0101-8240-2A

Temescal

Technical Manual for Simba 2® Power Supply

For Serial Number 371 and above

FerroTec

April 1997

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Revision History
0101-8240

REV.	VERSION/CHANGE DESCRIPTION	APPLICATION/REASON FOR CHANGE	DATE	APPROVED
-0		Applies to SN 200 and above	9/26/91	
-1	Made changes throughout manual. Added Figure 2-14.	Improved and corrected installation instructions. No Engineering changes.	7/21/93	MQM
-2	Revised instructions for connecting to system EMO/EPO circuit (pages 2-14 and 2-15). On p. 4-6, added description of new voltage regulator for tetrode tube filament. Revised Fig. 4-6 (p. 4-8) to show same.	To cover hardware features added since Rev. –1 of manual	5/3/96	RF
-2A	Revised Sections 7 and 8.	To update drawings and parts lists affected by ETL and CE certification. Applies to SN 371 and above.	4/10/97	MQM

CONTENTS

SAFETY INSTRUCTIONS FOR OPERATING AND SERVICE PERSONNEL

Operators and service personnel should always wear safety glasses. Operators shall not enter areas intended for service access only. Only experienced service personnel should enter such areas, and only after taking the preliminary precautions described in paragraphs 1 through 6 below.

DANGER

Potentially lethal voltages may exist within this unit, even with the line power switched off. Service should only be attempted by qualified personnel. Failure to observe all safety precautions may result in personal injury.

This component is designed to operate as part of a system containing high-voltage equipment. Observe the precautions described below when servicing this system, especially when servicing components where high voltages may be present.

1. Before servicing or operating this equipment, read all the component manuals supplied with the system, paying special attention to safety instructions.
2. Post HIGH VOLTAGE WARNING signs in conspicuous locations within the service area.
3. Remove rings, watches, bracelets, and any other metal jewelry before working around high voltage.
4. DO NOT WORK ALONE!
5. Be sure that all equipment is connected to a power receptacle having the correct polarity and grounding, as prescribed by the local electrical codes. Refer to the power supply portion of the documentation to determine the proper electrical ground for high-voltage components.
6. Before servicing any high-voltage component, switch off the electrical power at the component's main power switch. This switch should have a lockout feature. Lock the power off and keep the key with you while you are working on the equipment.
7. Certain electrical parts (e.g., electrolytic capacitors) hold a lethal voltage even after the power is switched off. Before entering any service area, use a grounding hook to discharge such parts. Be sure that these parts are discharged before starting any repairs.
8. DO NOT touch high-voltage leads unless power is off and a grounding hook is connected to the parts to be serviced.
9. The high-voltage components of the system should be equipped with electrical interlocks to protect personnel from injury. DO NOT ATTEMPT TO DEFEAT, OVERRIDE, OR BYPASS THESE PROTECTIVE DEVICES!
10. Never leave loose ends on high-voltage connections.
11. Observe the following warning if the system employs Radio Frequency (RF) power.

DANGER

RF radiation—even at modest power levels—can cause serious injury. If any of the RF components (e.g., the RF power supply, the RF matching network, or the RF electrodes or shielding inside the product chamber) are moved or changed in any way, the RF energy may be radiated outside the equipment. Monitor the equipment to assure that external RF radiation is below the levels prescribed by any and all applicable safety codes.

Special Amendment for United Kingdom Users

All Electrical Power Sources: Safety Precautions

This component is designed to be used in an extra-high-voltage system. Only authorized personnel should be permitted to carry out work on this system.

Prior to any servicing, grounding hooks should be used to short out all high-voltage parts and conductors in both the vacuum system and the high-voltage power supply. Screens protecting extra-high-voltage conductors should be removed only if appropriate action has been taken to ensure that extra-high-voltage conductors are dead and cannot be reenergized inadvertently.

In addition, all personnel should be aware of:

1. The Electricity (Factories Act) Special Regulations (1908 and 1944), in particular, Regulations 18(d) and 28 of the 1980 Regulations, as amended; and

2. The employer's responsibility to set up suitable systems to safeguard the health and safety of employees, according to the Health & Safety at Work etc. Act (1974).

USER RESPONSIBILITY

This equipment will perform in accordance with the instructions and information contained in the user's manual and its referenced documents when such equipment is installed, operated, and maintained in compliance with such instructions. The equipment must be checked periodically. Defective equipment shall not be used. Parts that are broken, missing, plainly worn, distorted, or contaminated, shall be replaced immediately. Should such repair or replacement become necessary, a telephone or written request for service should be made to Temescal, Livermore, CA, a division of Ferrotec (USA) Corp.

The equipment, or any of its parts, shall not be altered without the prior written approval of Temescal. The user and/or purchaser of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair, or alteration by any party other than Temescal.

GUIDELINES AND GOOD PRACTICES

1. Follow applicable clean room procedures (smocks, masks, gloves, etc.).
2. Do not expose the vent and purge valves to excessive pressures. The nitrogen line regulator is factory set at 15 psi and must not be adjusted above 20 psi.
3. Prevent oil, grease, water, sweat, etc. from getting into the vacuum chamber.
4. Replace the source tray shield correctly to ensure that the ceramic parts of the high voltage feedthroughs are protected from being coated.
5. Clean all mechanical parts and seals with lint-free paper/cloth soaked with isopropyl alcohol (IPA). Dispose of all IPA-exposed cleaning paper/cloth in a fireproof container, while ensuring proper safety precautions are being followed.
6. Polish scratched surfaces with Scotch-Brite, taking care not to produce any cross scratches.
7. Shaft seals are all ferromagnetic. No lubrication is required.
8. Check the chamber door's seal and sealing surfaces each time before closing it.
9. Check and clean the source tray seals and sealing surfaces with IPA each time before raising the source tray into place.
10. Staff must be trained by competent personnel. DO NOT allow staff to operate the system or do maintenance and recovery work on it until they are trained by competent personnel.
11. Document all alarms, deviations, breakdowns, and servicings, either on hardcopy or on an electronic equipment-log system.

HEALTH HAZARD

The condensates deposited on the tank walls of a vacuum system are generally in the form of extremely fine particles. The nature, as well as the form, of the materials poses the following potential health hazards:

a) Inhaling fine particles (powder) may cause damage to the lungs. To help prevent this, wear a protective respirator mask with fine filter that has been approved by the National Institute for Occupational Safety and Health (NIOSH) and the federal Mine Safety and Health Administration (MSHA).

b) Some substances are toxic and inhaling them should be avoided. Take steps to ascertain whether or not the material being deposited is a known toxic substance. Refer to the Material Safety Data Sheet(s) covering the evaporant(s) in question.

c) Certain powders (titanium, for instance) can cause flash fires when exposed to oxygen or other oxidizers. Therefore, when opening the chamber door after a deposition cycle, exercise extreme caution and allow time for the coating surface to oxidize. Breakage of some of the more reactive condensates may be hazardous, even when the above precautions are observed. In this situation, fire-protective clothing should be worn.

d) Certain powders (platinum, for instance) are known to catalyze methyl alcohol vapors upon contact, generating heat in the process and possibly causing a fire to erupt. Therefore, never use methyl alcohol to wipe down or clean any internal tank surfaces of a vacuum system. Use isopropyl alcohol (IPA), instead. Dispose of all IPA-exposed lint-free paper/cloth into a fireproof container, while ensuring all proper safety procedures and precautions are being followed.

SECTION 1
SPECIFICATIONS

OPERATING CHARACTERISTICS

The Simba 2 electron beam power supply is a constant-voltage power supply capable of continuously delivering -10.2 kV at 1.5 amperes as well as filament power for up to three electron beam sources. The entire 15-kW high-voltage output can be delivered to one electron beam source or shared with up to three sources operating simultaneously in one, two, or three vacuum chambers.

The power supply operates in user-selectable voltage ranges of -3 to -7 kV and -6 to -10 kV. Automatic voltage range switching via is available as an option (PN 0040-4263-0). If this option is implemented, the operating voltage range can be changed either via a front panel control or by a signal from a remote device. If the automatic voltage range switching option is not implemented, the power module must be reconfigured in order to change the operating voltage range (see Section 2 for complete instructions regarding such reconfiguration).

Voltage output is fully adjustable within each range and is regulated to within $\pm$1% when the power supply is under a load. The gun control circuit enables the user to define four emission current ranges for each electron beam gun, ensuring excellent low-power stability. Each gun's emission current is fully adjustable within each range and independently regulated to $\pm$1%.

Voltage is regulated by a full-power tetrode tube that acts as a massive variable resistor to counteract the effects of ripple, line voltage fluctuation, and voltage sag due to high current drain. The regulation circuit also provides convenient voltage selection, instantaneous arc-down recovery, and constant ground reference.

The power supply also provides control over the current delivered to the longitudinal deflection coil of an electron beam source. The power supply's beam-position control enables the operator to set high and low interlock limits for this current, thus ensuring that the electron beam will be shut off before it is driven beyond the target material.

MAIN COMPONENTS

The main components of the power supply are the power module, the high-voltage/gun control unit, and the gun interface chassis. The caster-mounted power module has been designed for ease of movement and small footprint. The high-voltage/gun control unit is a half panel designed for a standard 19-inch (483 mm) rack. This unit can be mounted either in the main system control cabinet or in an optional control console designed to stand on top of the power module. The gun interface chassis, also 19-inch-rack mountable, can be mounted either at the vacuum cubicle or in the optional control console.

CAUTION

Because of the danger to other electronic equipment posed by RF radiation from the gun interface, it must not be mounted in the system control cabinet.

CONTROLS

The high-voltage/gun control unit provides front panel control of the following functions for a single-gun system:

* High voltage ON/OFF
* Local/remote linear voltage control
* Filament power ON/OFF
* Local/remote gun control
* Emission current range selection
* Linear longitudinal coil current control
* Linear emission current control
* Linear emission current bias level control

In addition, the control unit accepts signals from a remote source to control:

* High voltage ON/OFF
* High-voltage level
* Gun (filament) power ON/OFF
* Selection of any of four emission current ranges that can be defined for each gun
* Emission current level.

CONTROL PANEL DISPLAYS

Meters

High Voltage/Total Emission Current. The high-voltage control panel includes a meter that displays either voltage level or current output.

Emission/Filament/Position Current. Each gun control panel has a meter that displays either emission current, filament current, or longitudinal coil current for one gun. (When the Simba 2 power supply is used in conjuction with a beam sweep controller such as the Temescal Programmable Sweep, this meter no longer displays the longitudinal coil current. Instead, a meter on the sweep controller front panel displays that value.)

Interlock LEDs

The Simba 2 power supply incorporates all essential internal interlocks and provides connections for a number of external interlocks. All interlocks are 24 V dc.

CAUTION

The interlocks are internally supplied with 24 V dc. Only contact closure need be supplied. The application of higher voltages to the interlock circuits will cause them serious damage.

LEDs on the HV Control and Gun Control panels are illuminated to indicate the following interlock conditions:

Internal Interlocks

PWR ON -- The main power circuit breaker is closed, and the line voltage is applied to the control transformer.

PCB'S/KEY -- All printed circuit boards (PCBs) are connected and working properly, and the front panel ON/OFF keylock is in the ON position.

INT COVERS -- The top cover of the gun interface chassis is in place.

AIR -- Cooling air is flowing to the socket and base seals of the voltage regulator tetrode tube.

DOORS -- All power module side covers are in place.

OUT OF REG -- The power supply is not regulating the high voltage to within ±1% of the desired value.

External Interlocks

TANK -- The covers and doors on the evaporation system are in place.

VAC GAUGE -- The source chamber ion gauge is on.

GUN WATER -- Cooling water is flowing in the electron beam source.

AUX -- Auxiliary interlock. Customer defined; used with multipocket sources to ensure that the beam is switched off while the turret is rotating. Must be jumpered ON if not used.

Internally or Externally Supplied

POSITION I/L -- The longitudinal beam deflection current is within the user-defined limits.

SPECIFICATIONS

High-Voltage Output	15 kW at 10 kV (can be supplied to one source or shared among two or three sources)
	Fully adjustable within either of two output ranges, -3 to -7 kV and -6 to -10 kV; regulated by a tetrode tube to within ±1% when the power supply is under a load
	Air-cooled
Beam Current	Fully adjustable from 0 to 1.5 A dc; regulated to within ±1%
Filament Primary Power	120 V ac, 7 A maximum per source
Filament Power	12 V ac, 70 A maximum per source
Longitudinal Coil Current	Adjustable, 0 to 3 A dc into a 5-ohm load per source
Auxiliary Power	120 V ac for gun interface power
Beam Sweep Capability	Available with optional programmable sweep
Remote Control Inputs	0 to ±10 V dc (emission current request) 0 to +10 V dc (high-voltage request) Contact closure
Meters (Digital)	HV control panel: High-voltage/total power supply current, 0 to 15 kV/0 to 1.5 A
	Gun control panel (one per source): emission/filament/longitudinal coil current, 0 to 1.5 A
Dimensions	Power module: 40 in. high x 27-3/4 in. deep x 23-1/4 in. wide (1016 mm x 705 mm x 590 mm)
	HV/gun control unit: 5-1/4 in. high x 19 in. wide (133 mm x 483 mm), rack mountable
	Gun interface chassis: 7 in. high x 19 in. wide (178 mm x 483 mm), rack mountable
Power Module Weight	720 lbs. (324 kg)

INSTALLATION REQUIREMENTS

Power	208/220/240 V ac, 50/60 Hz, 80 A (90-A inrush), 3-phase delta (4-wire cable; no neutral required)
	380/415 V ac, 50/60 Hz, 50 A (60-A inrush), 3-phase delta
	440/480 V ac, 50/60 Hz, 40 A (50-A inrush), 3-phase delta
	Breakers must be of a type designed to handle the inrush currents noted above. Site utility voltage must be specified at time of purchase.
Environment	Free of corrosive fumes and vapors
	Ambient temperature: 50° to 90° F (10° to 32° C)
	Humidity: 90% maximum relative humidity

SECTION 2
INSTALLATION

SECTION OVERVIEW

This section outlines the facility and system requirements for proper operation of the Simba 2™ power supply and describes the installation procedures. The subsections, in order, are:

- Top-Level Parts List
- Facility and Systems Requirements
- Gun Filament Transformer Installation
- Power Module Installation
- Gun Interface Installation
- HV/Gun Control Unit Installation

For an overview of power supply cabling, see Figure 2-14.

The basic Simba 2 power supply is configured to operate a single electron beam source in the -7 kV to -10 kV range. See Section 7 for instructions on installing gun upgrade kits, which equip the power supply for multisource operation. Section 7 also contains instructions on reconfiguring the power module to operate in the -3 kV to -7 kV range.

CAUTION

It is possible for the tetrode tube to become dislodged from its socket during shipment of the Simba 2 power supply. During installation check to be sure the tetrode tube is well seated in the tube socket. It should not be able to be lifted out easily. To seat the tetrode tube, grasp the handles on the outer edge of the top of the tube, push down while giving the tube a slight twist.

