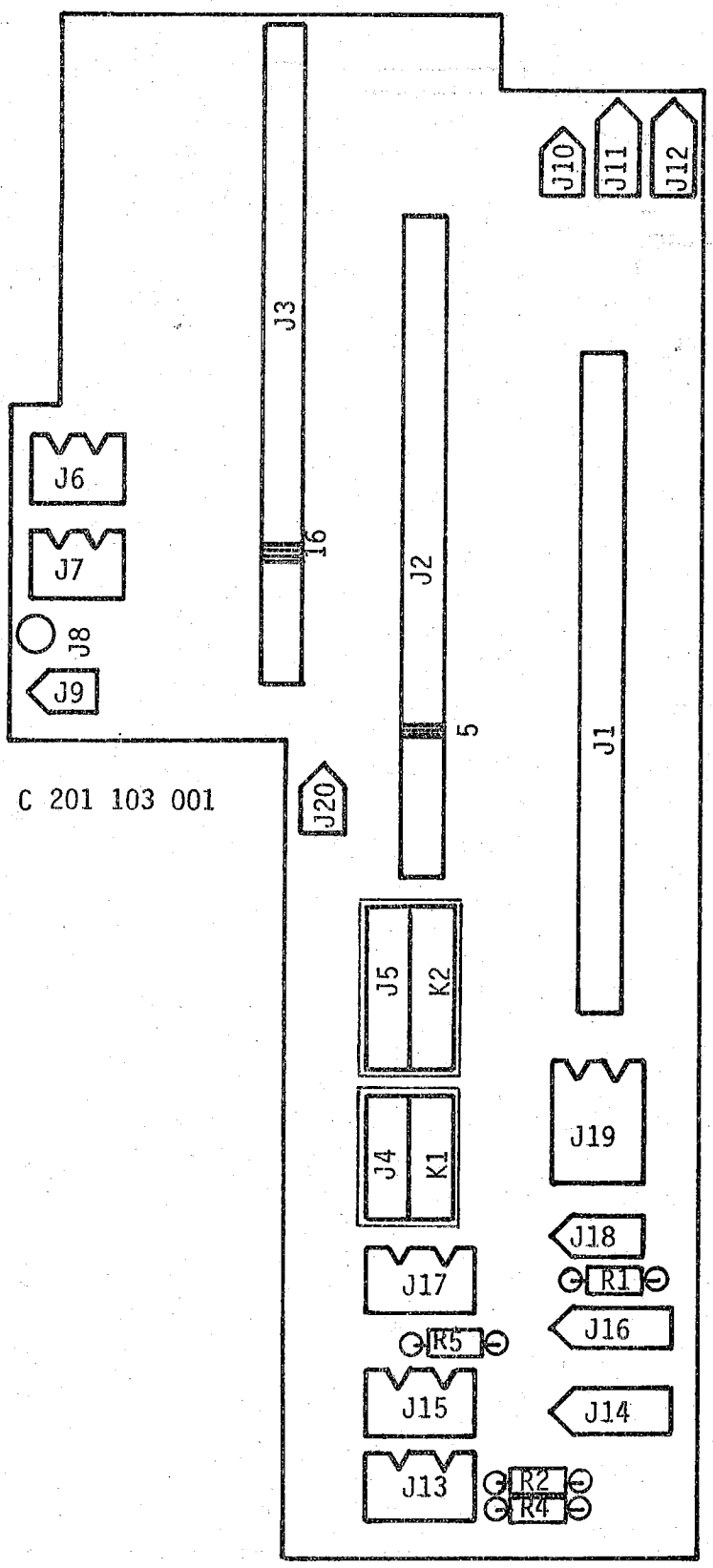
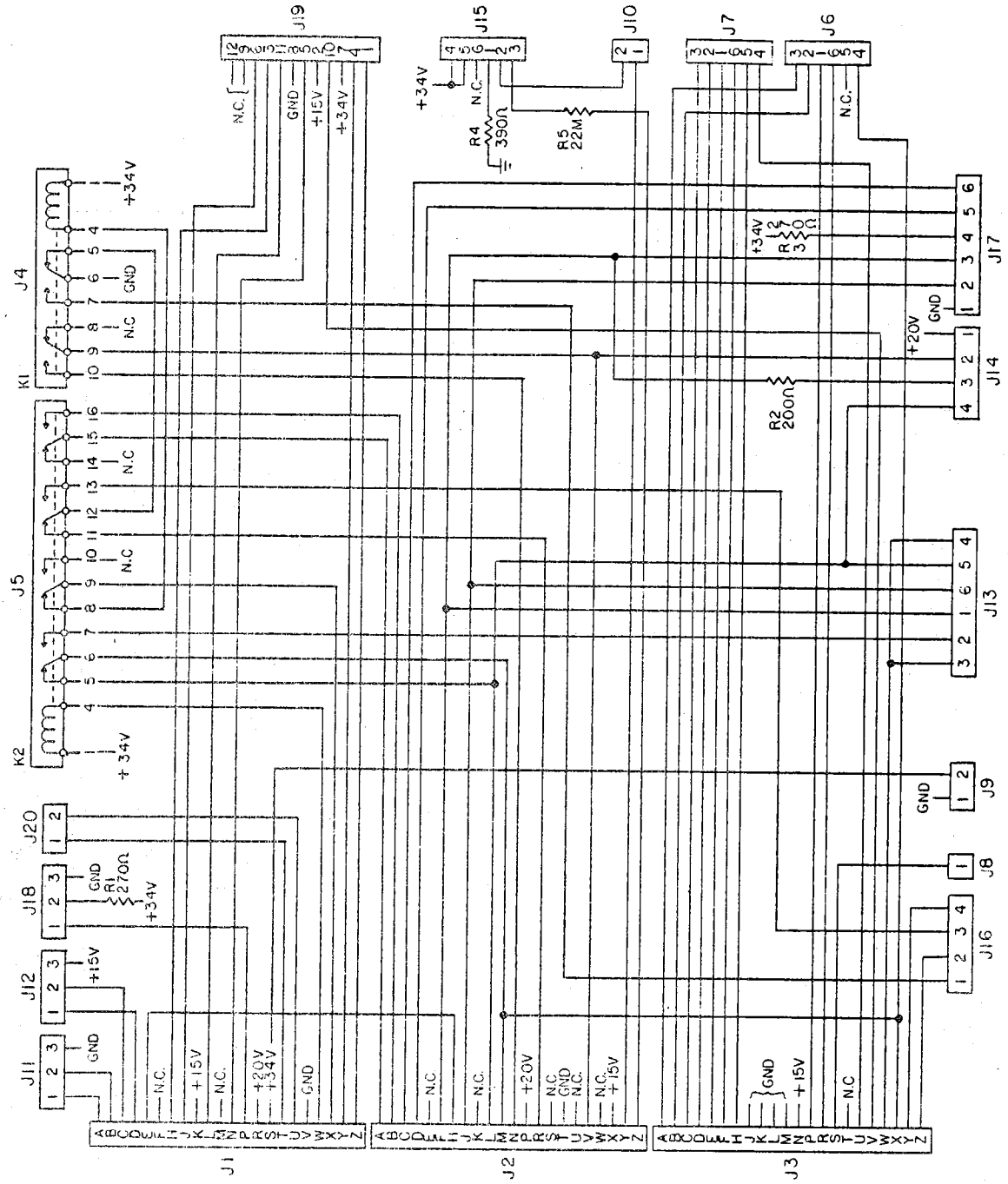


FIGURE 10

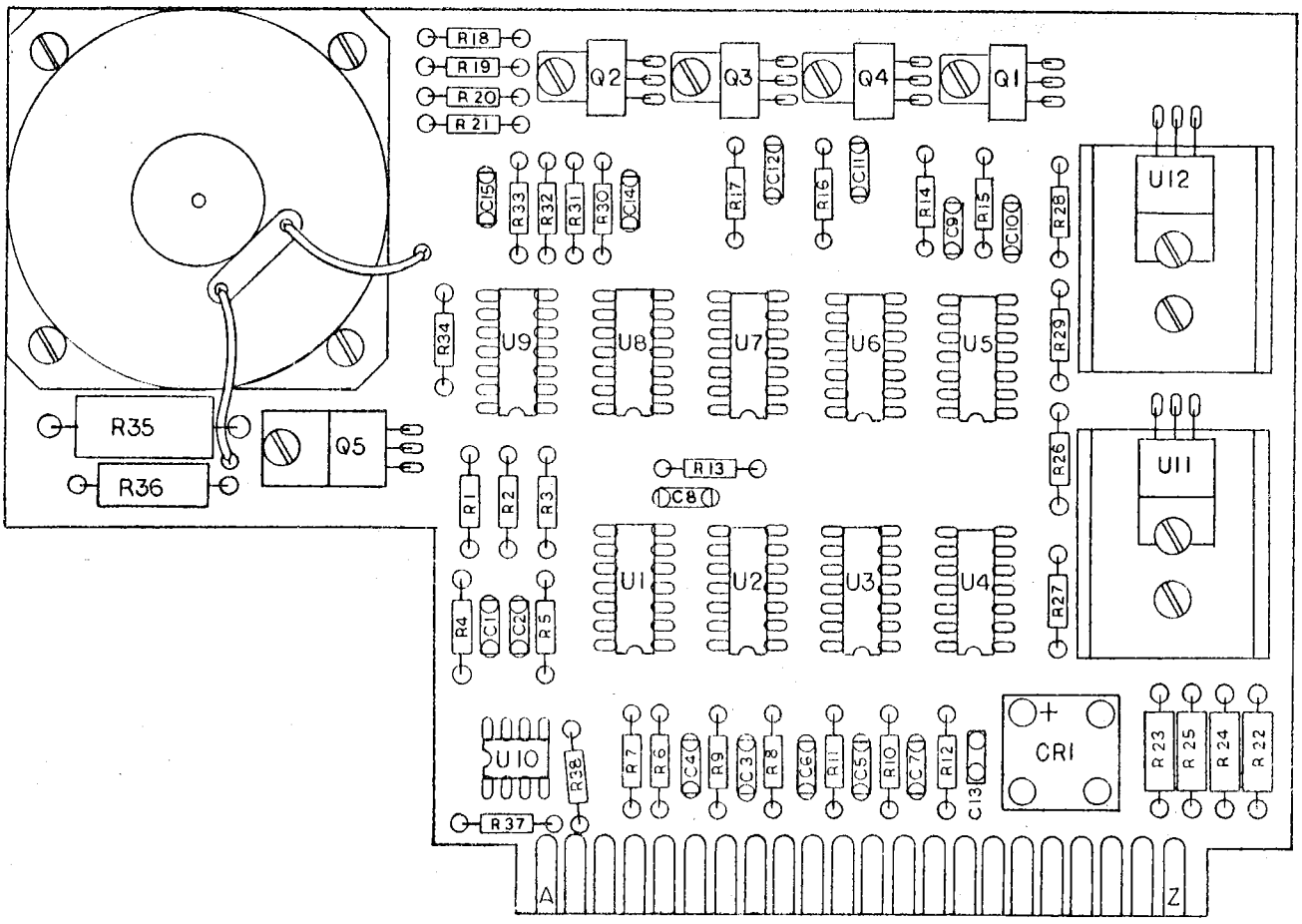
MASTER BOARD (A1)