TOP-LEVEL PARTS LIST

The basic Simba 2™ power supply kit (PN 0040-6720-1, -2, or -3) consists of:

- 1 power module (PN 0040-6740-1, -2, or -3)
- 1 gun interface (PN 0040-7040-0)
- 1 high-voltage/gun control unit (PN 0040-3583-0)
- 1 kit for rack-mounting the control unit (PN 0411-6183-2)
- 2 5-1/4" blank panels (PN 0411-6273-2) plus mounting screws
- 1 grounding hook (PN 0410-9474-0) with mounting bracket

Also required for installation of the power supply is the Cable and Filament Transformer Kit (PN 0040-7520-0 or -1). PN 0040-7520-0 consists of:

- 1 gun filament transformer (PN 0205-5443-0)
- 1 6-ft. high-voltage coaxial cable (PN 0040-3723-5)
- 1 20-ft. high-voltage coaxial cable (PN 0040-3723-2)
- 1 5-ft. high-voltage, high-current cable (PN 0609-9033-0)
- 2 25-ft., 50-pt. 'D' cables (PN 6338-4976-7), one each as HV control cable and gun control cable
- 1 20-ft. 120-V power cable (PN 0040-3733-2)
- 1 20-ft. position/sweep cable (PN 0040-3740-0)
- 1 20-ft. tank (i.e., filament current) cable (PN 0040-3750-0)
- 1 20-ft. gun control-system I/O cable (PN 0040-3760-0)
- 1 20-ft. HV control-system I/O cable (PN 0040-3770-0)
- 1 roll of 3-in. copper grounding strap (PN 5621-0032-3)
- 1 copper bracket (PN 0610-5162-0) for connecting the grounding strap and the grounding hook's lead to the power module
- 2 1/4-20 x 1" screws, plus washers and kept nuts, for securing the copper bracket to the power module
- 2 spare 1/4-20 x 1" screws, plus washers and kept nuts
- 2 1/4-20 x 5/8" screws, plus washers and kept nuts, for securing the copper strap to the copper bracket
- 10 spare flat-head, black 10-32 machine screws and finishing washers (for use in mounting HV/control units)

PN 0040-7520-1 is identical to 0040-7520-0 except that (1) it provides the two 25-pt. 'D' cables in 50-foot lengths and (2) it provides the following cables in 40-foot lengths:

- the HV coaxial cable (PN 0040-3723-3, replacing 0040-3723-2)
- the 120-V power cable
- the position\sweep cable
- the tank (i.e., filament current) cable
- the HV- and gun control-system I/O cables.

FACILITY AND SYSTEM REQUIREMENTS

Grounding Requirements

System Ground

Safe, dependable operation of the power supply cannot be ensured unless a good earth ground is provided for the power supply and for the system it supplies. In addition, the ground must have a low impedance to radio frequency as well as to direct current. Figure 2-1 illustrates the required grounding procedures:

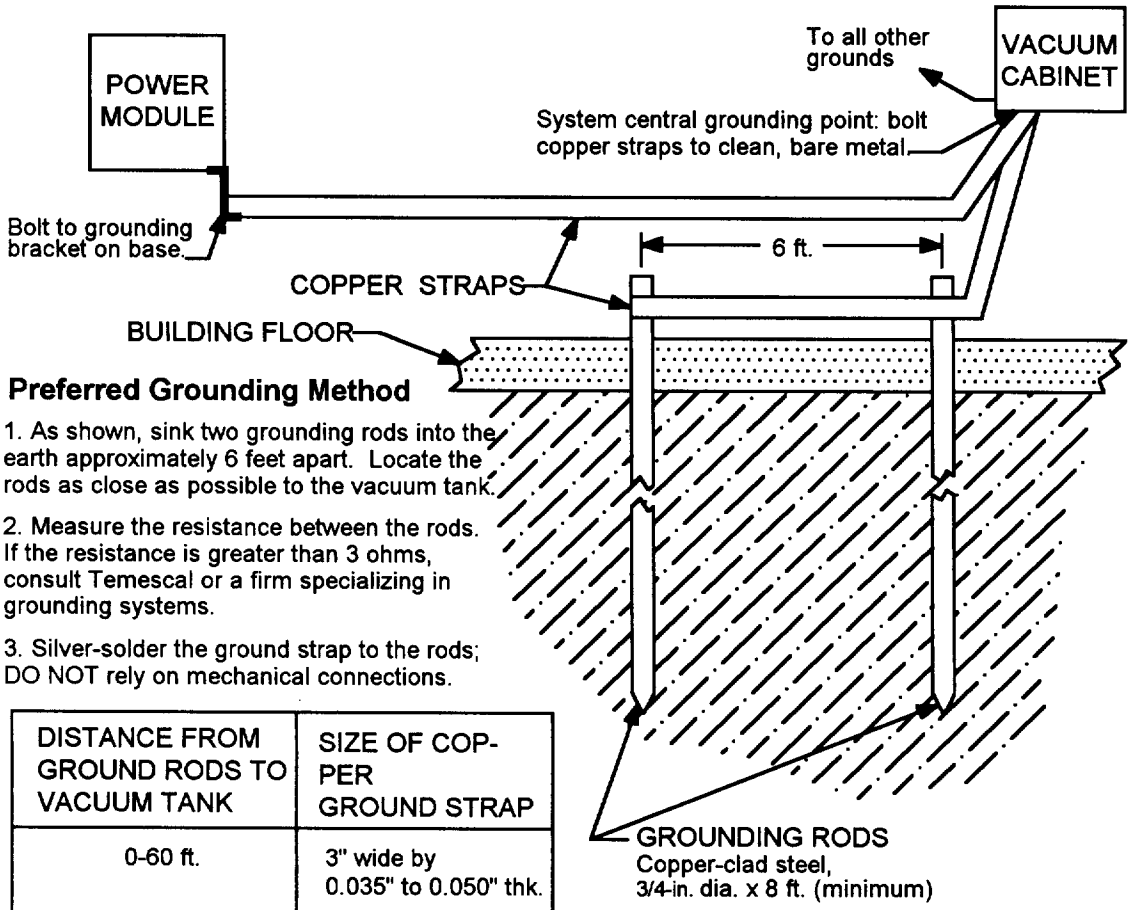
1. Two 8-foot copper-clad steel rods of 3/4-inch diameter should be driven through the floor and into the earth near the system's vacuum cubicle. The rods should be approximately 6 feet apart. After the rods are driven into the ground, the resistance between them should be measured with an accurate volt-ohm meter. The maximum allowable resistance is 3 ohms. If the resistance is greater than that value, pouring salt water or copper sulfate down the side of the rods may lower the resistance to the required level.

2. To ensure a low-impedance path to ground, the rods must be connected to each other and to the vacuum chamber by a 3-inch copper strap. For runs of less than 60 feet, this strap should be 0.035 to 0.050 inches thick; for runs longer than 60 feet, consult Temescal for specifications. The strapping should be silver-soldered to one of the rods and secured to the other mechanically so that it can be disconnected later for retesting the resistance between the rods. The other end of the ground strap should be connected to the evaporation system's central grounding point, an area of clean bare metal on the vacuum tank wall or frame, with a grounding lug or bolt. The outer (shield) conductor of each HV coaxial cable should be connected to this central grounding point.

NOTE

Do not use braided wire for these connections.

If the equipment is to be installed on the upper floors of a building, the system can be grounded by connecting the vacuum chamber to the steel structure of the building. This connection should also be made with 3-inch copper strapping of the gauge specified above.



Preferred Grounding Method

1. As shown, sink two grounding rods into the earth approximately 6 feet apart. Locate the rods as close as possible to the vacuum tank.
2. Measure the resistance between the rods. If the resistance is greater than 3 ohms, consult Temescal or a firm specializing in grounding systems.
3. Silver-solder the ground strap to the rods; DO NOT rely on mechanical connections.

DISTANCE FROM GROUND RODS TO VACUUM TANK	SIZE OF COPPER GROUND STRAP
0-60 ft.	3" wide by 0.035" to 0.050" thk.
60+ ft.	Consult Temescal

Alternative Grounding Method

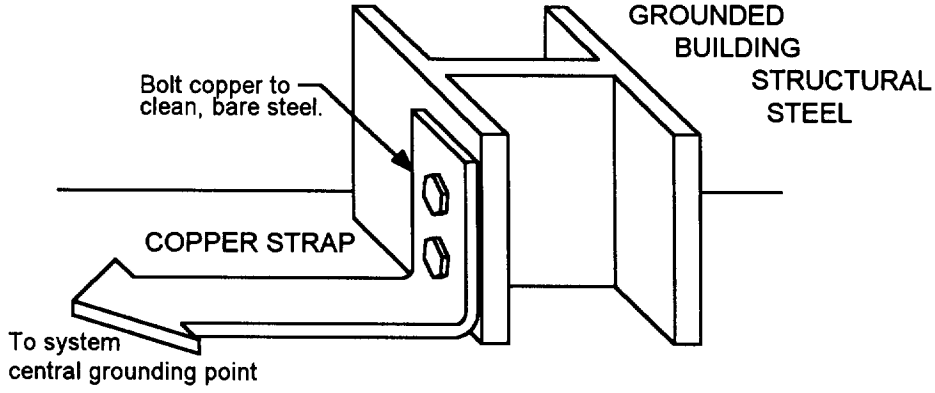


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Figure 2-1. System Grounding

If the building's structural steel forms part of the ground path, that structure must have a good earth ground. If it does not, a sufficient number of rods must be driven into the ground and connected to the structure to ensure a suitable ground. The rods must be connected to each other and to the structure with 3-inch copper strapping, as described above.

CAUTION

DO NOT rely on water pipes to establish the system ground connection. Multiple plumbing joints, each with tape and/or sealing compounds, make such a ground unreliable.

Electron Beam Source Ground

To ensure a good ground between the electron beam source and the vacuum cubicle:

1. The base of the source and the surface onto which it is mounted should be clean and free of evaporated material.

2. The mounting surface should be made of nonmagnetic material.

3. The source should be securely bolted to this surface (usually the upper surface of the source tray).

Grounding Hooks

One grounding hook is provided with each Simba 2 power supply. An additional grounding hook must be available near each enclosure or vacuum cubicle containing high voltage.

Utility Power

The Simba 2 power supply comes in three configurations. Power supplies ordered under PN 0040-6720-1 are configured for 208 V ac input power. Power supplies ordered under PN 0040-6720-2 are configured for 380 V ac input power. Power supplies ordered under PN 0040-6720-3 are configured for 480 V ac input power. The -1 version can be internally reconfigured to accept 200, 220 or 240 V ac power. The -2 version can be internally reconfigured to accept 415 V ac power. The -3 version can be internally reconfigured to accept 440 V ac power. Reconfiguration instructions are provided below, under "POWER MODULE INSTALLATION."

The site electrical service must have its own disconnect and must be capable of supplying three-phase power at the current levels indicated below. Breakers must be of a type designed to handle the inrush currents specified below.

INPUT VOLTAGE	CURRENT
208/220/240 V ac	80A (90-A inrush)
380/415 V ac	60A (70-A inrush)
440/480 V ac	40A (50-A inrush)

System Requirements

External Interlocks

The external interlocks are interfaced to the power supply via the Gun Control cable(s), which plug into the SYSTEM I/O connectors(s) (J2) on the back of the gun control unit(s). The interlock switches are to be of a type prescribed by local safety codes. All of the interlocks listed below must be supplied to each gun control unit. However, if all guns are in one vacuum chamber, the TANK and VACUUM GAUGE interlocks can be connected in parallel. Detailed instructions for connecting these interlocks appear below, under "HV/GUN CONTROL UNIT INSTALLATION."

CAUTION

The interlocks are internally supplied with 24 V dc. Only contact closure need be supplied. The application of higher voltages to the interlock circuits will cause them serious damage.

NOTE

All statements regarding operator and equipment safety are void if the external interlocks are not correctly installed.

INTERLOCK	FUNCTION/INSTALLATION NOTES
TANK	This interlock must prevent anyone from touching sources of high voltage within the vacuum system itself. Normally-open switches should be installed on all vacuum cubicle doors (including the access door to the gun filament transformer enclosure) and the product chamber door or bell jar cover. These switches should be placed so that they are closed only when the doors are latched shut.

VACuum GAUGE — This interlock must ensure that the source cannot be switched on unless the source chamber ion gauge is on.

GUN WATER — This interlock must ensure that the gun receives sufficient cooling water. A water flow switch should be installed in the return line of the water flow system. This switch should close when the water flow is sufficient to cool the crucible.

AUXiliary — Customer-defined. On systems with a multipocket gun, this interlock is used to ensure that the beam is switched off when the turret is turning. If not used, this interlock must be jumpered ON.

In addition, the **POSITION** interlock is externally supplied on systems with a beam sweep controller. If that device is a Temescal Programmable Sweep, see Section of its manual for instructions on connecting this interlock.

Output Connections at the Vacuum Cubicle

To promote safe, dependable power supply operation, follow the guidelines below and refer to Figure 2-2 in making connections to the electron beam source.

1. The conductors from the cathode and anode of the electron beam source to their respective feedthroughs must be uninsulated, #6-gauge, and capable of carrying 70 A.

2. The feedthroughs must be rated for a minimum of 70 A and 12 kV.

3. The leads from the focus coil terminals to their feed-through must be made with 16-gauge (minimum) copper wire with high-temperature insulation. These wires can be glass jacketed or insulated with silicone-rubber or Kapton. They must be placed well away from the filament conductors, and they must be shielded by a ground plane.

The site electrical service must have its own disconnect and must be capable of supplying three-phase power at the current levels indicated below. Breakers must be of a type designed to handle the inrush currents specified below.

INPUT VOLTAGE	CURRENT
208/220/240 V ac	80A (90-A inrush)
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3. The leads from the focus coil terminals to their feed-through must be made with 16-gauge (minimum) copper wire with high-temperature insulation. These wires can be glass jacketed or insulated with silicone-rubber or Kapton. They must be placed well away from the filament conductors, and they must be shielded by a ground plane.

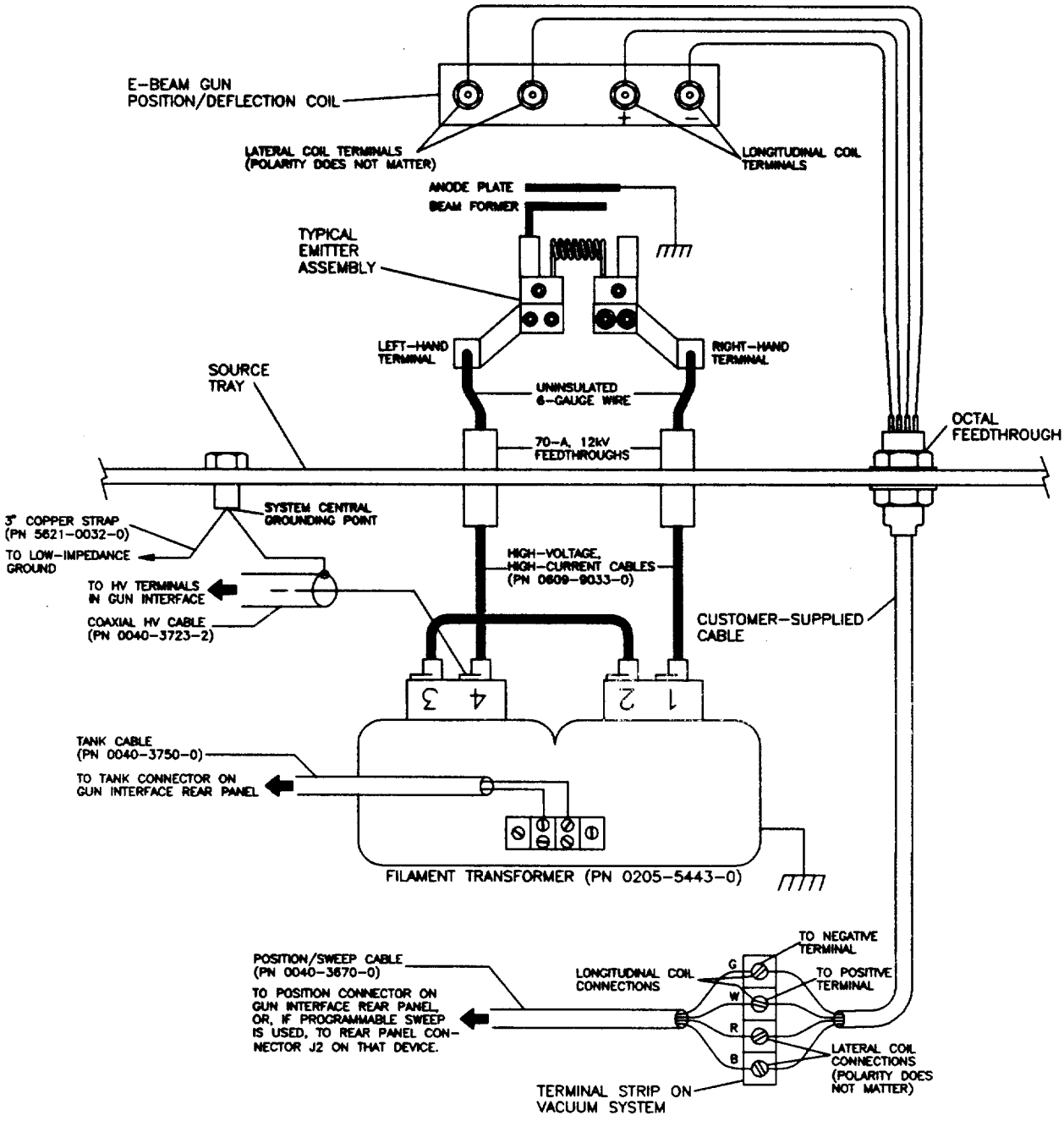


Figure 2-2. Output Connections at Vacuum Cubicle

GUN FILAMENT TRANSFORMER INSTALLATION

Follow the procedure described below and refer to Figure 2-2 in mounting the gun filament transformer(s) in the vacuum cubicle(s). Each transformer should be mounted as close as possible to the high-voltage feedthroughs, and connections between the secondary terminals and the feedthroughs should be kept as short as is practical.

DANGER

The secondary of this transformer carries lethal high voltage. A protective barrier should be installed to prevent accidental contact with the wires connected to it.

STEP	ACTION
1	Secure the transformer to the vacuum cubicle at the desired location with mounting bolts.
	NOTE **To ensure that the transformer core and ground shield do not rise above ground potential during operation, the transformer's mounting base must be connected to chamber ground. This can best be accomplished by removing the paint from a small area around the mounting holes in the transformer and in the vacuum cubicle before putting the transformer in place.**
2	Determine which high-voltage feedthrough is connected to the emitter assembly terminal that is attached to the beam former (see Figure 2-2). This is the left-hand terminal when the gun is viewed from behind the emitter assembly.
3	Attach one of the high-voltage, high-current cables (PN 0040-9033-0) to this feedthrough.
4	Connect the other end of this wire to terminal #4 on the gun filament transformer secondary.
5	Connect the other high-voltage/high-current wire to the other feedthrough and to terminal #1 on the transformer secondary.
6	Find the 20-ft. coaxial cable (PN 0040-3723-2) that is to carry the high voltage from the gun interface to the vacuum cubicle.

STEP	ACTION
7	Drill a 3/4-inch hole cabinet in the filament transformer enclosure for the conduit connector. The cable center conductor must be able to reach from this hole to the source chamber feedthrough connected to transformer secondary terminal #4.
8	Unscrew the nut on the conduit connector, insert the conductors and the conduit connector through the 3/4-inch hole, and screw the nut back onto the connector securely.
9	Connect the cable center conductor to terminal 4 on the transformer secondary.
10	Connect the outer conductor (shield) of the coaxial cable to the vacuum cubicle's central grounding point or to a grounding bolt or lug connected to the central grounding point by 2-inch copper strap.

Repeat this procedure as needed for multigun installations. Note that each gun upgrade kit includes a 20-ft. coaxial HV cable (PN 0040-3723-2).

POWER MODULE INSTALLATION

This subsection covers the following topics, in order:

* Reconfiguring for site utility power voltage
* Connecting the utility power cable
* Connecting to a system EPO/EMO circuit
* Connecting the HV output cable
* Installing the tetrode tube
* Connecting the low-impedance ground

Reconfiguring For Site Utility Power Voltage

As noted above, the power module is factory-configured for either 208 V ac, 380 V ac, or 480 V ac utility power. If the site utility power is at some other voltage, it will be necessary to reconfigure the connections to the primary of the main power transformer, the secondary of the control transformer, and the primary of the EPO circuit transformer.

Main Power Transformer Reconfiguration. The main power transformer is mounted next to the tetrode base, on the bottom panel of the module. The power transformer's primary terminals are attached to a vertically-mounted strip of insulated material that runs across the inner side of the transformer (see Figure 2-3).

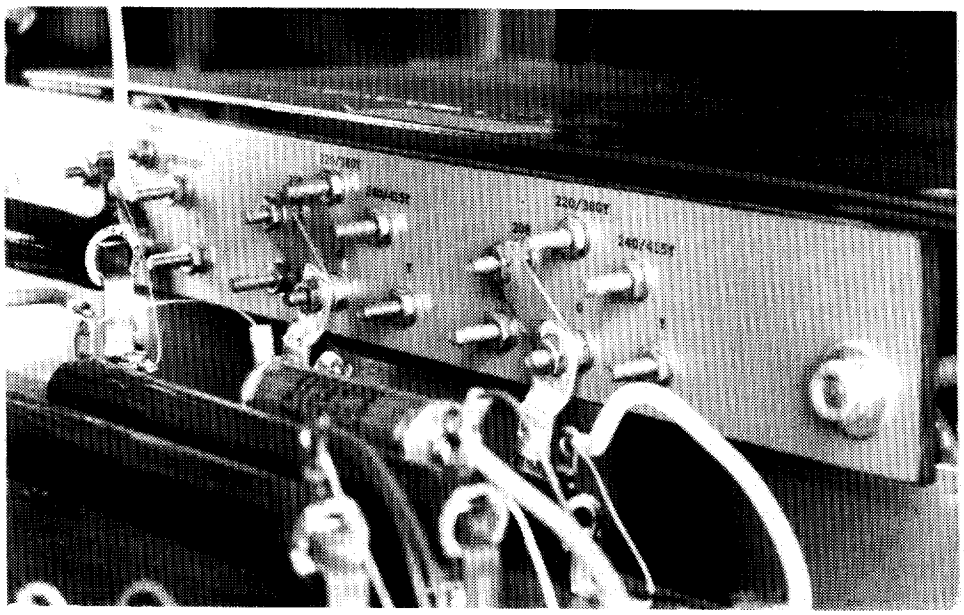


Figure 2-3. Configurable Terminals on Primary of Main Power Transformer

STEP	ACTION
1	Remove the power module's left-hand side cover.
2	Find the mounting strip for the power transformer primary terminals. Note that there are three sets of terminals on the strip, with short copper bars connecting two of the terminals in each set.
3	Loosen the nut that secures the lower part of one bar to the unmarked lower terminal, remove the nut that secures the upper part of the bar to the other terminal, and pull the bar off of this terminal, which will be labeled either **208, 380,** or **480.**
4	Remove the nut from the terminal marked with a number that corresponds to the site voltage.
5	Attach the jumper bar over this terminal.
6	Replace the nuts that were removed and retighten all nuts securley.
7	Repeat steps 3 through 6 in reconfiguring the other two sets of terminals on the strip.

Control Transformer Reconfiguration. The control transformer is mounted on the control panel just in front of the vent duct for the tetrode tube's cooling air. The transformer's secondary terminals are mounted toward the inside of the module, and the sticker on top of the transformer indicates which terminal is which. To reconfigure the transformer on a 208-V model for 220-V or 240-V power, disconnect the wire connected to terminal X4 on the transformer secondary and connect it to terminal X3. No reconfiguration is requied for 200-V input power. The control transformer on a 380-V model need not be reconfigured for 415-V utility power. The same applies to 440-V operation of a 480-V model.

EPO Circuit Transformer Reconfiguration. The transformer that provides +24 V ac to the power module's EPO circuit is next to the control transformer. Like the main power transformer and the control transformer, this transformer is factory configured to accept input current at either 208 V ac, 380 V ac, or 480 V ac. The only reconfiguration option for this transformer is for 240 V ac input power. In that case, disconnect the wire connected to terminal H2 on the transformer's primary and reconnect it to terminal H3.

Connecting the Utility Power Cable

The conductors that supply utility power are connected to terminals on the rear of the main circuit breaker. Follow the instructions below and refer to Figures 2-4 and 2-5 in making these connections.

STEP	ACTION
1	Make sure that the power is shut off at the service disconnect.
2	Connect a suitable length of 4-conductor cable to the terminals on the service box. The gauge of these conductors should be determined by the local electrical codes and by the rating of the main contact breaker. However, these conductors should be no smaller than #4 gauge.
3	Insert the free end of the cable through the cable clamp near the upper right-hand corner of the rear of the power module (see Figure 2-4).
4	Carefully remove 6-8 inches of the cable insulation and strip 3/4 inch of insulation from each wire.
5	Insert the stripped ends of the cable's three hot wires through the cone lugs attached to the terminals on the main circuit breaker, as shown in Figure 2-4.
6	Insert the stripped end of the cable's ground wire into the cone lug attached to the control panel's central grounding point (also shown in Figure 2-4).

Connecting the Utility Power Cable

The conductors that supply utility power are connected to terminals on the rear of the main circuit breaker. Follow the instructions below and refer to Figures 2-4 and 2-5 in making these connections.

STEP	ACTION
1	Make sure that the power is shut off at the service disconnect.
2	Connect a suitable length of 4-conductor cable to the terminals on the service box. The gauge of these conductors should be determined by the local electrical codes and by the rating of the main contact breaker. However, these conductors should be no smaller than #4 gauge.
3	Insert the free end of the cable through the cable clamp near the upper right-hand corner of the rear of the power module (see Figure 2-4).
4	Carefully remove 6-8 inches of the cable insulation and strip 3/4 inch of insulation from each wire.
5	Insert the stripped ends of the cable's three hot wires through the cone lugs attached to the terminals on the main circuit breaker, as shown in Figure 2-4.
6	Insert the stripped end of the cable's ground wire into the cone lug attached to the control panel's central grounding point (also shown in Figure 2-4).

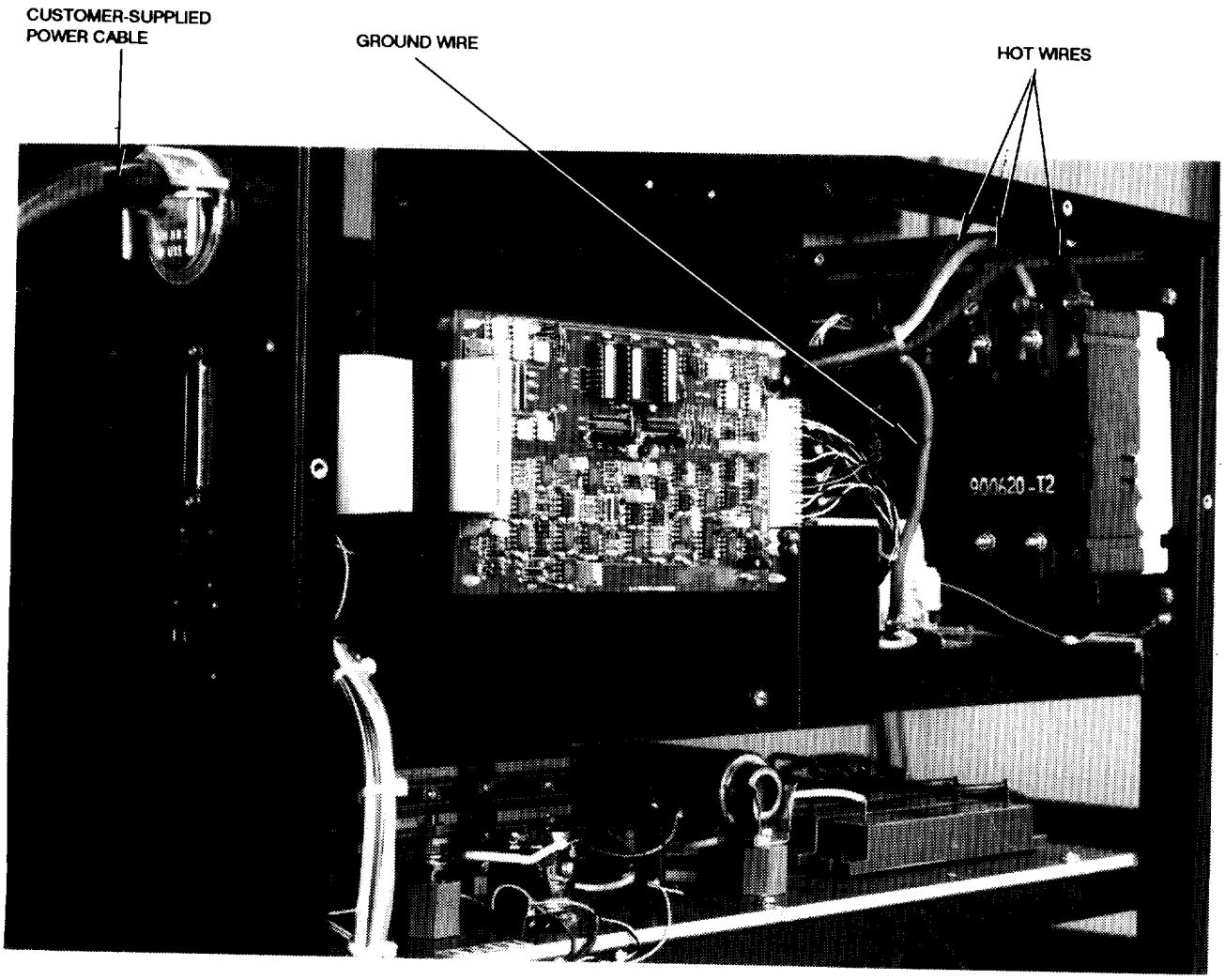


Figure 2-4. Input Power Cable Installed in Power Module
(Power Module Shown From Rear)

Connecting to a System EPO/EMO Circuit

The EPO (Emergency Power Off) circuit in the Simba 2 power module can be connected to a vacuum system's EPO (or EMO) circuit via the 6-pt. circular Amp connector on the rear of the power module (see Figure 2-5). Pins 1 and 2 in this connector are connected to the contacts of the double-pole **EPO** switch on the front of the power module. Pins 3 and 4 are connected to the 24-V ac circuit that pulls in the power module's main power contactor. Pins 5 and 6 are connected in parallel with the contacts of the RESET button on the front of the power module.

NOTE

If pins 3 and 4 are not connected to a set of normally-closed contacts in an external circuit, they MUST be jumpered together. If this contact closure is not made, the power supply cannot be switched on.

There are two ways to connect the power module's EPO circuit to a system-wide EMO/EPO circuit. The first approach is to connect pins 1 and 2 in series with the system EMO/EPO circuit. When pins 1 and 2 are connected this way, pressing the power module's **EPO** button switches off the system functions under the control of the system EPO/EMO circuit in addition to switching off the power supply. However, pressing a system EPO/EMO button does not switch off the power supply.

Alternatively, you can connect pins 3 and 4 in series with contacts on a double-pole system EMO/EPO switch. Making these connections makes the control reciprocal, so that pressing any system EPO/EMO button switches off the power supply in addition to the other system functions subject to EMO/EPO shutoff, and pressing the power supply's **EPO** button switches off these system functions as well as the power supply.

Regardless of which way the EMO/EMO connections are made, connecting pins 5 and 6 in parallel with an external RESET button makes reset-control reciprocal.

Connecting the HV Output Cable (PN 0040-3723-1)

The cable that carries the high voltage to the gun interface is a 6-foot HV coaxial cable (PN 0040-3723-1). Follow the instructions below and refer to Figures 2-5 and 2-6 as you attach this cable to the standoff terminals on the HV rectifier/resistor panel, which is the horizontal haysite panel immediately below the control panel.

STEP	ACTION
1	Remove the power module's left-hand side cover, if you have not already done so.
2	Remove the nut from the plastic conduit connector near one end of the coaxial cable.
3	Pass this end of the cable through the 7/8"-diameter hole in the rear of the power module (Figure 2-5).
4	Insert the conduit connector into the hole and screw the nut back onto the connector securely.

STEP	ACTION
5	Attach the cable's center and outer (shield) conductors to the labelled standoffs on the HV rectifier/resistor panel, as shown in Figure 2-6.

NOTE

The cable's center conductor MUST be connected to the standoff that is connected by a short length of wire to the HV relay (see Figure 2-6). This is the standoff closest to the relay.