C 938 103 000

FIGURE 11

MASTER BOARD SCHEMATIC (A1)



C 201 102 000

FIGURE 12

LOGIC BOARD (A2)

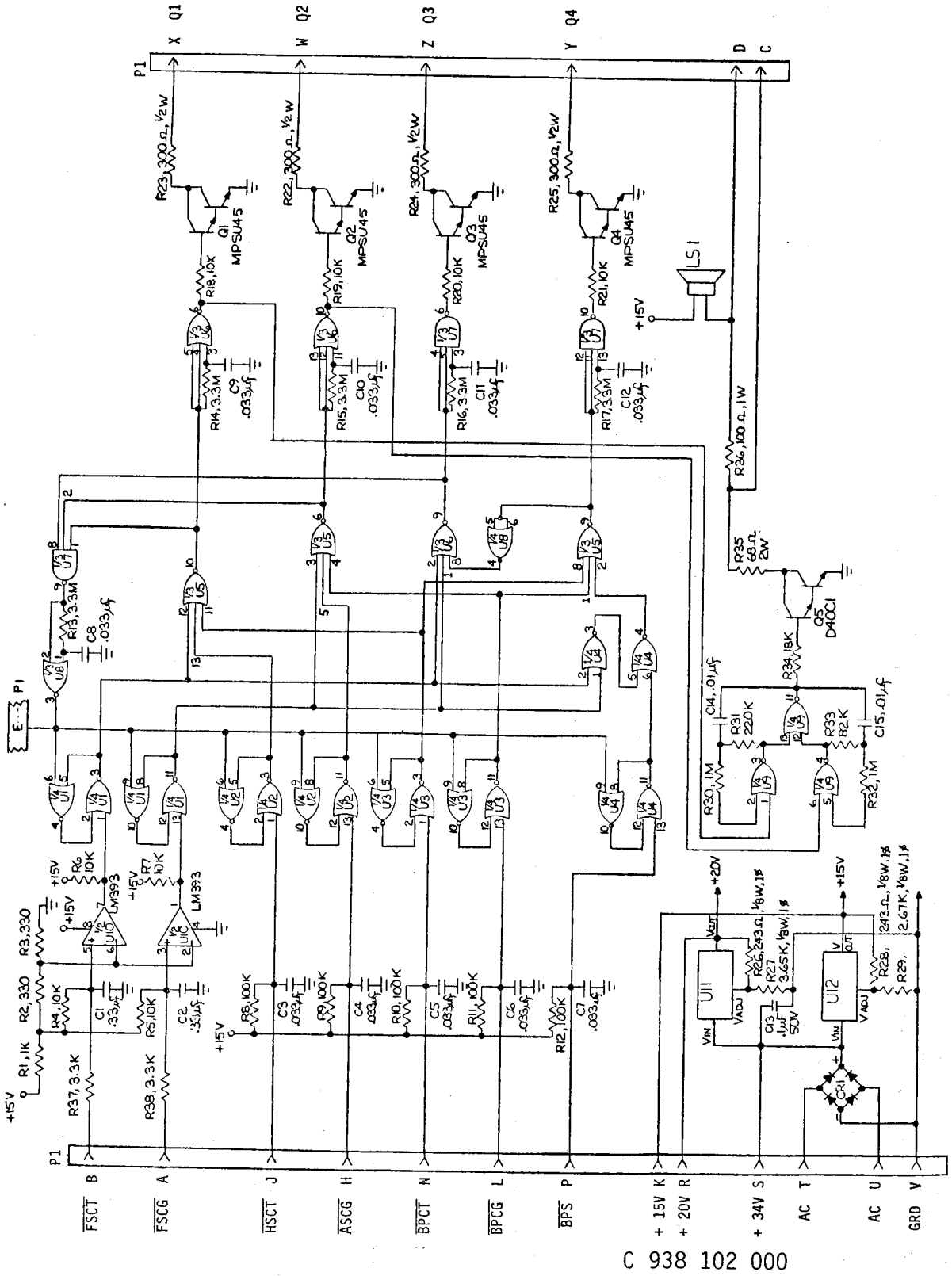
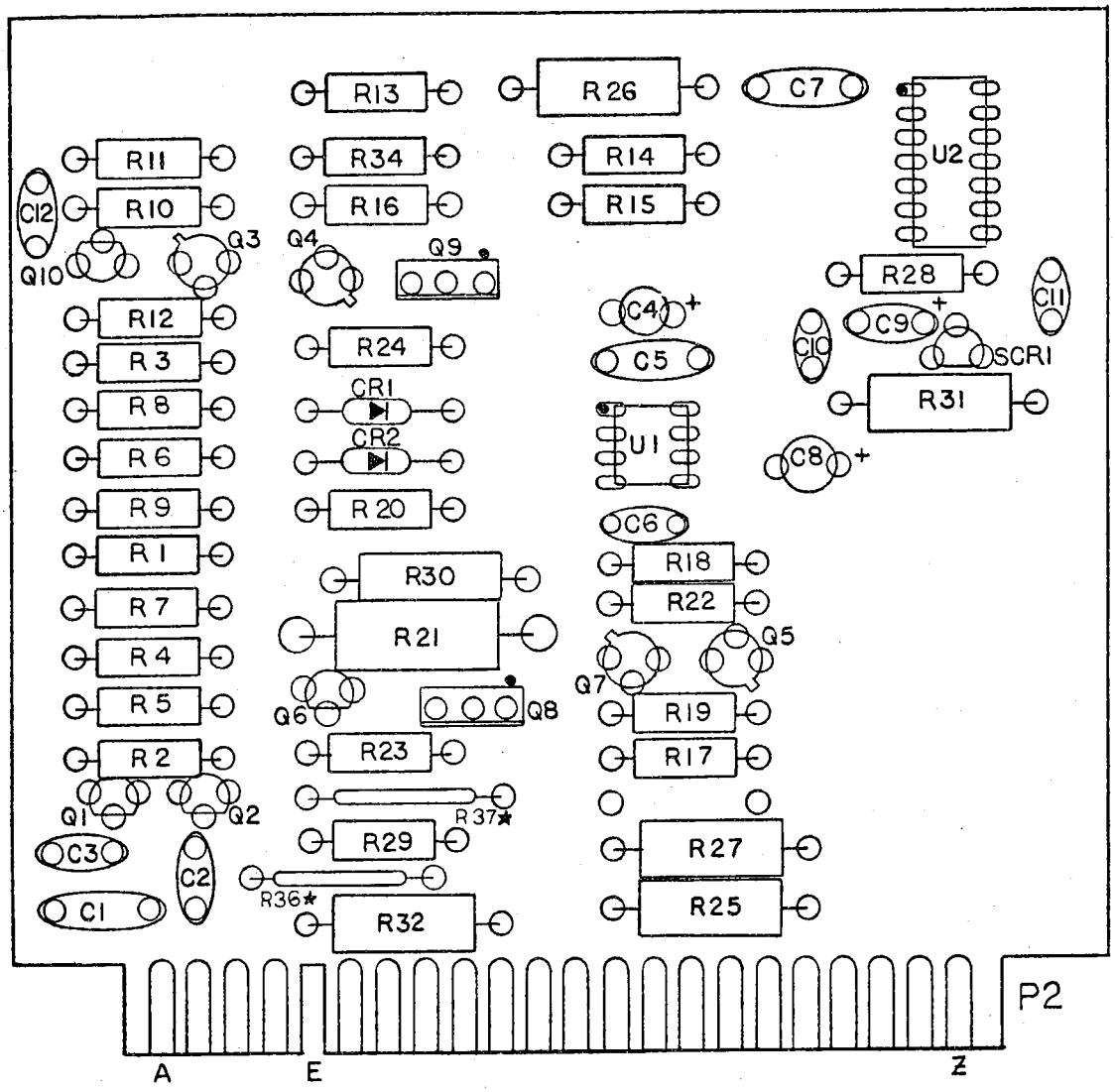


FIGURE 13

LOGIC BOARD SCHEMATIC (A2)

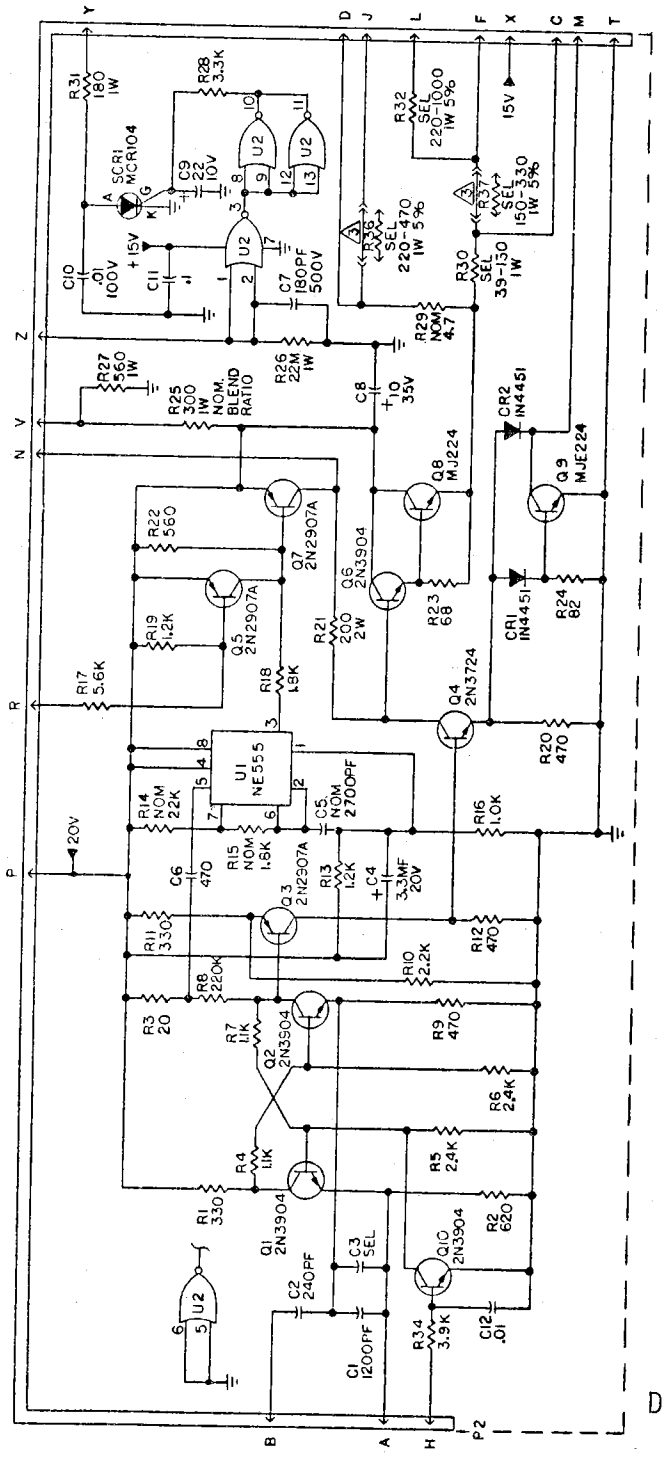


* See FIGURE 15, NOTE 3

C 201 108 000

FIGURE 14

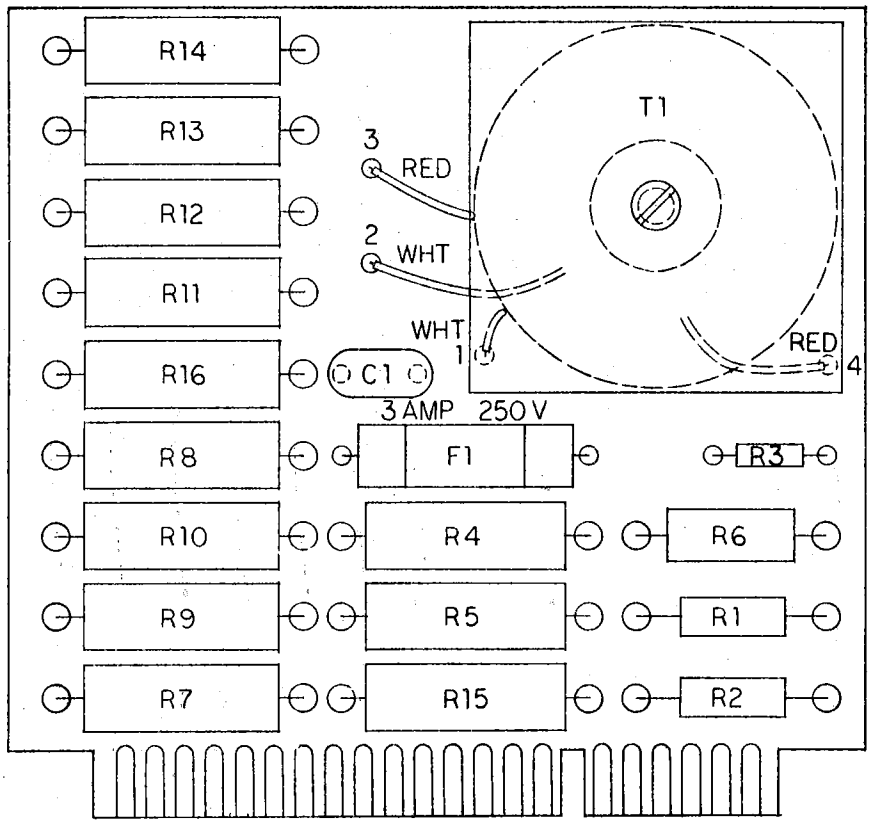
MULTIVIBRATOR BOARD (A3)



NOTES: 1. ALL RESISTOR VALUES ARE IN OHMS, ½W, +5%
2. ALL CAPACITOR VALUES ARE IN MICROFARADS
3. SHORTING WIRES ARE INSTALLED ON STANDARD UNITS. R36 & R37 ARE INSTALLED ON UNITS WITH HI-LO OPTION.

FIGURE 15

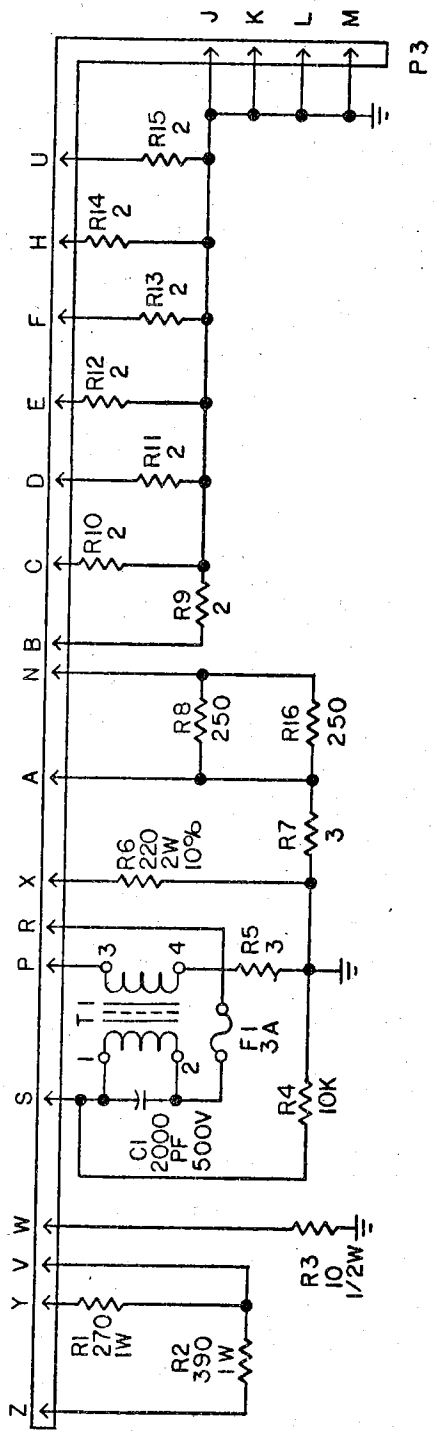
MULTIVIBRATOR BOARD SCHEMATIC (A3)