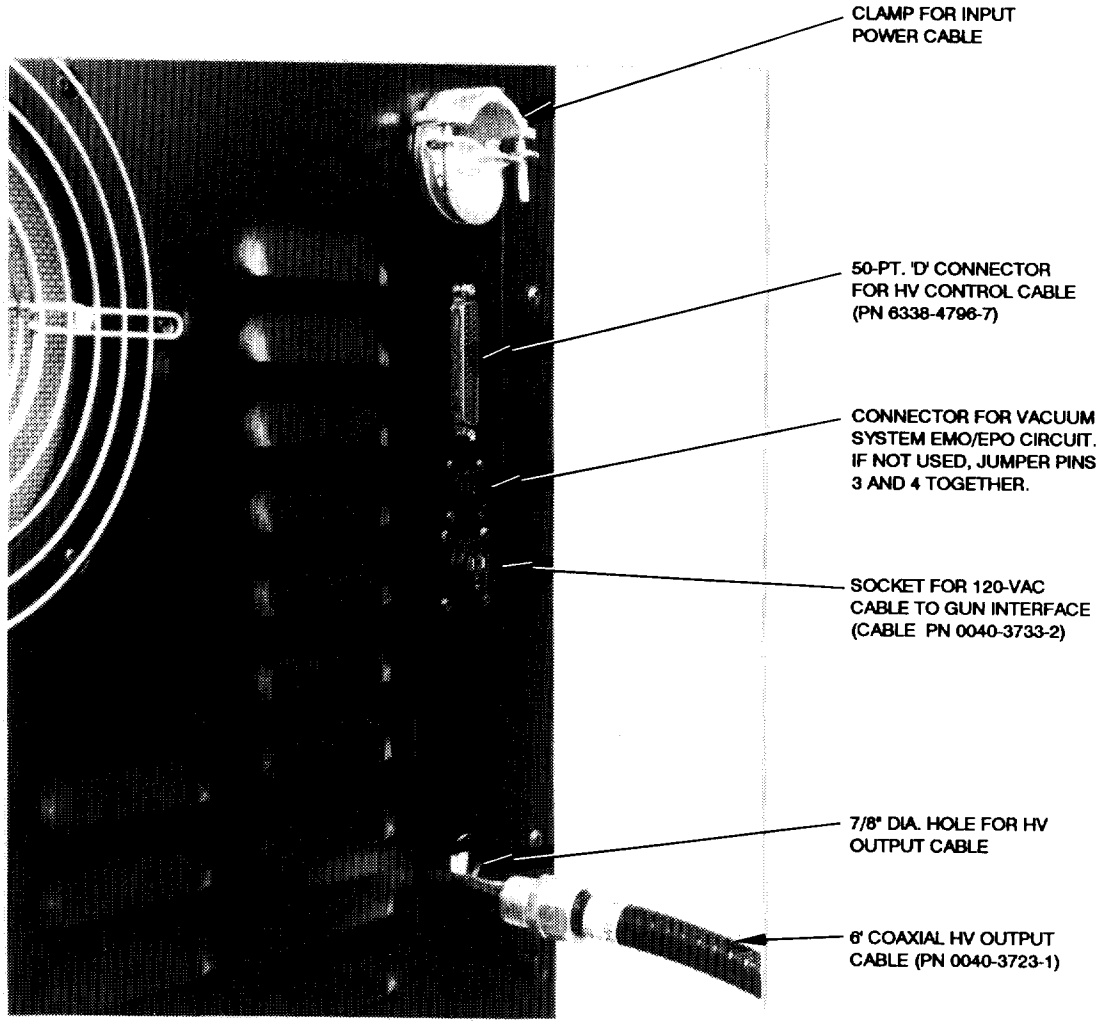


Figure 2-5. Connecting the Coaxial HV Output Cable to the Rear of the Power Module

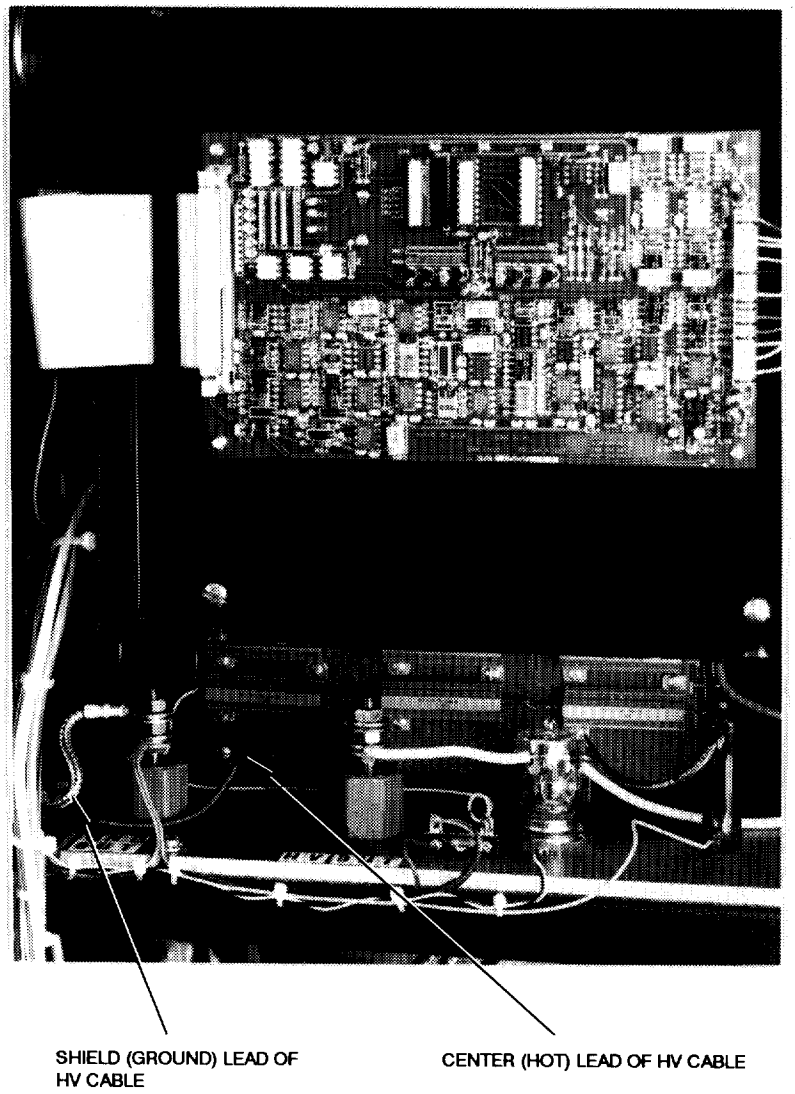


Figure 2-6. HV Coaxial Cable Connected to Standoffs on Rectifier/Resistor Panel

Connecting the HV Control Cable (PN 6338-4796-7) and the 120-Volt AC Cable (PN 0040-3733-2)

The Cable and Filament Transformer Kit (PN 0040-7520-0) contains two 20-foot 50-pt. Belden cables (PN 6338-4796-7). Use one of these cables to connect the power module to the HV control unit. Plug the male end of this cable into the 50-pt. 'D' connector shown in Figure 2-5. The Cable/Transformer Kit also contains a 6-foot cable (PN 0040-3733-2) that carries 120-V ac power from the power module to the gun interface chassis. Plug either end of this cable into the socket indicated in Figure 2-5. Figure 2-7 shows the rear of the power module with these cables connected.

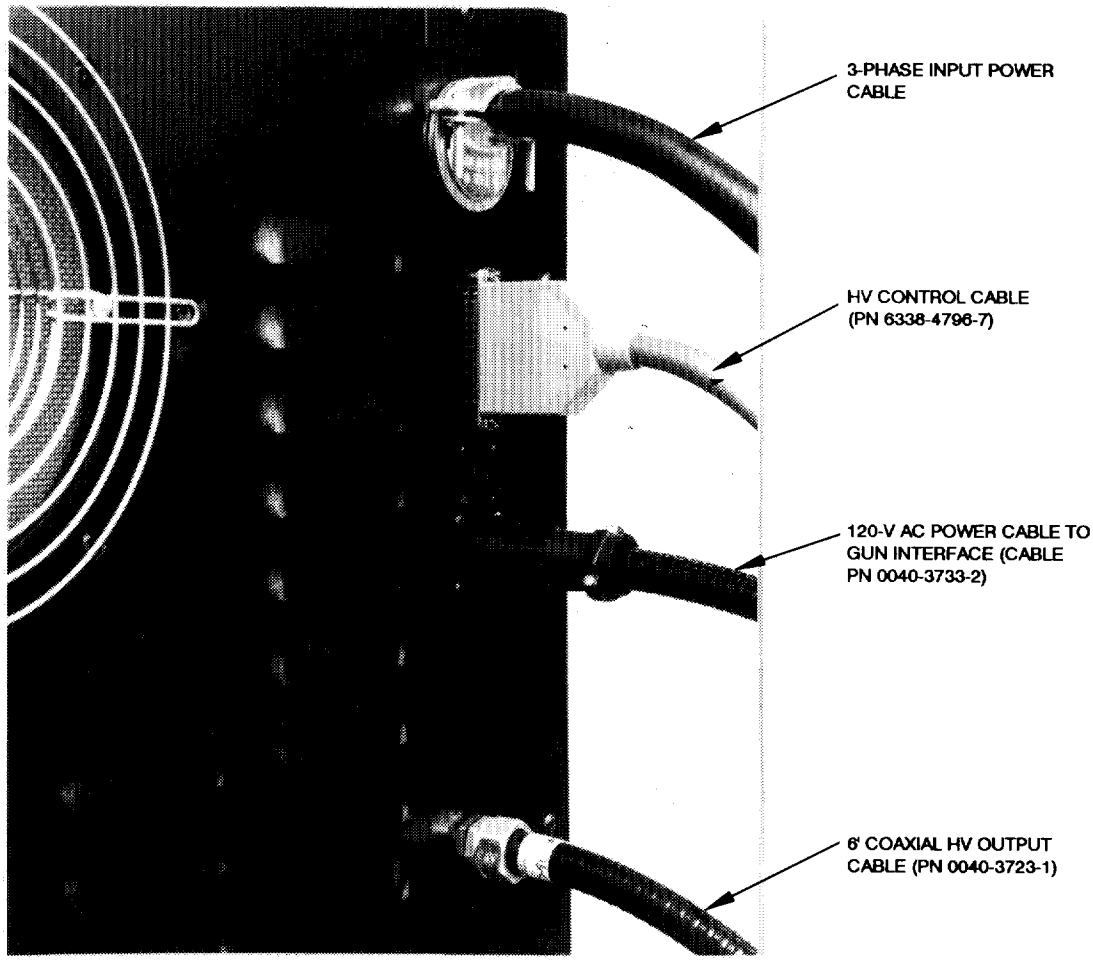


Figure 2-7. Rear of Power Module with All Standard Cables Connected

Installing the Grounding Hook and Connecting the Low-Impedance Ground

Follow the procedure described below and refer to Figures 2-2, 2-8, and 2-9 in mounting the storage bracket for the grounding hook and connecting the low-impedance ground.

STEP	ACTION
1	Use the screws provided to mount the storage bracket for the grounding hook, as shown in Figure 2-8.

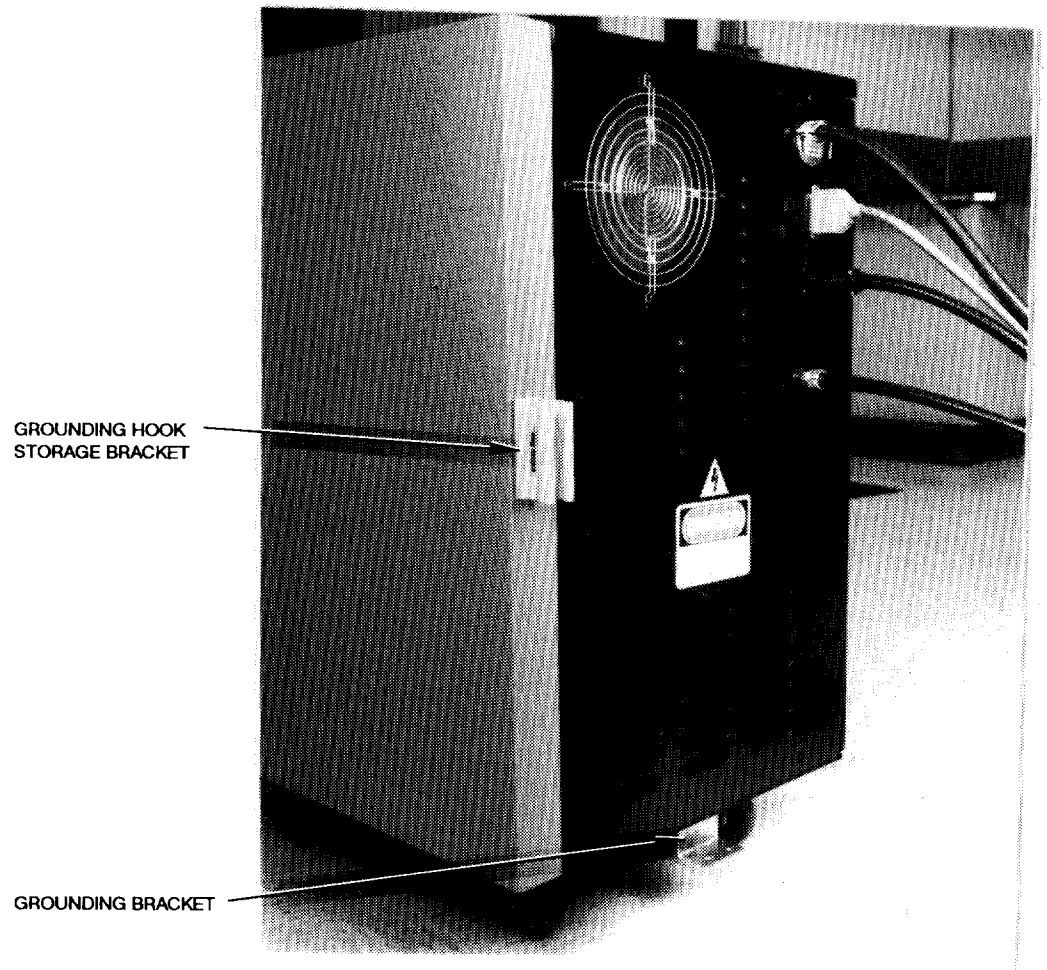


Figure 2-8. Rear of Power Module, with Grounding Hook Storage Bracket and Grounding Bracket Installed

STEP	ACTION
2	Find the kit containing the L-shaped copper grounding bracket (0610-5162-0) and associated mounting hardware.
3	Remove the power module rear panel, if you have not already done so.
4	Near the middle of the base plate's rear edge you will see two green/white ground wires secured by bolts. Remove the nuts from these bolts and use them to mount the copper grounding bracket. Retighten these nuts securely. (Figure 2-8 shows this bracket installed.)
5	Find the 3-in. copper strapping supplied with the power supply and use the holes in the bracket as templates for making holes in the strapping.
6	Find the 1/4-20 mounting bolts and push them through the holes in the bracket and the strapping. Then screw the nut onto one of the bolts.
7	Find the grounding hook supplied with the power supply. Put the lug on the grounding hook's lead over the unsecured 1/4-20 bolt and screw the nut onto this bolt.
8	Replace the power module rear cover and any other covers that are not in place at this point.

STEP	ACTION
9	Secure the other end of the grounding strap to the central grounding point on the vacuum cubicle. Figure 2-9 shows the rear of the power module with all cables installed and with the grounding hook and low-impedance ground properly connected.

Figure 2-9. Rear of Power Module, with Grounding Hook and Low-Impedance Copper Ground Strap Correctly Installed

GUN INTERFACE INSTALLATION

The gun interface is subdivided into two enclosures, a gun control section that occupies most of the chassis and a narrow high-voltage section that lies along the left side of the chassis. This subsection covers the following topics, in order:

* Connecting the high-voltage cables
* Installing the chassis in a cabinet
* Connecting the Tank cable
* Connecting the Position/Sweep cable
* Connecting the 120-V ac power cable

Refer to Figure 2-14 in making cable connections to the gun interface.

Connecting the High-Voltage Cables

Follow the procedure described below and refer to Figures 2-10 and 2-11 when connecting the input and output high-voltage cables.

STEP	ACTION
1	Remove the chassis cover.
2	Remove the cover from the rear panel hole labeled **10KV IN** (see Figure 2-10).