C 201 109 000

FIGURE 16

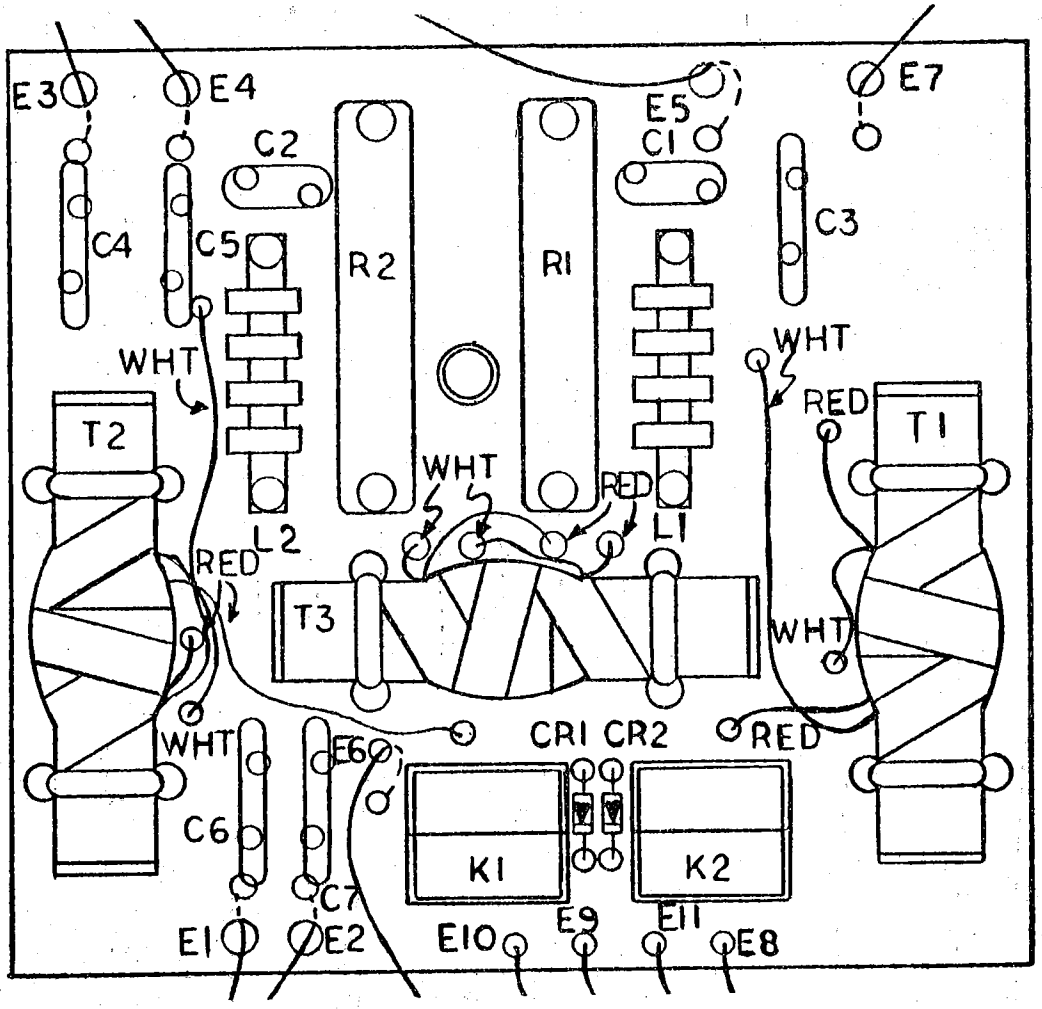
LIMIT RESISTOR BOARD (A4)



C 938 109 000

FIGURE 17

LIMIT RESISTOR BOARD SCHEMATIC (A4)



C 201 101 001

FIGURE 18

OUTPUT BOARD (A5)

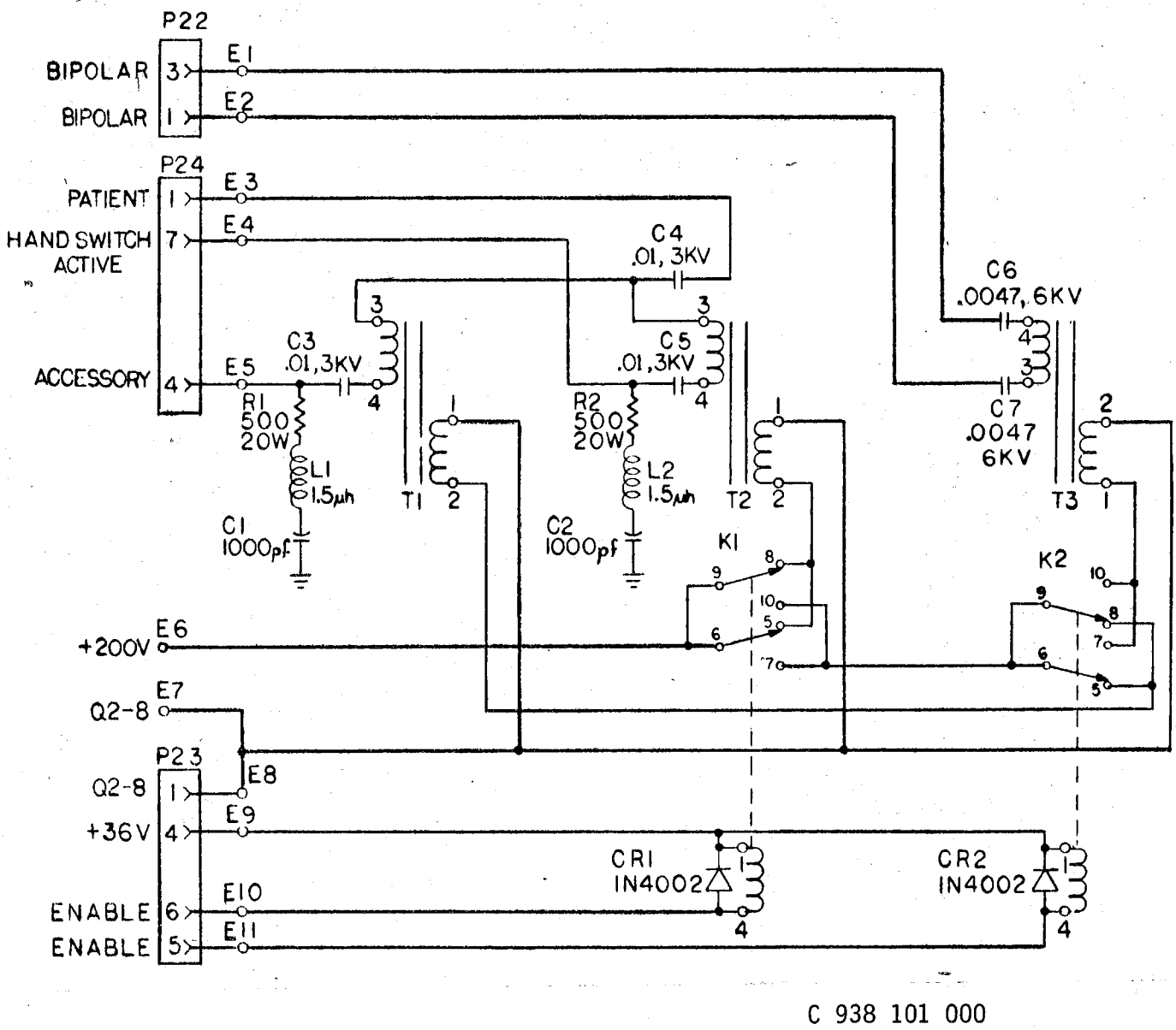
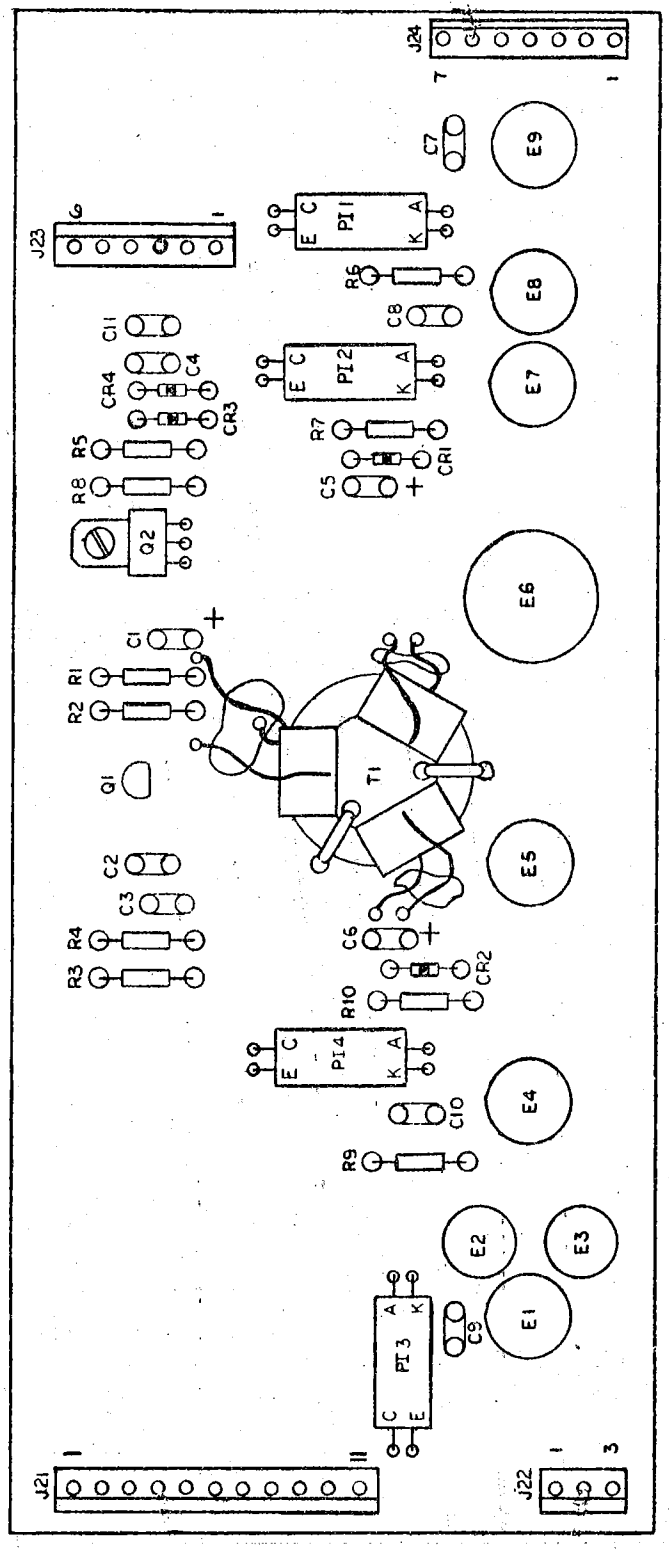