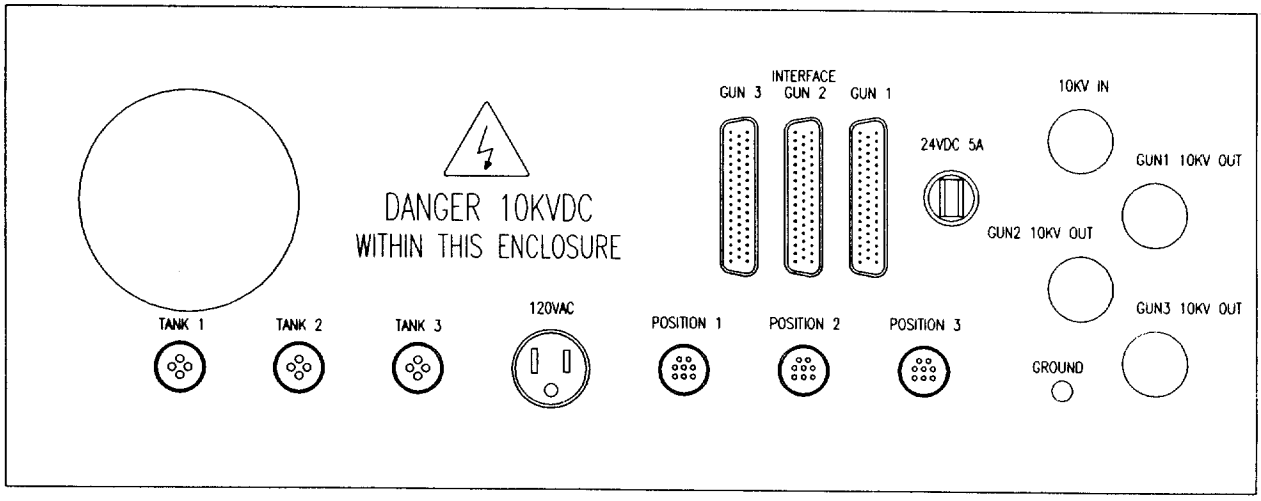


Figure 2-10. Gun Interface Rear Panel

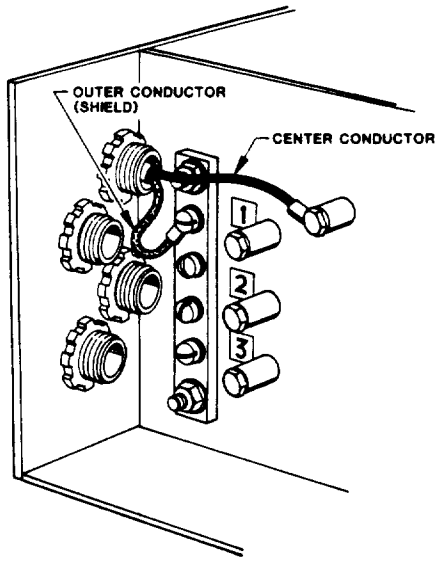
STEP	ACTION
3	Unscrew the nut from the conduit connector on the free end of the HV input cable (PN 0040-3723-1); the other end of this cable should already be attached to the power module.
4	Insert the cable conductors and the conduit connector through the rear panel hole and screw the nut back onto the connector securely.
5	Attach the cable conductors as shown in Figure 2-11A. The outer (shield) conductor **must** be connected to the ground bus bar, and the center conductor **must** be connected to the topmost standoff (the unnumbered standoff). Tighten the terminal fasteners securely.
6	Remove the cover from the rear panel hole labeled **GUN1 10KV OUT** (see Figure 2-10).
7	Remove the nut from the conduit connector on the end of the 20-ft. coaxial HV output cable (PN 0040-3723-2).
8	Insert this cable's conductors and conduit connector into the **GUN1 10KV OUT** hole and screw the nut back onto the connector securely.
9	Attach the cable center conductor to the standoff marked **1**, as shown in Figure 2-11B. Tighten the terminal fastener securely.
10	Attach the outer (shield) conductor to the second terminal from the top on the ground bus bar, as shown in Figure 2-11B. Tighten the terminal fastener securely.

WARNING

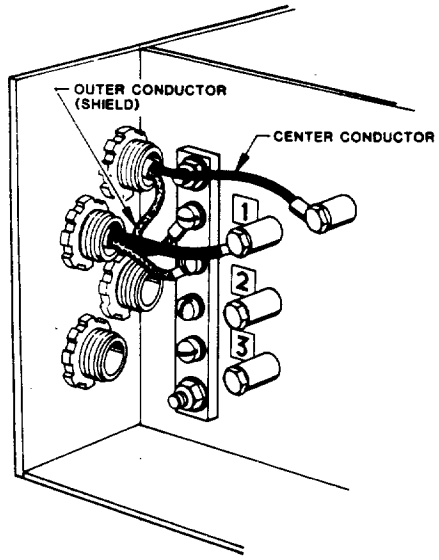
Make sure that the shield conductors do not loop toward the standoffs that the center conductors connect to (see Figure 2-11B). Allowing these conductors to short together would be extremely dangerous for both equipment and personnel.

11	If you have not already done so, connect the other end of this cable at the vacuum cubicle as shown in Figure 2-3 and as described above under the heading "GUN FILAMENT TRANSFER INSTALLATION."

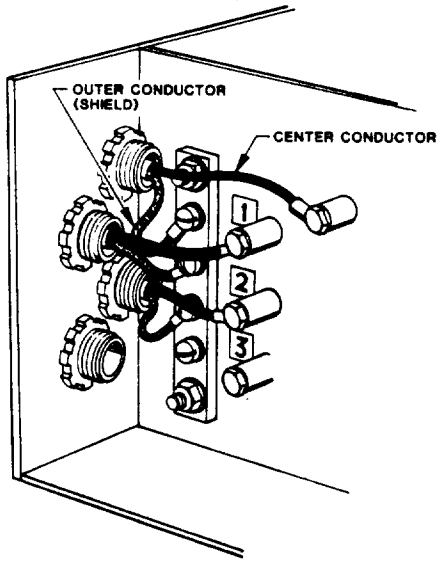
STEP	ACTION
12	If the supply is powering a second gun: a. Remove the cover from the rear panel hole labeled **GUN2 10KV OUT** (see Figure 2-10). b. Remove the nut from the conduit connector on the end of the coaxial cable for the second gun. c. Insert this cable's conductors and conduit connector into the **GUN2 10KV OUT** hole and screw the nut back onto the connector securely. d. Attach the conductors as shown in Figure 2-11C, making sure that the center conductor is secured to the standoff labeled **2**.
13	If the supply is powering a third gun: a. Remove the cover from the rear panel hole labeled **GUN3 10KV OUT** (see Figure 2-10). b. Remove the nut from the conduit connector on the end of the coaxial cable for the third gun. c. Insert this cable's conductors and conduit connector into the **GUN3 10KV OUT** hole and screw the nut back onto the connector securely. d. Attach the conductors as shown in Figure 2-11D, making sure that the center conductor is secured to the standoff labeled **3**.
14	Replace the chassis cover.



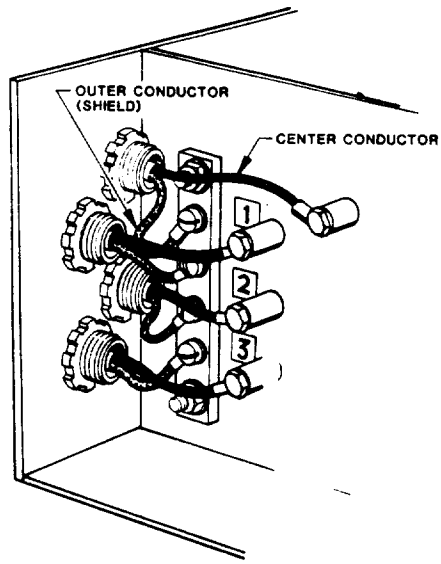
A. Connecting the Input HV Cable (From the Power Module)



B. Connecting the Output Cable for Gun #1



C. Connecting the Output Cable for Gun #2



D. Connecting the Output Cable for Gun #3

Figure 2-11. HV Coaxial Cable Connections to HV Section of Gun Interface

Installing the Chassis in a Cabinet

The gun interface is designed to be mounted in a standard 19-inch rack. After the high-voltage cables are connected and the chassis covers replaced, the chassis should be installed in the designated cabinet or enclosure. This can be the optional control console designed to stand on top of the power module, another standard 19-inch rack, or a special enclosure at the vacuum cubicle.

CAUTION

Because of the danger to other electronic equipment posed by RF radiation from the gun interface, it must not be mounted in the evaporation system's control cabinet.

Connecting the Tank Cable(s) (PN 0040-3750-0)

Each gun filament transformer primary is connected to a rear panel **TANK** connector by a Tank cable (PN 0040-3750-0). Follow the procedure described below and refer to Figure 2-14 in connecting each Tank cable.

STEP	ACTION
1	Make a hole for the cable in the filament transformer enclosure. The hole should be near the filament transformer and large enough to hold a standard electrical box connector or another device that will secure the cable and protect it from chafing against the edges of the hole.
2	Strip 1/4 inch of insulation off the ends of both of the exposed wires.
3	Attach one of the spade lugs provided with the cables to each stripped wire. Hollingsworth crimping tool H-7B is recommended for this operation.
4	Attach the electrical box connector or other securing device loosely to the cable and remove the nut from the connector.
5	Insert the cable and connector through the hole in the filament transformer enclosure, screw the nut back onto the connector securely, and tighten the connector's retainer around the cable until it is tight enough to prevent the cable from moving through the connector.

STEP	ACTION
	WARNING **DO NOT overtighten this retainer; doing so could short the filament current circuit.**
6	Attach the lugs to the termimals on the gun filament transformer primary, as shown in Figure 2-3.
7	Plug the other end of the cable into the **TANK 1** connector on the gun interface rear panel and screw the twistlock down snugly.

Repeat this procedure as needed for multigun installations. If the system has only two guns, use the **TANK 2** connector for the second gun's filament transformer connection.

Connecting the Position/Sweep Cable(s) (PN 0040-3740-0 or -1)

Except for guns controlled by beam sweep controllers, each gun's position coils must connected to a rear panel **POSITION** connector by a Position/Sweep cable (PN 0040-3740-0 for a 20-ft. cable, 0040-3740-1 for a 40-ft. cable). Refer to Figure 2-2 and follow the procedure described below in connecting each of these cables.

STEP	ACTION
1	Make a hole for the cable in the vacuum cabinet wall near the coil-current feedthrough. The hole should be large enough to hold a standard electrical box connector or another device that will secure the cable and protect it from chafing against the edges of the hole.
2	Strip 1/4-inch of insulation off the ends of all four exposed wires.
3	Attach the spade lugs provided with the cables to each stripped wire. Hollingsworth crimping tool H-7B is recommended for this operation.
4	Attach the electrical box connector or other securing device loosely to the cable and remove the nut from the connector.
5	Insert the cable and connector through the hole in the vacuum cubicle wall, screw the nut back onto the connector securely, and tighten the connector's

STEP ACTION

retainer around the cable until it is tight enough to prevent the cable from moving through the connector.

WARNING
DO NOT overtighten this retainer; doing so could short the longitudinal position control circuit.

6 Attach the lugs on the ends of the green-white wire pair to the feedthrough terminals for the longitudinal position coil. (See table below for polarity.) Note that the cable shield does not get connected.

POSITION COIL WIRING

COLOR	POLARITY	FUNCTION
Green	Negative (-)	Longitudinal
White	Positive (+)	Position Coil
Shield	(unconnected)	
Red	(Polarity does	Lateral
Black	not matter)	Position Coil
Shield	(unconnected)	

NOTE
The white wire MUST be connected to the positive (+) terminal for the logitudinal coil, and the green wire MUST be connected to the negative (-) terminal for the longitudinal coil.

7 Attach the lugs on the ends of the red-black wire pair to the feedthrough terminals for the lateral position coil. Note that the shield does not get connected.

8 Plug the other end of the cable into the **POSITION 1** connector on the gun interface rear panel and screw the twistlock down snugly.

NOTE
If this gun is to be controlled by a programmable sweep, plug the Position/Sweep cable into rear panel connector J2 on that component instead of the gun interface's POSITION 1 connector.

Repeat this procedure as needed for multigun installations. If the system has only two guns, use the **POSITION 2** connector for the second gun's longitudinal coil connection.

Connecting the 120VAC Cable

Finally, plug in the 20-ft. cable (PN 0040-3733-2) that carries 120 V ac power from the power module to the gun interface (see Figure 2-14). This female end of this cable plugs into the gun interface rear panel connector labeled **120VAC**. The male end of the cable plugs into an unlabeled receptacle on the rear surface of the power module left-side cover (see Figure 2-6).

HV/GUN CONTROL UNIT INSTALLATION

This subsection contains the instructions for mounting the high-voltage and gun control unit(s) and for connecting them to the other components and to the evaporation system. The topics in this subsection, in order, are:

* Mounting the control unit(s)
* Connecting the HV control and gun control cables
* Connecting the HV control-system I/O cable and the gun control-system I/O cable

Refer to Figure 2-14 in making cable connections to these control units.

Mounting the Control Unit(s)

The high-voltage/gun control unit and any additional gun control units can be mounted in any 19-inch rack. Generally, this will be either the system control cabinet or the optional control console designed to stand on top of the power module. A rack-mounting kit (PN 0411-6183-2) has been provided to facilitate this installation. Follow the procedure described below in mounting the control unit(s).

STEP	ACTION
1	Install the rack-mounting kit in the cabinet.
2	Mount the HV/gun control unit in the rack-mounting kit. It is generally best to mount the control unit on the left-hand side of the rack, particulary if one or more additional gun control units are to be mounted next to the HV/gun control unit.
3	Mount any additional gun control units to the right of the gun control section of the HV/gun control unit.
4	Install one or more blank quarter-panel covers, as needed, in the remaining open space.

Connecting the HV Control and Gun Control Cables (PN 0338-4976-7)

Follow the procedure below in attaching the cable that connects the power module to the high-voltage and the cable that connect the gun interface to the gun control unit.

STEP	ACTION
1	Plug the female end of one of the HV control cable into connector **J3** on the rear panel of the HV/gun control unit. The other end of this 50-pt. Belden cable (PN 6338-4976-7) should be plugged into the 50-pt. 'D' connector on the rear of the power module (see Figure 2-6).
2	Plug the male end of the other 50-pt. Belden cable (PN 6338-4976-7) into connector **J1** on the rear panel of the HV/gun control unit.
3	Plug the other end of this cable into the 50-pt. 'D' connector labeled **GUN 1** on the gun interface rear panel.

An additional 50-pt. cable is included with each gun upgrade kit. Plug the male end of the cable for the first additional gun into rear panel connector **J1** on the gun control unit immediately to the right of the HV/gun control unit. Plug the other end of the cable into the 50-pt. D connector labeled **GUN 2** the gun interface rear panel. For three-gun systems, plug the male end of the last cable into rear panel connector **J1** on the gun control unit farthest to the right. Plug the other end of the cable into gun interface rear panel connector **GUN 3**.

WARNING
It is extremely important that the cables for multigun systems be connected exactly as described above.

Connecting the HV Control-System I/O Cable (PN 0040-3770-0) and Gun Control-System I/O Cable(s) (PN 0040-3760-0)

The HV Control-System I/O cable and the Gun Control-System I/O cable carry the signals that are exchanged between the power supply and other portions of the evaporation system. The gun control-system I/O cable plugs into the gun control unit via rear panel connector J2, which is labeled **SYSTEM I/O**. Figure 2-12 shows the pinout for the signals that can be interfaced to the gun control unit via this connector. Tables 2-1 and 2-2 provide more detailed information about these signals. The HV control-system I/O cable plugs into the HV control unit via rear panel connector J4, which is also labeled **SYSTEM I/O**. Figure 2-13 shows the pinout for the signals that can be interfaced to the HV control unit via this connector. Tables 2-3 and 2-4 provide more detailed information about these signals.