FIGURE 19

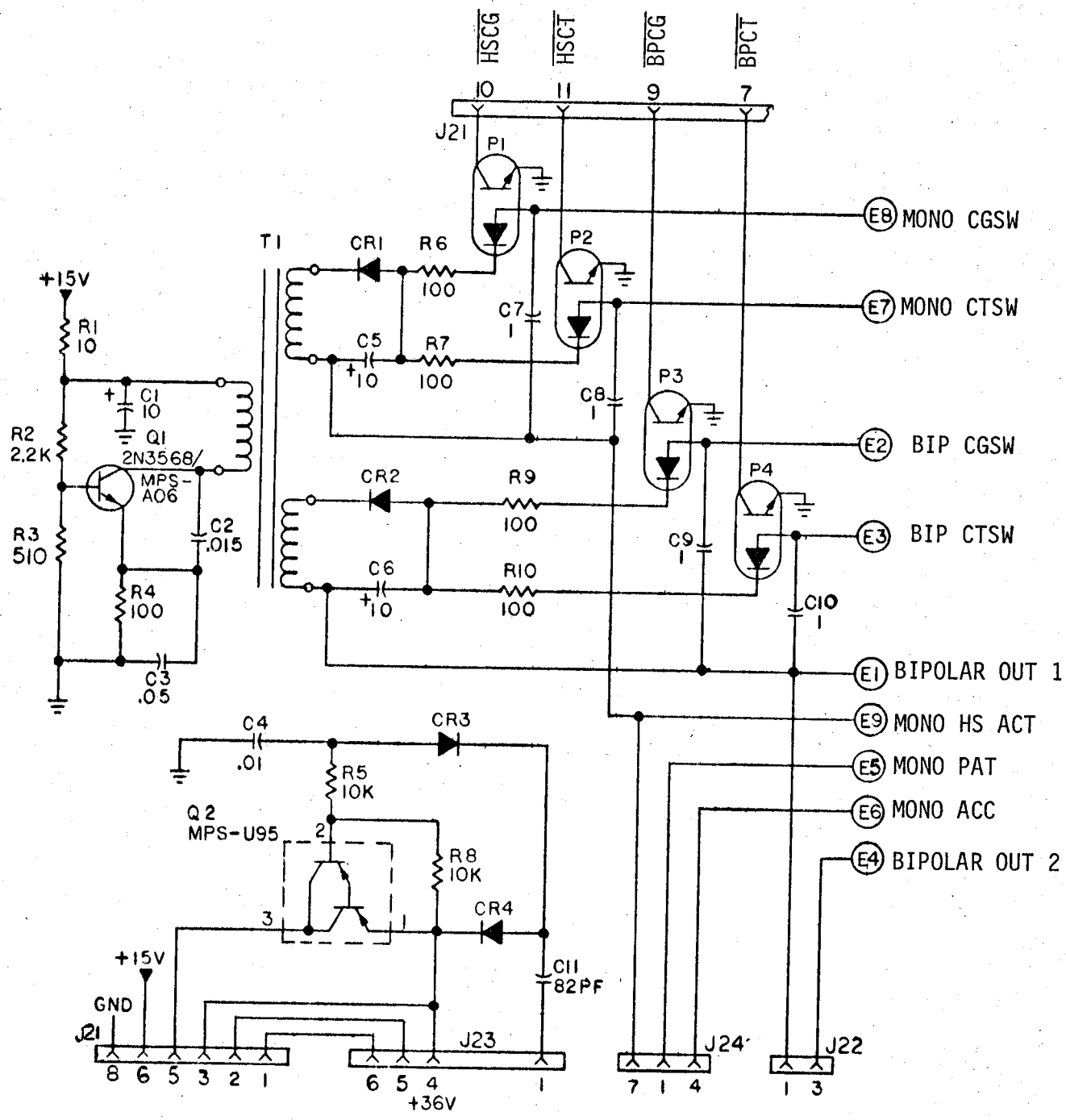
OUTPUT BOARD SCHEMATIC (A5)



D 201 100 001

FIGURE 20

ISOBLOC BOARD (A6)



C 938 100 000

FIGURE 21

ISOBLOC BOARD SCHEMATIC (A6)

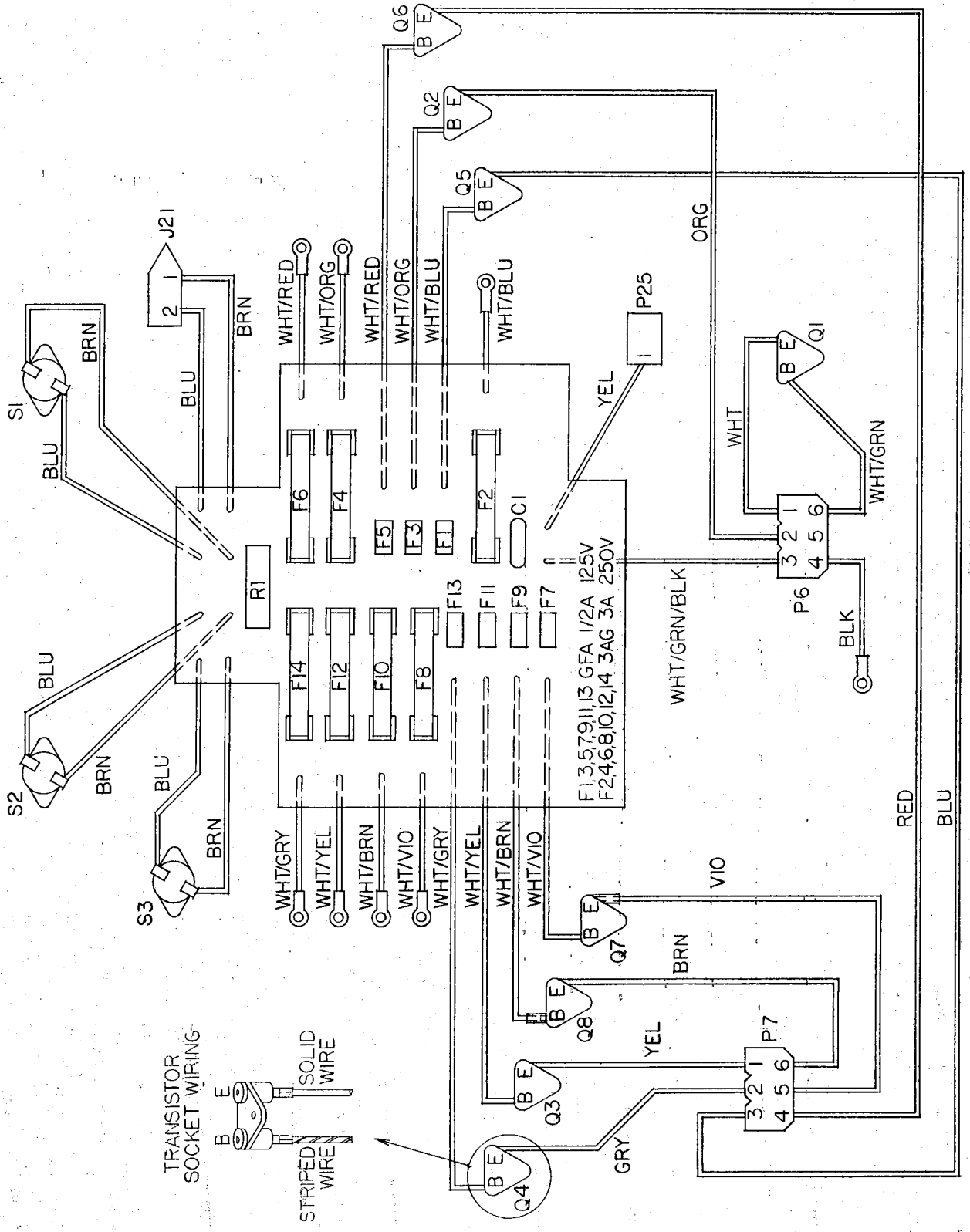
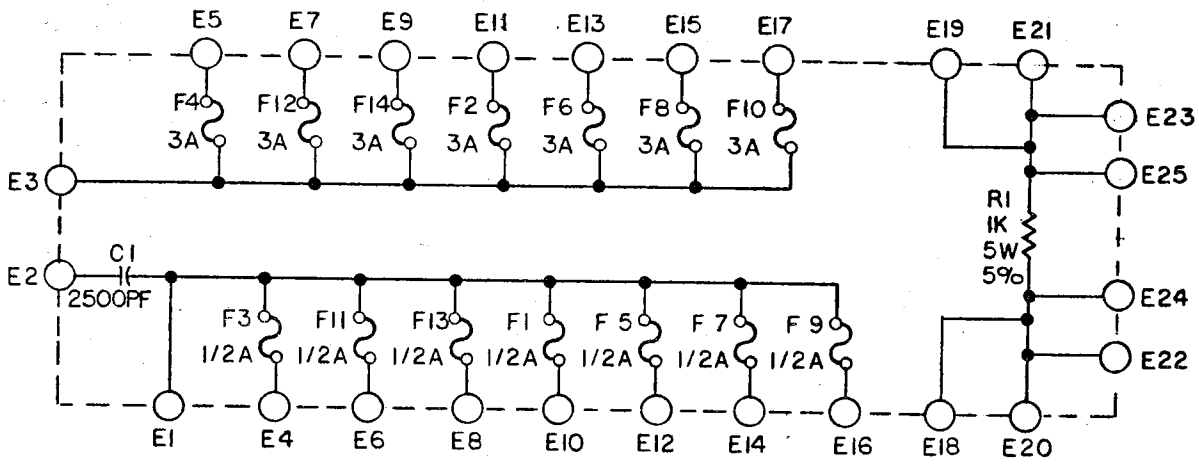


FIGURE 22

B 201 037 000

FUSE BOARD (A7)



C 938 037 000

FIGURE 23

FUSE BOARD SCHEMATIC (A7)

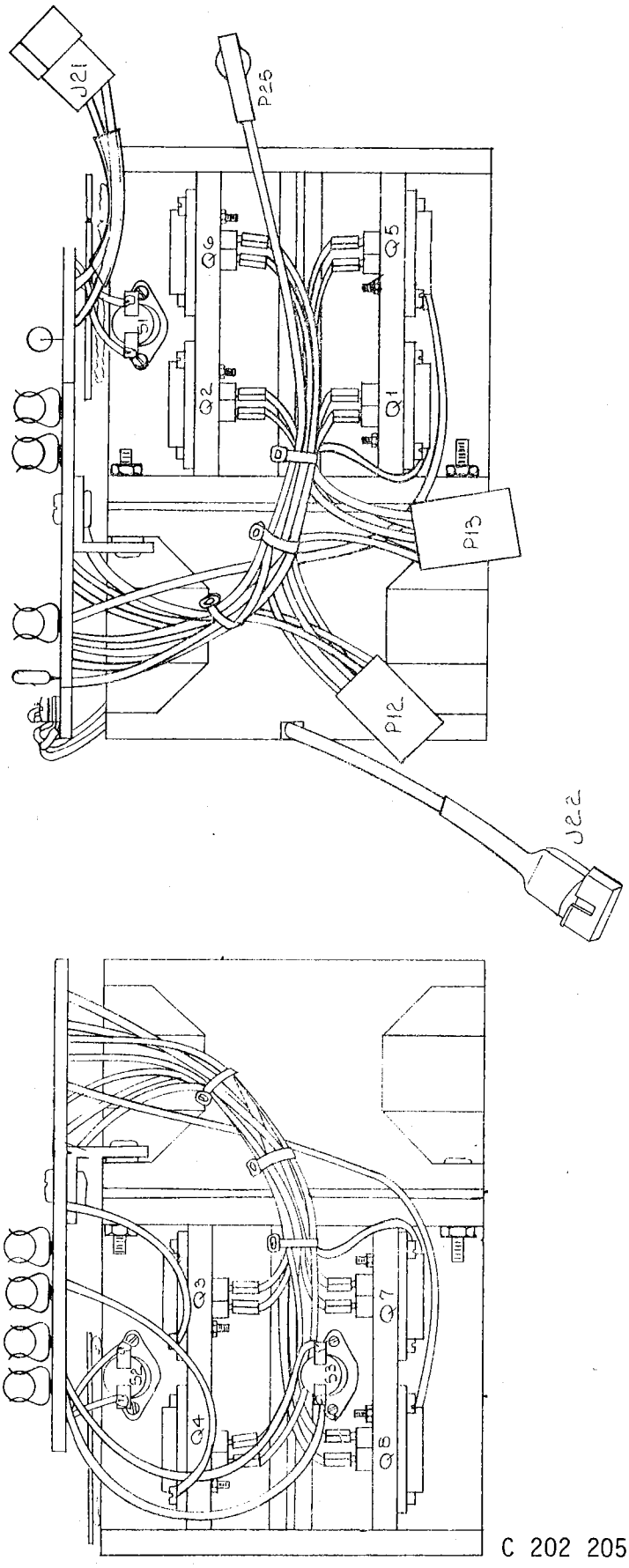
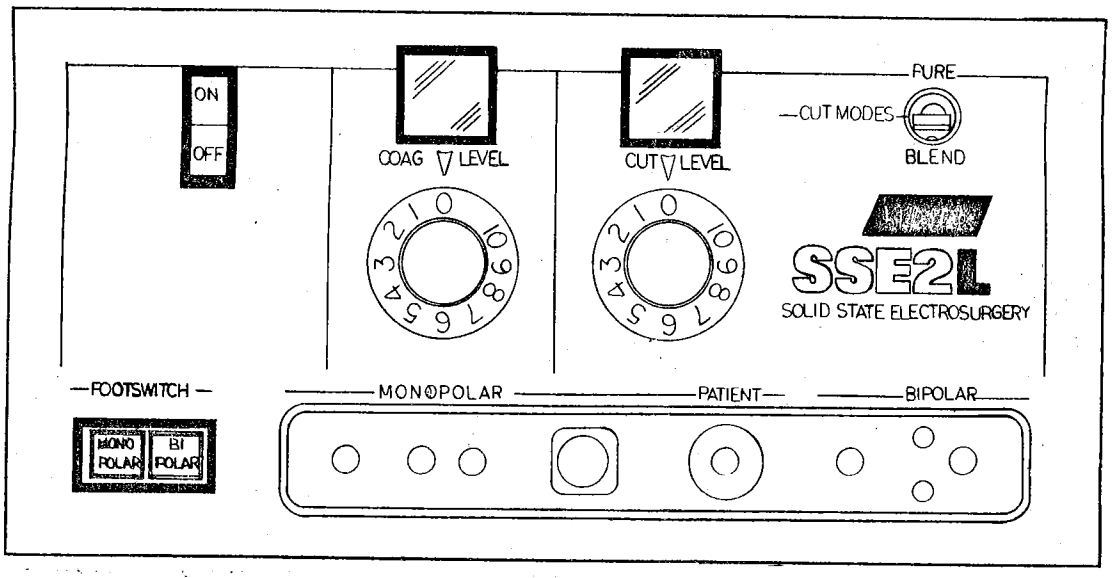
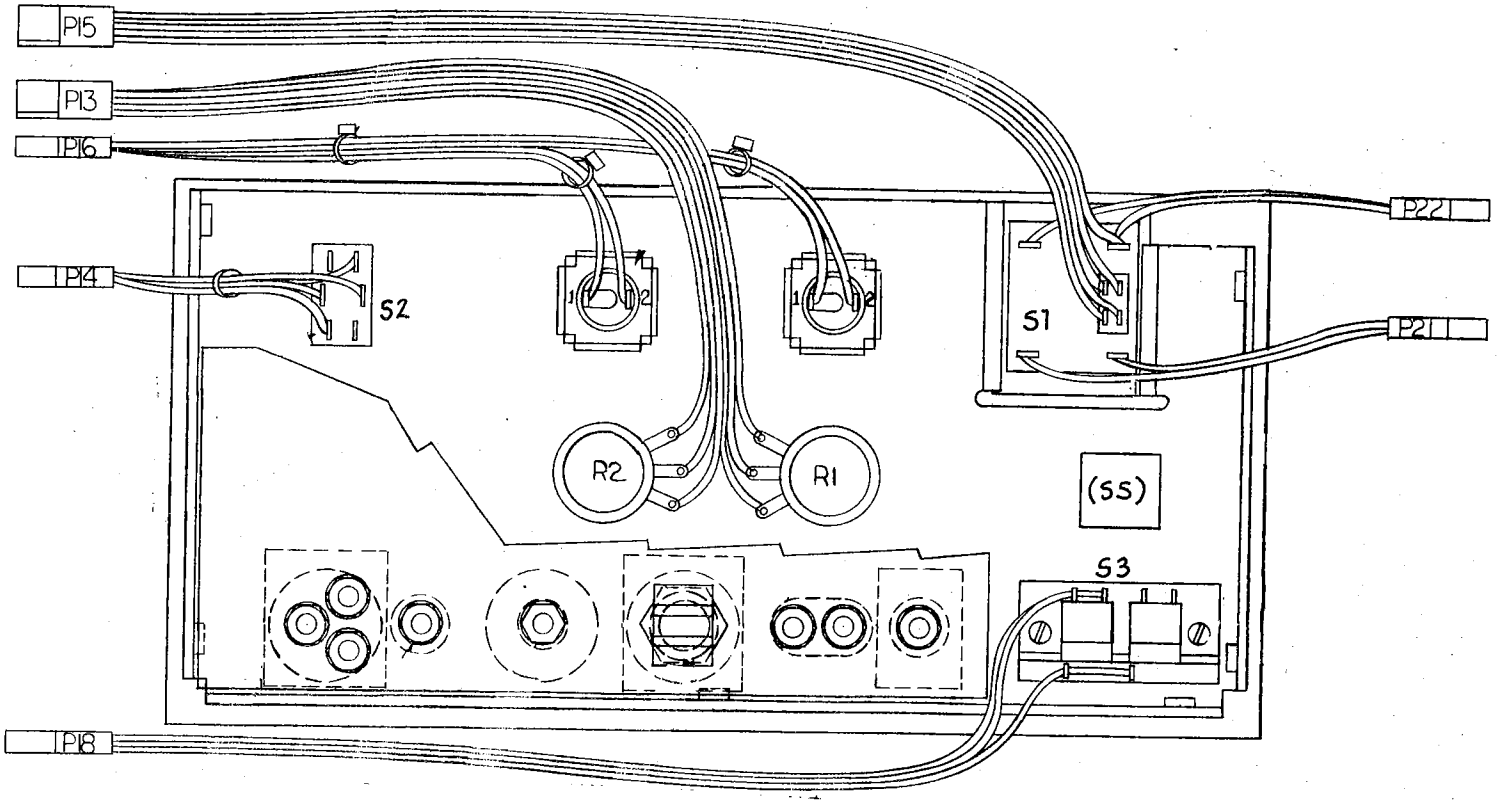


FIGURE 24
COOLER ASSEMBLY (A7)