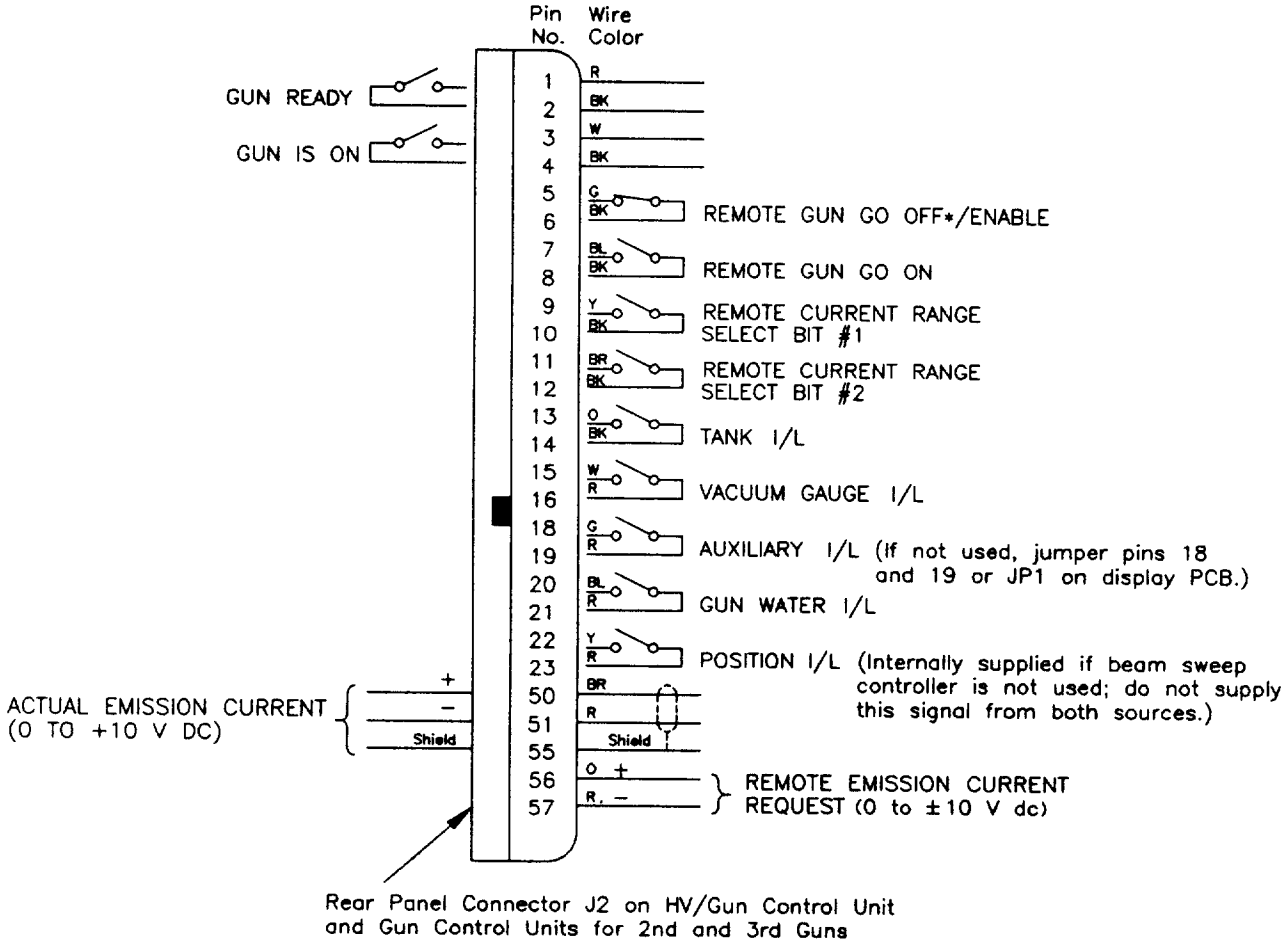


Figure 2-12. Inputs and Outputs via the Gun Control-System I/O Cable

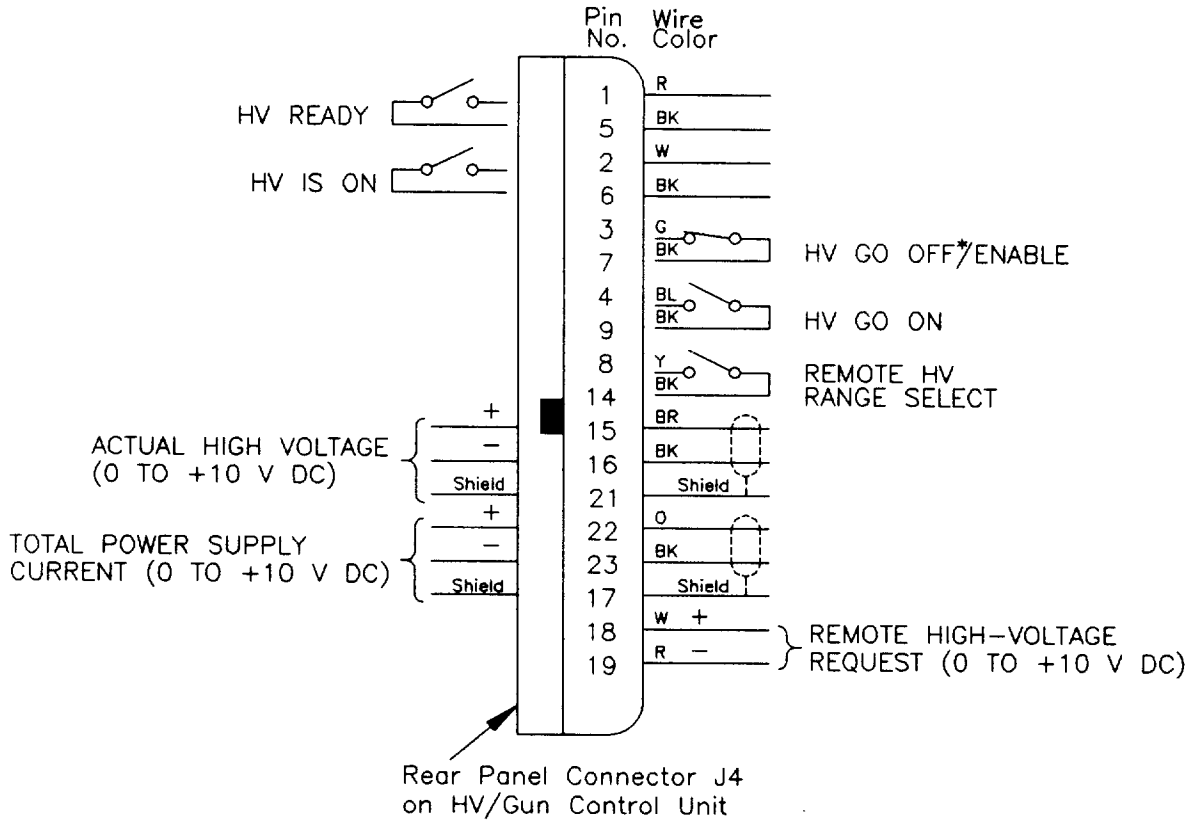


Figure 2-13. Inputs and Outputs via the HV Control-System I/O Cable

If you are not going to implement any remote control or monitoring functions, the only system I/O lines that must be connected are:

(1) those supplying interlock signals to the gun control unit (see Table 2-1)

(2) the green-black wire pair in the gun control-system I/O cable, which must be jumpered together to complete the normally-closed GUN GO OFF*/ENABLE loop

(3) the green-black wire pair in the HV control-system I/O cable, which must be jumpered together to complete the normally-closed HV GO OFF*/ENABLE loop.

NOTE

The gun filament current cannot be switched on if the GUN GO OFF*/ENABLE loop is not complete, and the high voltage cannot be switched on if the HV OFF*/ENABLE loop is not complete. Either function can be switched on with the other off, but emission current cannot be obtained unless both OFF*/ENABLE loops are closed.

Guidelines for Connecting the External Interlocks

Each of the interlock signals listed in Table 2-1 must be supplied to each remote gun control unit. If all guns are in one vacuum chamber, the TANK and VACUUM GAUGE interlocks must be connected in parallel.

NOTE

All statements regarding operator and equipment safety are void if the external interlocks are not correctly installed.

CAUTION

The interlocks are internally supplied with 24 V dc. Only contact closure need be supplied. The application of higher voltages to the interlock circuits will cause them serious damage.

Other I/Os: Control and Status Signals

The remote control inputs and status outputs include both digital and analog signals. Digital inputs require a simple contact closure and carry 24 V dc at approximately 20 mA. All digital outputs are from contact closures rated for 5 A @ 115 V ac or 5A @ 28 V dc.

Connecting the Gun Control-System I/O Cable(s) (PN 0040-3760-0)

Follow the procedure described below in connecting the gun control-system I/O cable(s). Refer also to Figure 2-12, which shows the pinout for the signals that can be interfaced to the gun control unit via its **SYSTEM I/O** connector (**J2**). Tables 2-1 and 2-2 provide more detailed information about these signals.

STEP	ACTION
1	Refer to Tables 2-1 and 2-2 and determine which wires will be needed to interface the power supply to the evaporation system. Tie the unused wires back to the cable insulation and cover the ends with electrical tape. Make sure that the exposed ends of the unused conductors do not touch each other or ground.
2	Strip 1/4 inch of insulation away from the end of each of the remaining wires.
3	Attach one of the spade lugs provided with the cables to the end of each wire. Hollingsworth crimping tool H-7B is recommended for this operation.
4	Carefully note the function of each color-coded wire (see Tables 2-1 and 2-2), and connect each spade lug to the appropriate terminal on the system terminal strip.
5	Plug the other end of the cable into rear panel connector **J2** on the gun control unit.

Repeat this procedure for each additional gun, making sure that signals are routed correctly to either gun control unit #2 or gun control unit #3.

Connecting the HV Control-System I/O Cable (PN 0040-3770-0)

Follow the procedure described below in connecting the HV control-system I/O cable(s). Refer also to Figure 2-13, which shows the pinout for the signals that can be interfaced to the HV control unit via its **SYSTEM I/O** connector (**J4**). Tables 2-3 and 2-4 provide more detailed information about these signals.

STEP	ACTION
1	Refer to Tables 2-3 and 2-4 and determine which wires will be needed to interface the power supply to the evaporation system. Tie the unused wires back to the

STEP	ACTION
	cable insulation and cover the ends with electrical tape. Make sure that the exposed ends of the unused conductors do not touch each other.
2	Strip 1/4 inch of insulation away from the end of each of the wires that will be used.
3	Attach one of the spade lugs provided with the cables to the end of each wire. Hollingsworth crimping tool H-7B recommended for this operation.
4	Carefully note the function of each color-coded wire (see Tables 2-3 and 2-4), and connect each spade lug to the appropriate terminal on the system terminal strip.
5	Plug the other end of the cable into rear panel connector **J4** on the HV control unit.

Table 2-1. Inputs via the Gun Control-SYSTEM I/O Cable

Digital Interlock Inputs (Required)

INTERLOCK	J2 PIN #	WIRE PAIR	FUNCTION
TANK	13, 14	O, BK	Prevents the gun from being switched on unless all vacuum system doors and covers are closed and locked so that personnel cannot come into contact with high voltage within the vacuum cubicle.
VACuum **GAUGE**	15, 16	W, R	Protects the gun filament by ensuring that the product chamber ion gauge is on before the gun is switched on.
AUXiliary	18, 19	G, R	Customer defined. Used with multipocket sources to ensure that the beam is OFF while the turret is rotating. Must be jumpered ON if not used; can also be jumpered on at JP1 on the display panel PCB.
GUN WATER	20, 21	BL, R	Prevents the gun from being switched on unless it is receiving sufficient cooling water. Signal to be supplied by a customer-installed flow switch.
POSITION	22, 23	Y, R	Prevents the gun from being switched on unless the beam is correctly positioned in the pocket. Signal can be supplied via these lines by an external beam sweep controller. If no external sweep controller is used, the position PCB in the gun interface chassis supplies this signal internally.

Table 2-1. Inputs via the Gun Control-SYSTEM I/O Cable (Cont.)

Analog Control Inputs

SIGNAL	J2 PIN #	WIRE PAIR	FUNCTION
REMOTE EMISSION CURRENT REQUEST	56, 57	O(+), R(-)	If the gun control unit's REMote/RANGEswitch is in the REMOTE position, this input linearly controls emission current within the selected range: 0 V = min. current for the selected range; ± 10 V = max. current for that range.

Digital Control Inputs

SIGNAL	J2 PIN #	WIRE PAIR	FUNCTION
REMOTE GUN GO OFF*/ENABLE	5, 6	G, BK	A momentary open pulse switches off the gun. If all gun control interlocks are made, the gun can be switched on again. **NOTE** **If these pins are not connected to a remote contact closure, they must be jumpered together, or the gun cannot be switched on.**
REMOTE GUN GO ON	7, 8	BL, BK	If all gun control interlocks are made and the GUN GO OFF*/ENABLE loop is closed, a 2-sec. contact closure across these pins switches on the gun.
REMOTE CURRENT RANGE SELECT BIT #1	9, 10	Y, BK	If the gun control unit's REMote/ RANGE switch is in the REMOTE position, a binary-coded input via pins 9, 10 and 11, 12 selects one of the four gun current ranges, as the table below indicates.
REMOTE CURRENT RANGE SELECT BIT #2	11, 12	BR, BK	CONTACTS CLOSED / RANGE SELECTED NONE — 1 BIT 1 ONLY — 2 BIT 2 ONLY — 3 BOTH — 4 See Section 3 for information on setting up current ranges.

Table 2-2. Outputs via the Gun Control-SYSTEM I/O Cable

Digital Outputs

SIGNAL	J2 PIN #	WIRE PAIR	FUNCTION
GUN READY	1, 2	R, BK	Indicates that all gun control interlocks are made and that the GUN GO OFF */ENABLE loop is closed so the gun can be switched on.
GUN IS ON	3, 4	W, BK	Indicates that the gun is switched on.
———		Y, B	Not used

Analog Outputs

SIGNAL	J2 PIN #	WIRE PAIR	FUNCTION
ACTUAL EMISSION CURRENT	50, 51	BR(+), R(-)	Linearly represents the emission current drawn by the gun controlled by this gun control unit: 0 V = 0 A; 10 V = 2 A.

Table 2-3. Inputs via the HV Control-SYSTEM I/O Cable

Digital Control Inputs

SIGNAL	J4 PIN #	WIRE PAIR	FUNCTION
HV GO OFF*/ ENABLE	3, 7	G, BK	A momentary open pulse switches off the high voltage. If all HV control interlocks are made, contact closure of this line enables the HV to be switched on. NOTE If these pins are not connected to a remote contact closure, they must be jumpered together, or the HV cannot be switched on.
HV GO ON	4, 9	BL, BK	If all HV control interlocks are made and the HV GO OFF*/ENABLE loop is closed, a momentary contact closure switches on the high voltage.

Analog Control Inputs

SIGNAL	J4 PIN #	WIRE PAIR	FUNCTION
REMOTE HIGH-VOLTAGE REQUEST	18, 19	W(+), R(-)	If the HV control unit's REMote/RANGE switch is in the REMOTE position, this input linearly controls the high voltage within the selected range. **NOTE** **This input must be 0 V dc to +10 V dc. The HV circuit cannot be controlled by a -10 V dc input.**

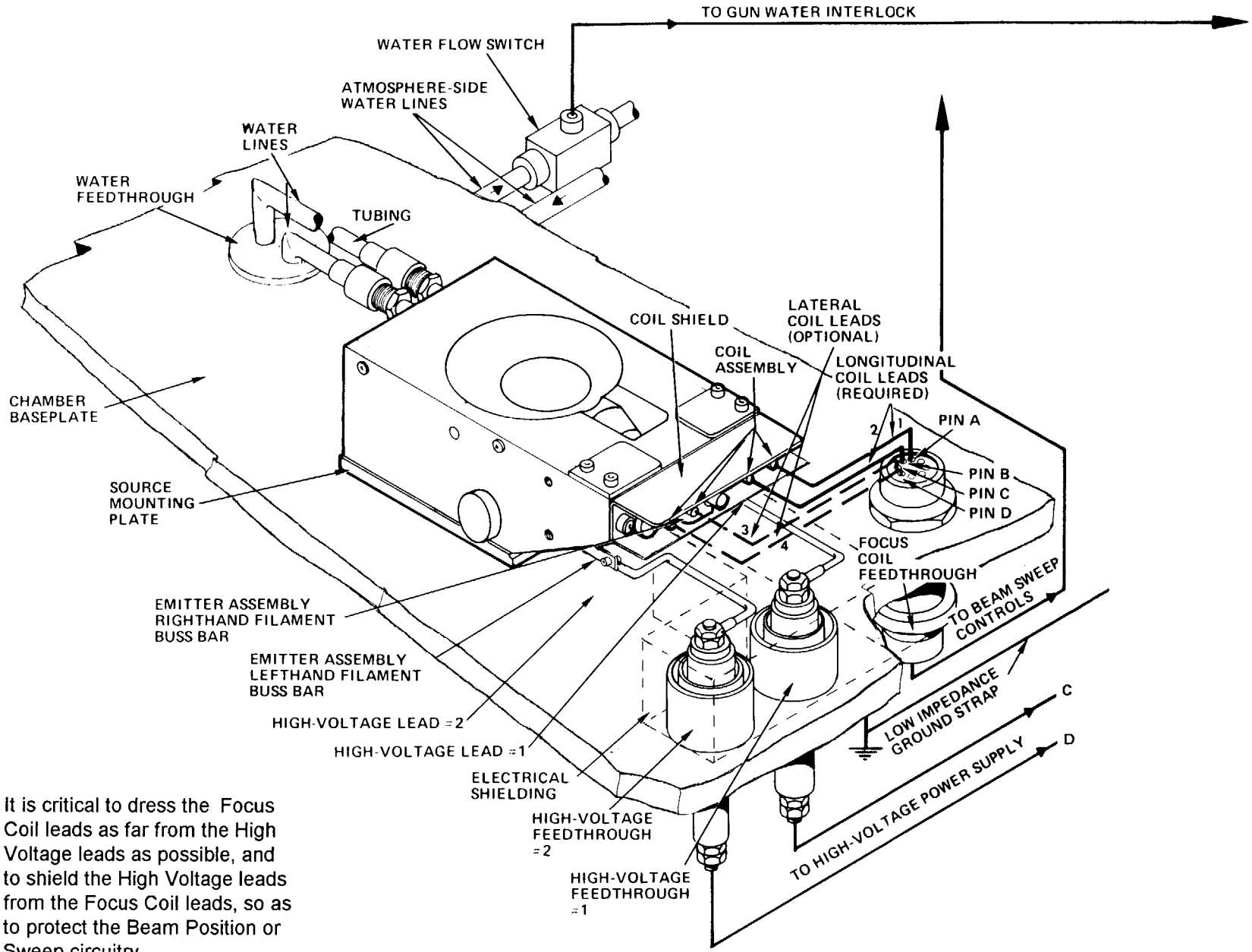
Table 2-4. Outputs via the HV Control-SYSTEM I/O Cable

Digital Outputs

SIGNAL	J4 PIN #	WIRE PAIR	FUNCTION
HV READY	1, 5	R, BK	Indicates that all HV control interlocks are made and that the HV GO OFF */ENABLE loop is closed; the HV is ready to be switched on.
HV IS ON	2, 6	W, BK	Indicates that the high voltage is on.

Analog Outputs

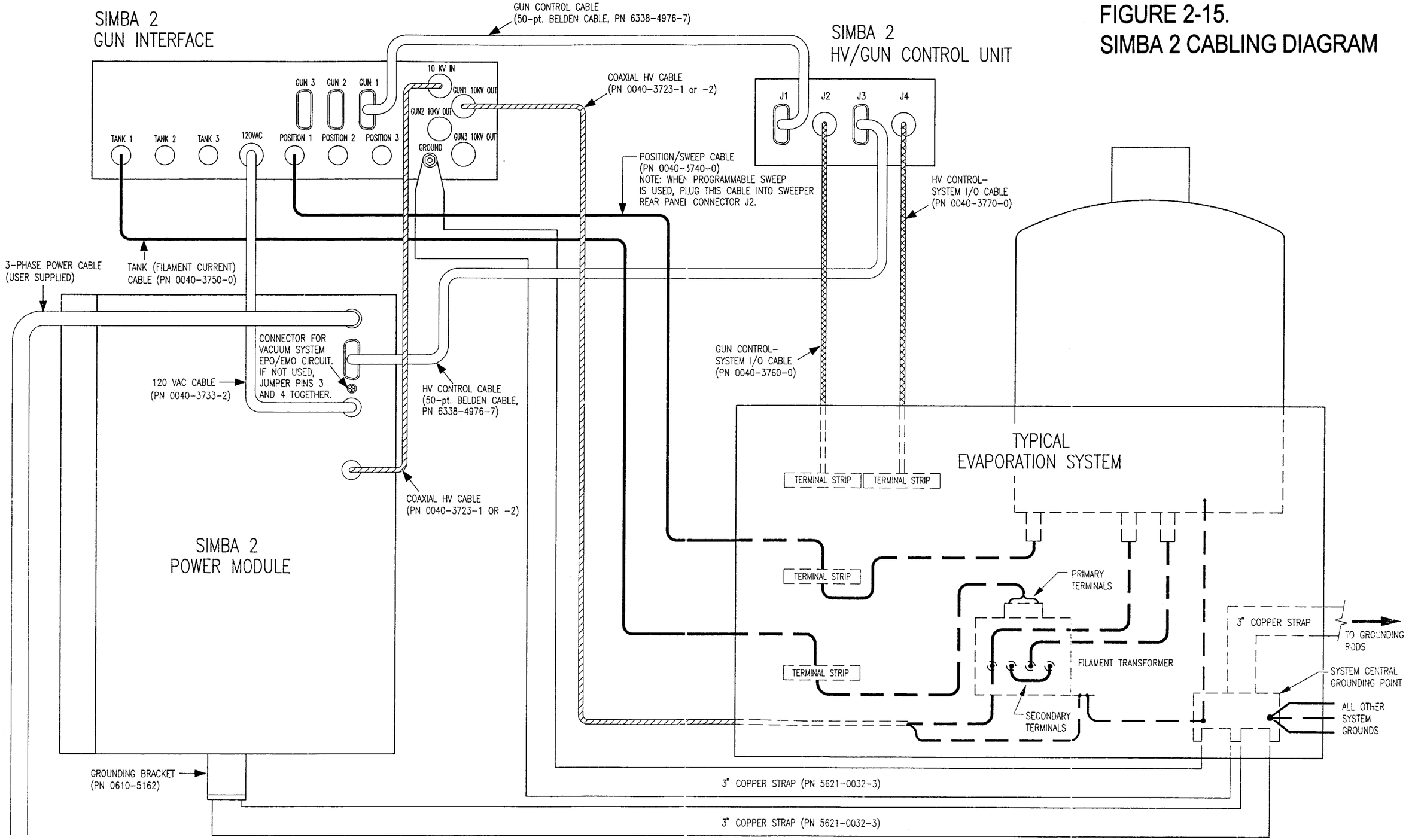
SIGNAL	J4 PIN #	WIRE PAIR	FUNCTION
ACTUAL HIGH VOLTAGE	15, 16	BR(+),BK(-)	Linearly represents the load (gun) voltage: 0V = 0 kV, 10 V = 10 kV.
TOTAL POWER SUPPLY CURRENT	22, 23	O(+), BK(-)	Linearly represents the total power supply current (i.e., the total emission current drawn by all guns powered by the power supply): 0 V = 0 A; 10 V = 2 A.



Note: It is critical to dress the Focus Coil leads as far from the High Voltage leads as possible, and to shield the High Voltage leads from the Focus Coil leads, so as to protect the Beam Position or Sweep circuitry.

Figure 2-14. Typical Gun Installation

FIGURE 2-15.
SIMBA 2 CABLING DIAGRAM



SECTION 3
CONTROL/DISPLAY FEATURES AND OPERATION

SECTION OVERVIEW

This section describes the power supply's control and display features and outlines preliminary operating procedures and calibration procedures. The subsections, in order, are:

* Power Module Front Panel
* HV Control Panel
* GUN Control Panel
* HV Regulator PC Board
* Gun Interface Front Panel
* Front-Edge Components on Gun Control and Position PCBs
* Initial Operation
* Setting The Longitudinal Coil Current Limits
* Setting The Filament Current Bias Level
* Setting Up Current Ranges

POWER MODULE FRONT PANEL

Indicator Lights and EPO Pushbutton

Near the upper right-hand corner of the power module's front panel (see Figure 3-1) there is a red pushbutton labelled **EPO**. Pushing this button drops out the main power contactor, switching off the high voltage and all 110-V ac functions. The green **PWR ON** light is illuminated whenever the main power contactor is pulled in. The amber **HV ON** light is illuminated whenever the high voltage is on in the power module.

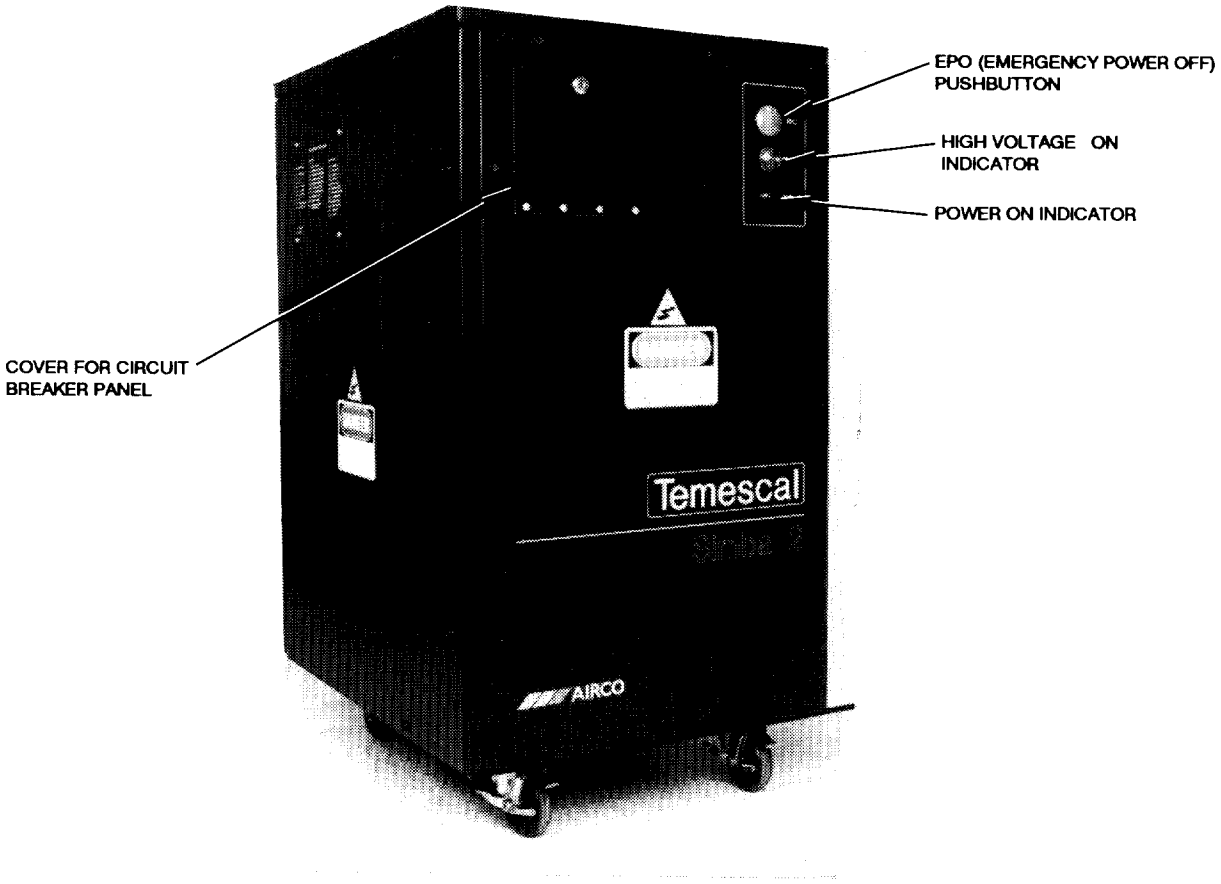


Figure 3-1. Power Module Front Panel

Circuit Breaker Panel

The power module circuit breaker panel (see Figure 3-2) is behind the hinged cover shown in Figure 3-1. The features on this panel are:

Main Circuit Breaker. A resettable main-power-protection device. On 208-volt models, this breaker is rated at 80 A. On 380-volt and 480-volt models, it is rated at 40 A and 30 A, respectively.

Control Circuit Breaker. A resettable 15-A circuit breaker that protects the power module's control transformer, which produces the 120 V ac distributed to the gun interface and to other devices within the power module.

RESET Button. A red pushbutton located just above the column of device-specific circuit breakers. To switch on the power supply, the user must press this button after switching on the main circuit breaker.

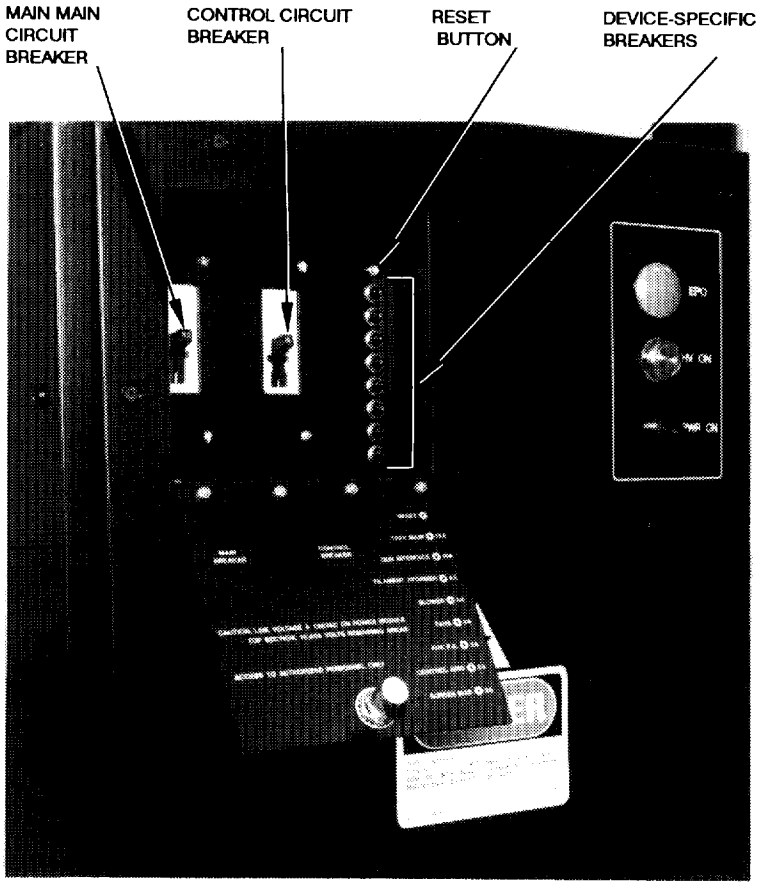


Figure 3-2. Power Module Circuit Breaker Panel

Device-Specific Circuit Breakers

Pushbutton circuit breakers designed to protect specific devices in the power module. These breakers pop up during an overload condition are reset by being pushed in. They cannot be used to switch off or disable the device they protect. They all supply 120 V ac to their respective devices.

From top to bottom, these circuit breakers are:

FRONT PANEL LEGEND	CIRCUIT BREAKER FUNCTION/RATING
120V MAIN	15-A breaker protecting the other breakers listed here
GUN INTERFACE	10-A breaker for the 120 V ac supplied to the gun interface chassis
FILAMENT XFORMER	8-A breaker protecting the gun filament transformer primary
BLOWER	5-A breaker protecting the blower used to cool the tetrode tube
FANS	3-A protecting the three small exhaust fans mounted on the rear of the power module
AUX POWER SUPPLY	3-A breaker protecting the internal DC power supplies (PS1 and PS2)
CONTROL GRID	3-A breaker protecting the circuitry that generates the unregulated 350 V dc that is supplied to the MOSFET power amplifier on the control grid PCB
SCREEN BIAS	3-A breaker protecting the circuitry that supplies the unregulated 500-600 V dc to the tetrode tube's screen grid

HV CONTROL PANEL

The HV CONTROL section of the HV/gun control panel contains the control and display features pictured in Figure 3-3 and described below.