D 202 700 045

FIGURE 25

FRONT PANEL ASSEMBLY

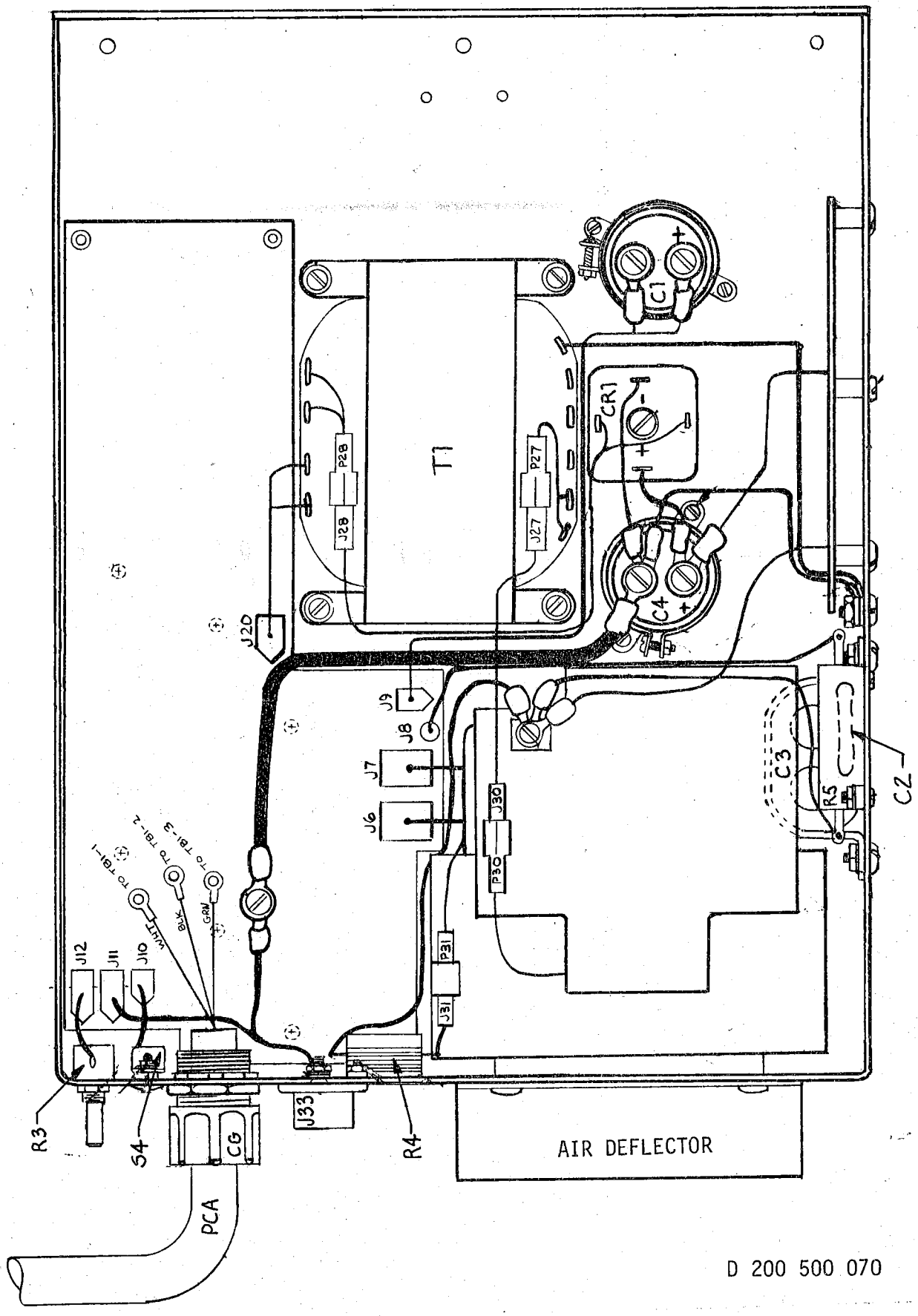


FIGURE 26
CHASSIS ASSEMBLY (A1)

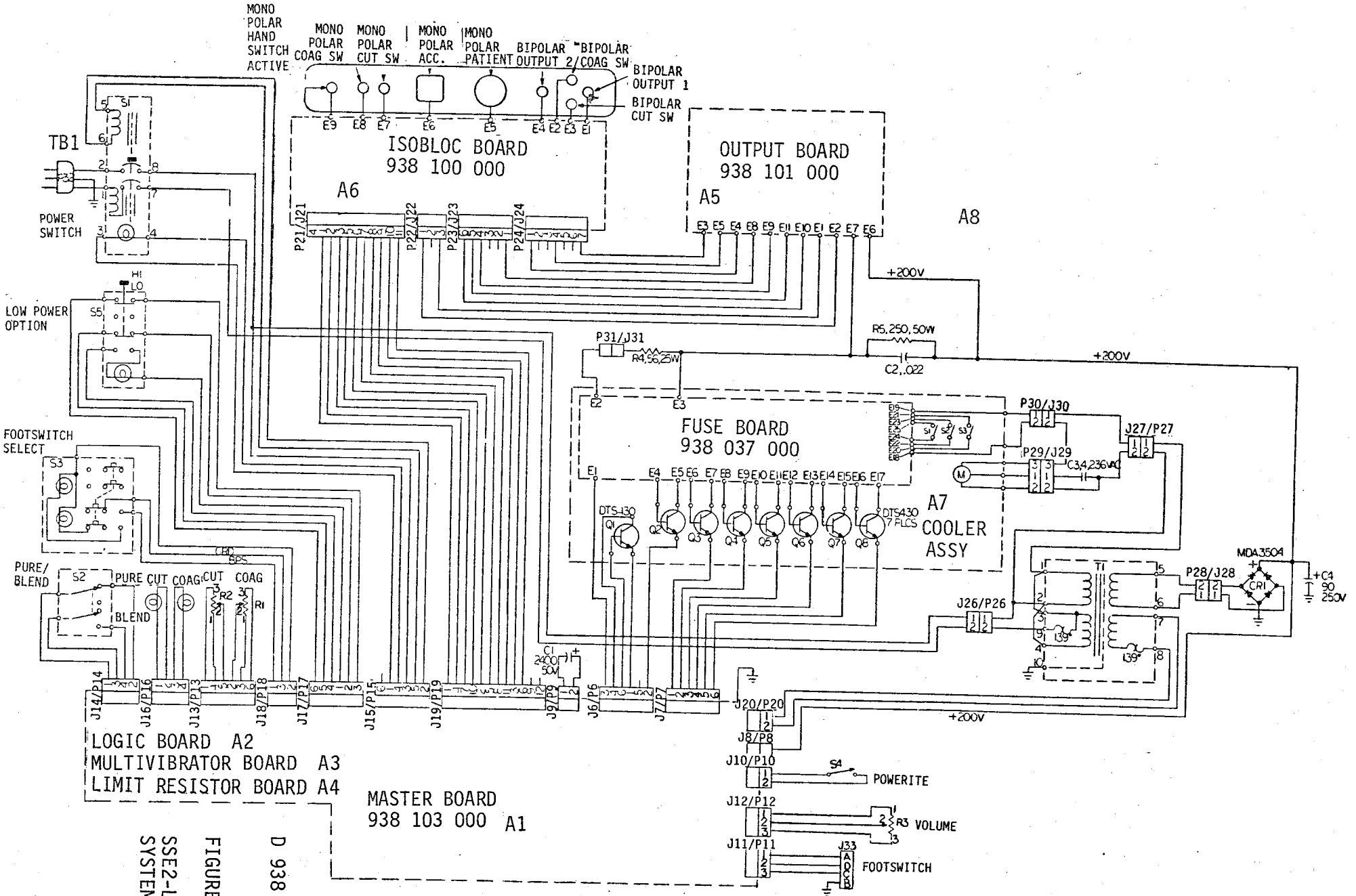


FIGURE 27
SSE2-L
SYSTEM SCHEM.
D 938 106 000

Section 9
Parts List

MASTER BOARD (A1) — C 201 103 001

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1, R3	Carbon 270 ohm 5% 1W	A 234 022 049
R2	Carbon 200 ohm 5% 1W	A 234 022 046
R4	Wire Wound 390 ohm 5% 31/3W	A 234 015 072
R5	Carbon 22M, 10% 1W	A 234 004 084
K1	Relay	A 230 005 007
K2	Relay	A 230 005 006

ASSY LOGIC BOARD (A2) — C 201 102 000

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1	Carbon 1K ohm 5% ¼W	A 234 024 063
R2, R3	Carbon 330 ohm 5% ¼W	A 234 024 051
R4,5,6,7,18,19,20,21	Carbon 10K ohm 5% ¼W	A 234 024 087
R8,9,10,11,12	Carbon 100K ohm 5% ¼W	A 234 024 111
R13,14,15,16,17	Carbon 3.3M ohm 5% ¼W	A 234 024 146
R22,23,24,25	Carbon 300 ohm 5% ½W	A 234 014 094
R26, R28	Film 243 ohm 1% 1/8W	A 234 201 230
R27	Film 3.65K ohm 1% 1/8W	A 234 201 343
R29	Film 2.67K ohm 1% 1/8W	A 234 201 330
R30, R32	Carbon 1M ohm 5% ¼W	A 234 024 135
R31	Carbon 220K ohm 5% ¼W	A 234 024 119
R33	Carbon 82K ohm 5% ¼W	A 234 024 109
R34	Carbon 18K ohm 5% ¼W	A 234 024 093
R35	Carbon 68 ohm 5% 2W	A 234 001 003
R36	Carbon 100 ohm 10% 1W	A 234 004 027
R37, R38	Carbon 3.3K ohm 5% ¼W	A 234 024 075
CAPACITORS		
C1, C2	Cap Mono. .33 ufd 20% 50V	A 204 118 011
C3,4,5,6,7,8,9,10,11,12	Cap Mono. .033ufd 20% 16V	A 204 123 003
C13	Cap Mono. .1ufd 20% 50V	A 204 118 007
C14, C15	Cap Ceramic .01ufd 20% 100V	A 204 049 001

ASSY LOGIC BOARD (A2) (CONTD)		C 201 102 000
INTEGRATED CIRCUITS		
U1,2,3,4,8,	IC Quad 2input nor gate	A 210 007 000
U5, U6	IC Triple 3input nor gate	A 210 017 000
U7	IC Triple 3input nand gate	A 210 002 000
U10	IC Dual Comparator	A 210 300 011
U11, U12	IC Voltage Regulator	A 210 400 001
U9	IC Quad 2input nand gate	A 210 003 000
DIODES		
CR1	Rectifier VS247	A 239 006 000
TRANSISTORS		
Q1,2,3,4	Transistor MPS-U45	A 239 100 002
Q5	Transistor D40C1	A 239 037 001
MISCELLANEOUS		
LS1	Speaker 8 ohm 2" sq	A 241 003 001

MULTIVIBRATOR BOARD (A3)		C 201 108 000
REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1, 11	Resistor 330ohm ½W 5%	A 234 014 036
R2	Resistor 620ohm ½W 5%	A 234 014 040
R3	Resistor 20ohm ½W 5%	A 234 014 074
R4, R7	Resistor 1.1K ½W 5%	A 234 014 022
R5, R6	Resistor 2.4K ½W 5%	A 234 014 018
R8	Resistor 220ohm ½W 5%	A 234 014 034
R9,12,20	Resistor 470ohm ½W 5%	A 234 014 038
R10	Resistor 2.2K ½W 5%	A 234 014 103
R13, R19	Resistor 1.2K ½W 5%	A 234 014 041
R14	Resistor 22K ½W 5% NOMINAL	A 234 014 005
R15, R18	Resistor 1.8K ½W 5%	A 234 014 042
R16	Resistor 1.0K ½W 5%	A 234 014 001
R17	Resistor 5.6K ½W 5%	A 234 014 014
R21	Resistor 200ohm 2W 5% (TYPE OMITE 995)	A 234 001 034
R22	Resistor 560ohm ½W 5%	A 234 014 039
R23	Resistor 68ohm ½W 5%	A 234 014 032

MULTIVIBRATOR BOARD (A3) (CONTD) C 201 108 000

RESISTORS

R24	Resistor 82ohm ½W 5%	A 234 014 033
R25	Resistor 300 ohm 1W 5% NOMINAL	A 234 022 050
R26	Resistor 22meg 1W 10%	A 234 004 084
R27	Resistor 560ohm 1W 5%	A 234 022 057
R28	Resistor 3.3K ½W 5%	A 234 014 025
R29	Resistor carbon 4.7ohm 5% ½W NOMINAL	A 234 014 060
R30	Resistor SELECT 1W 5%	A 234 022 select
R31	Resistor 180 ohm 1W 10%	A 234 004 030
R32	Resistor SELECT 1w 5%	A 234 022 select
R34	Resistor 3.9K ½W 10%	A 234 005 036

CAPACITORS

C1	Cap 1200pf 500V min 5%	A 204 105 028
C2	Cap 240pf 500V 5%	A 204 105 011
C3	Cap 500pf5% SELECT	A 204 105 select
C4	Cap 3.3uf 35WV 20% TANT	A 204 104 045
C5	Cap 2700pf 500V min 5% NOMINAL	A 204 105 036
C6	Cap 470pf 100V min 5%	A 204 106 027
C7	Cap 180pf 500V 5%	A 204 105 008
C8	Cap 10uf, 35WV 20% TANT	A 204 104 048
C9	Cap 22uf, 10V 10%	A 204 111 003
C10, C12	Cap 01uf 100V 20%	A 204 049 001
C11	Cap 0.1uf 100V 5%	A 204 121 048

INTEGRATED CIRCUITS

U1	IC Timer	A 210 006 000
U2	IC Quad 2 input nor gate	A 210 011 000

DIODES

CR1, CR2	Diode 1N4451	A 239 050 000

TRANSISTORS

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

MISCELLANEOUS

SCR1	Silicone Controlled Rectifier	A 239 059 000

LIMIT RESISTOR BOARD (A4)		C 201 109 000
REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1	Resistor 270ohm 1W 5%	A 234 022 049
R2	Resistor 390ohm 1W 5%	A 234 022 053
R3	Resistor 10ohm ½W 10%	A 234 005 056
R4	Resistor 10K ohm 8W ± 5%	A 234 000 012
R5, R7	Resistor 3 ohm 8W ± 5%	A 234 000 004
R6	Resistor 220ohm 2W ± 10%	A 234 002 002
R8, R16	Resistor 250ohm 8W 5%	A 234 000 018
R9,10,11,12,13,14,15	Resistor 2ohm 8W ± 5%	A 234 000 003
CAPACITORS		
C1	Cap. 2000pf 500V 5%	A 204 105 033
MISCELLANEOUS		
T1	Toroid Assy - Driver	A 202 188 000
F1	Fuse 3amp 250V 3AG3	A 215 019 021

OUTPUT BOARD (A5)		C 201 101 001
REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1, R2	Resistor 500 5% 20W	A 234 023 018
CAPACITORS		
C1, C2	Capacitor .001uf 6KV	A 204 025 041
C3,4,5	Capacitor .01uf 3KV	A 204 113 063
C6, C7	Cap. Cer. .0047uf 20% 6KV	A 204 025 050
DIODES		
CR1, CR2	Diode - IN4002	A 239 092 002
MISCELLANEOUS		
K1, K2	Relay	A 230 005 005
L1, L2	Inductor 1.5uh	A 251 029 011

ISOBLOC BOARD (A6) D 201 100 001

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1	Carbon 10ohm 5% ¼W	A 234 024 015
R2	Carbon 2.2Kohm 5% ¼W	A 234 024 071
R3	Carbon 510ohm 5% ¼W	A 234 024 056
R4,6,7,9,10	Carbon 100ohm 5% ¼W	A 234 024 039
R8	Carbon 10Kohm 5% ¼W	A 234 024 087
CAPACITORS		
C1,5,6	Cap TANT 10ufd 10% 20V	A 204 055 002
C2	Cap MONO .015ufd 20% 50V	A 204 118 002
C3	Cap CERAMIC .05uf 20% 16V	A 204 123 004
C4	Cap CERAMIC .01ufd 20% 100V	A 204 049 001
C7,8,9,10	Cap MONO 1ufd 20% 50V	A 204 121 082
C11	Cap CERAMIC 82pf 10% 1000V	A 204 079 025
DIODES		
CR1,2,3,4,	Diode IN4148	A 239 014 000
TRANSISTORS		
Q1	Transistor 2N3568	A 239 017 000
	Transistor MPS-A06(Alternate)	A 239 093 002
Q2	Transistor MPSU95	A 239 078 000
MISCELLANEOUS		
P1,2,3,4	Photo/Isolator OPI-120	A 239 069 000
T1	Toriod Assy	A 202 224 000

ASSY FUSE BOARD (A7) B 201 037 000

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1	Resistor 1K 5W 5%	A 234 027 088

ASSY FUSE BOARD (A7) (CONTD)		B 201 037 000
CAPACITORS		
C1	Capacitor 2500pf 500WV 5%	A 204 105 044
MISCELLANEOUS		
F1,3,5,7,9,11,13	Fuse ½A 125V GFA	A 215 017 012
F2,4,6,8,10,12,14	Fuse 3A 250V 3AG	A 215 005 005
S1,2,3	Thermostat-Snap Action Prec	A 240 001 004

CHASSIS ASSEMBLY (A8) D 200 500 070

REFERENCE DESIGNATION	DESCRIPTION	VALLEYLAB PART NUMBER
RESISTORS		
R1,2	Potentiometer 250ohm, 2W	A 236 003 005
R3	Potentiometer 100ohm, 2W	A 236 006 000
R4	Wirewound 56ohm, 25W	A 234 020 002
R5	Wirewound 250ohm, 50W	A 234 003 003
CAPACITORS		
C1	Electrolytic 2400uf, 50V	A 204 500 025
C2	Silver Mica .022uf, 500V	A 204 002 001
C3	Motor Running 4uf, 236V	A 204 100 000
C4	Electrolytic 90uf, 250V	A 204 061 001
DIODES		
CR1	Rectifier MDA3504	A 239 700 003
SWITCHES		
S1	Power Switch/Circuit Breaker	A 243 017 007
S2	Pure/Blend	A 243 001 000
S3	Footswitch Select	A 243 031 000
S4	Powerite	A 243 013 004
S5	Low Power (OPTION)	A 243 010 000
TRANSFORMERS		
T1	Power Transformer	A 251 200 006

CHASSIS ASSEMBLY (A8) (CONTD)		D 200 500 070
MISCELLANEOUS (FRONT PANEL)		
DS1	Coag Indicator Assembly	A 202 700 047
DS2	Cut Indicator Assembly	A 202 700 059
RL1,2	Lamp - Cut/Coag Indicator	A 215 000 000
RL3	Lamp - Powerswitch	A 215 021 028
	Panel Jack Assembly	A 202 700 060
	Knob	A 213 054 004
MISCELLANEOUS (REAR PANEL)		
J33	Footswitch Connector	A 208 071 000
	Power Cord Assembly	A 202 400 106
	Power Plug Only	A 208 104 000
	Cord Grip	A 213 077 006
	Air Deflector	A 222 499 000
	Plug Button	A 222 026 003
COOLER ASSEMBLY (A7)		C 202 205 000
Heatsink Assembly		B 202 203 000
Q1 through Q8	Power Transistors	A 239 300 014
Fan Assembly		A 202 204 000
Fuseboard Assembly		B 201 037 000
	Mica Insulator	A 214 100 025
	Nylon Screw Insulator	A 214 100 011

Section 10
Warranty

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 apply 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

INFUSION PUMPS

IV 5000	One year

DISPOSABLE PRODUCTS

Lectrohesive ™	Shelf life only, as stated on packaging
Sterile Disposables	Sterility only, as stated on packaging

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