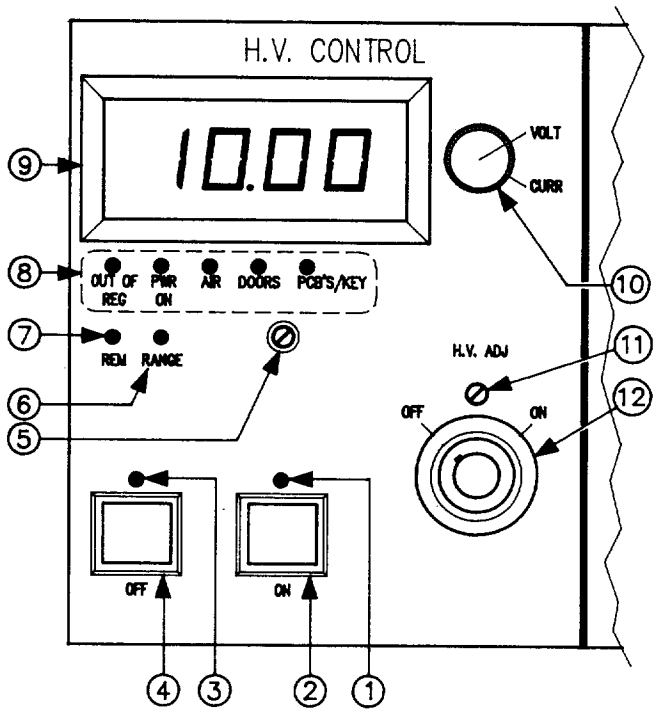


Figure 3-3. HV CONTROL Panel

FEATURE	FUNCTION
1. HV ON LED	This LED lights to indicate that the high-voltage is on in the power module.
2. HV **ON** pushbutton	This momentary-action pushbutton switches on the high-voltage contactor, which supplies three-phase AC power to the main power transformer if all HV interlocks are made.
3. HV OFF*/ ENABLE LED	This LED lights to indicate that the high voltage is off and that all high-voltage interlocks are made. The LED therefore functions as a ready light, indicating that the high voltage can be switched on.

FEATURE	FUNCTION
4. HV **OFF** pushbutton	This momentary-action pushbutton switch opens the high-voltage latching circuit, removing power from the main power transformer.
5. Remote/Range switch	This switch is operational only when turned to its most clockwise position. When the switch is in that position, the **REM**ote LED lights, indicating that a remote device can assume analog control over the high voltage.
6. **RANGE** LED	Not operational

FEATURE	FUNCTION
7. **REMote** LED	This LED lights when the REMote/RANGE switch is in the REMote position.
8. **OUT OF REG** and interlock indicators	
OUT OF REG indicator	When the supply is on, this LED lights to indicate an out-of-regulation condition caused by arcing or some other event. The LED will often flicker on and off in response to intermittent arcing. It also remains lit after the power supply has switched itself off because of an unclearrable out-of-regulation fault. Under these conditions, the power supply cannot be switched on again unless the HV OFF*/ENABLE LED (feature 3) is lit. To reenable the HV circuit, it is necessary to press the HV OFF pushbutton (feature 4). If a remote HV OFF input is connected, supplying a momentary remote OFF pulse will also reenable the HV circuit if all HV interlocks are made.
POWER ON indicator	This LED lights when power is applied to the power supply through the power module's main circuit breaker, control circuit breaker, and pop-up circuit breakers.
AIR indicator	This LED lights to indicate that a sufficient amount of cooling air is flowing to the tetrode tube.
DOORS indicator	This LED lights to indicate that the power module's front, rear, and left-side covers are in place.
PCBS/KEY indicator	This LED lights to indicate that (1) all the PCBs in the power module are correctly installed, and (2) the HV keylock switch is (feature 12) in the ON position.

FEATURE	FUNCTION
9. DC voltage/ current meter	Displays either the voltage available for the electron beam guns or total power supply current, which includes the emission current being supplied to all the guns powered by the power supply.
10. **VOLT/CURR** selector	This switch enables the user to select either high voltage or total power supply current for display on the digital meter.
11. **HV ADJ** control	This potentiometer provides analog control over the high voltage in either voltage range (-3 to -7 kV and -6 to -10 kV). Clockwise rotation increases the voltage.
12. KEYLOCK	This key-operated switch must be in the ON position in order for the high-voltage circuit to be enabled.

GUN CONTROL PANEL

Each GUN CONTROL panel contains the control/display features pictured in Figure 3-4 and described below. The front panel features are the same whether the panel is on the GUN CONTROL section of the basic HV/gun control unit or on a separate gun control unit for an additional gun

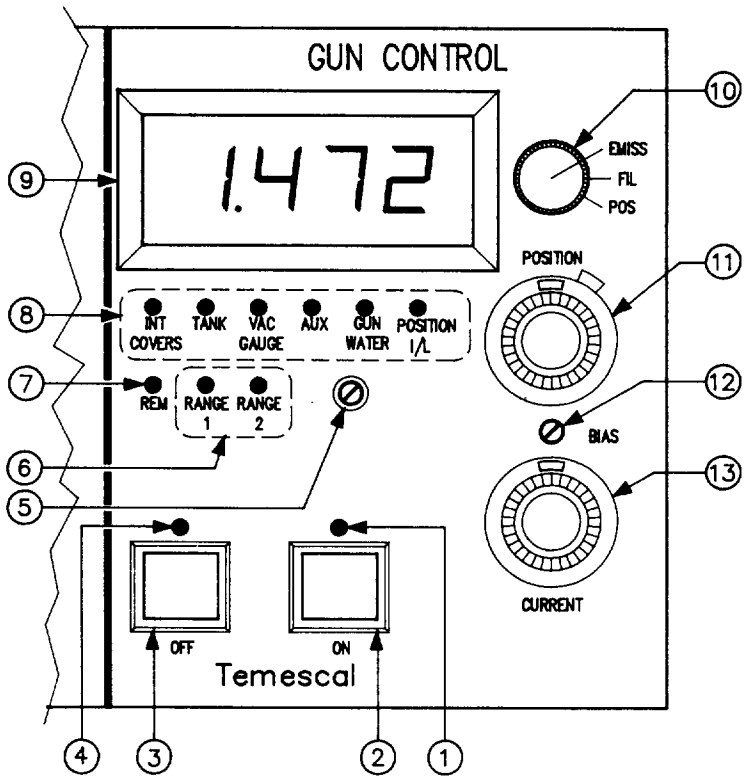


Figure 3-4. GUN CONTROL Panel

FEATURE	FUNCTION
1. Gun ON indicator	This LED lights to indicate that the gun is switched on. Filament current will be supplied to the gun whenever this LED is lit. If the high voltage is on in the power module, high voltage will be applied to the filament when this LED is lit.

FEATURE	FUNCTION
2. Gun **ON** pushbutton	A pushbutton that switches on the high-voltage relays in the gun interface and the relay (also in the gun interface) that supplies power to the gun filament transformer primary. If the GUN OFF*/enable is made, pressing this pushbutton for two seconds should energize the relays.
3. Gun **OFF** pushbutton	A momentary-action pushbutton that deenergizes the gun interface's high-voltage relays and its filament relay. This pushbutton is in series with the normally closed external GUN OFF*/enable contact closure, if such a remote control is implemented.
4. Gun OFF*/ ENABLE LED	This LED lights to indicate that the gun is off and that all gun control interlocks are made. The LED therefore functions as a READY light indicator, indicating that the gun can be switched on.
5. REMote/RANGE switch	This five-position rotary switch permits direct selection of emission current ranges 1-4 and remote current range selection and remote analog control of current in the selected range. The switch position farthest counterclockwise selects range #1, the next position selects range #2, the middle position selects range #3, and the fourth position selects range #4. Turning the switch all the way clockwise puts current range selection and current level in the range selected under remote control.

FEATURE	FUNCTION
6. **RANGE** indicators	The binary-coded **RANGE 1** and **RANGE 2** LEDs light to indicate current range selection according to the scheme shown in the table below.

LEDs LIT	RANGE SELECTED
NONE	1
RANGE 1	2
RANGE 2	3
BOTH	4

To set the limits for any desired current range(s), follow the instructions provided below, under "SETTING UP CURRENT RANGES."

7. **REM**ote indicator — This LED lights to indicate that the REMote/RANGE switch is in the remote position. The LED therefore indicates that the gun control unit is in remote mode, enabling remote current-range selection remote current-level control and disabling the front panel **CURRENT** control.

8. Interlock indicators — These LEDs light to indicate that the interlock in question has been made.

INT COVERS indicator — This LED lights to indicate that the top cover of the gun interface chassis is in place.

TANK indicator — This LED lights to indicate that the interlocked doors and covers on the vacuum cubicle are in place.

VAC GAUGE indicator — This LED lights to indicate that the source chamber vacuum gauge is reading within the set limits.

AUXiliary indicator — This LED lights to indicate that a customer-defined interlock is made. This interlock is used with multipocket sources to ensure that the beam is switched off when the turret is rotating. If no auxiliary interlock is used, this LED must be jumpered ON, either at J2 pins 18 and 19

FEATURE	FUNCTION
	on the gun control unit's rear panel or at JP1 on the gun control unit's display PCB.
GUN WATER indicator	This LED lights to indicate that the customer-supplied flow switch indicates that sufficient cooling water is flowing in the electron beam gun.
POSITION I/L indicator	This LED lights to indicate that the longitudinal coil current is within the set limits. (If supplied by an external beam sweep controller, the limits must be set via that component. If the gun is not under the control of a beam sweep controller, the limits are set according the to the instructions provided below, under "SETTING THE LONGITUDINAL COIL CURRENT LIMITS.")
	WARNING **1. All statements regarding operator and equipment safety are void if the external interlocks are not correctly installed.** **2. The external interlock signals and any remote control signals are supplied to the power supply via the SYSTEM I/O connector (J2) on the gun control rear panel. These signals are all 24 V dc, and external contact closure must be supplied. Care must be taken not to allow voltages from other sources to affect these signals, as safety could thereby be compromised.**
9. **EMISS**ion/ **FIL**ament/ **POS**ition current display	This digital meter displays the value of the current selected via the **EMISS/FIL/POS** switch, either (1) emission current in dc amperes, (2) gun filament transformer primary current in ac amperes, or (3), the longitudinal coil current in dc amperes, if the gun is not under the control of a beam sweep controller. If the gun is under the control of a beam sweep controller, this meter does not display longitudinal coil current.

FEATURE	FUNCTION
10. **EMISS/FIL/POS** switch	This switch is used to select either emission current, filament current, or longitudinal coil current for display on the digital meter.
11. **POSITION** control	If no external beam sweep controller is used for the gun connected to this control unit, this potentiometer is used to control the gun's longitudinal coil current. If the gun is under the control of a beam sweep controller, the POSITION pot is nonfunctional.
12. **BIAS** control	This potentiometer is used to set the filament current bias level. (See the procedure described below, under "SETTING THE FILAMENT CURRENT BIAS LEVEL.")
13. **CURRENT** control	This potentiometer provides analog control of filament current level (and therefore of emission current level) when the gun control unit is not in remote mode.

VOLTAGE REGULATOR PC BOARD

The voltage regulator PC board is mounted on the power module's left-hand side. Removing the small panel covering this board provides easy access to the LEDs, test points, and adjustment pots on the voltage regulator PCB (see Figure 3-5 and drawings 040-6653 and 040-6624). These indicator, test, adjustment features are:

CONTROL/ DISPLAY FEATURE	FUNCTION
DS1	LED that lights to indicate that one or more gun(s) have been switched on and that the high-voltage relay in the power module has been energized, sending high voltage to the gun interface.
DS2	LED that lights to indicate that all of the internal power module interlocks (POSITION, if internally supplied, PWR ON, AIR, DOORS, PCBS/KEY, and INT COVERS) are satisfied.
DS3	LED that lights to indicate that the HV OFF*/enable has been made (i.e., that the OFF pushbutton on the HV CONTROL panel has been pressed and that the external HV OFF signal has been supplied).
DS4	LED that lights briefly either when the ON pushbutton on the HV CONTROL panel is pressed or when the external ON signal is supplied.
DS5	LED that lights to indicate that the contactor that supplies three-phase power to the primary of the high-voltage step-up transformer is pulled in. When this occurs, the ON LED on the HV panel should light and the HV IS ON signal should be supplied to the external system via J2 pins 3 and 4.
DS6	LED that lights to indicate that the gun control PCB is operating normally (i.e., that a gun cutback is not occurring). If this LED is off, the gun should be cut back to the preset bias level.
DS7	Deleted from board.
DS8	Deleted from board.

CONTROL/ DISPLAY FEATURE	FUNCTION
DS9	LED that lights to indicate that the power supply has switched itself off due to a severe out-of-regulation condition.
TP1	Test point for the ground, or return, for the PCBs and the dc power supplies in the power module. This ground is held at 10 ohms above system ground.

DANGER

This test point should NEVER be grounded through test equipment or through any other conductor.

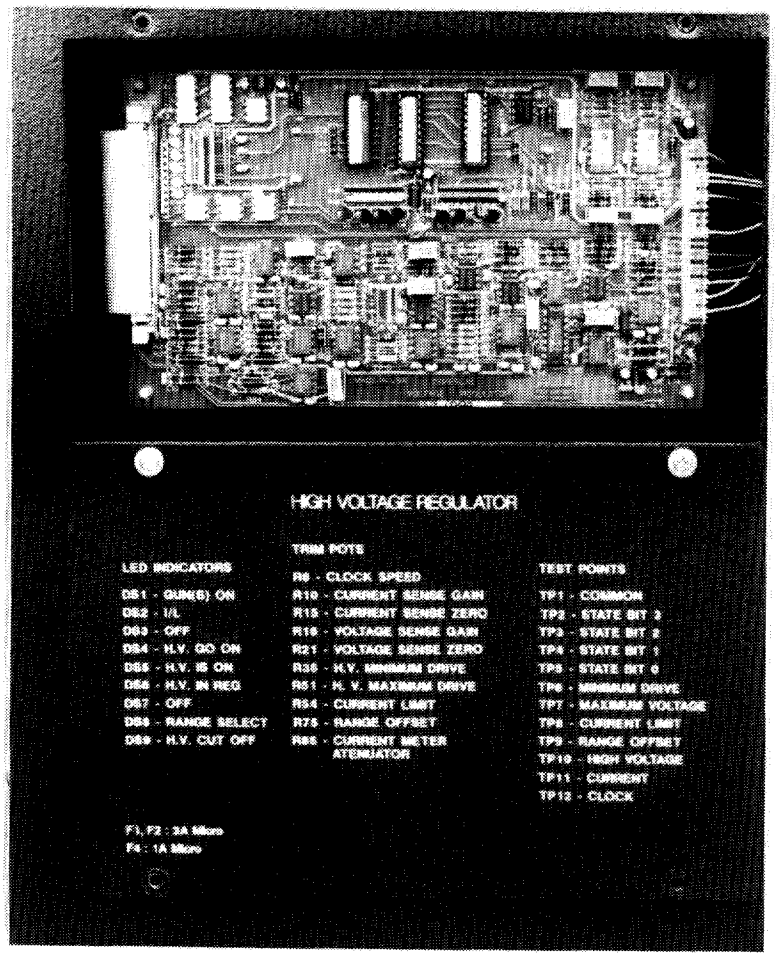


Figure 3-5. HV Regulator PC Board

CONTROL/ DISPLAY FEATURE	FUNCTION
TP2	Test point for determining whether state bit 3 is high or low.
TP3	Test point for determining whether state bit 2 is high or low
TP4	Test point for determining whether state bit 1 is high or low
TP5	Test point for determining whether state bit 0 is high or low

NOTE

State bits 0 through 3 are output by U11. For further information regarding the use of test points TP2-TP5, see 040-6624 and Figure 4-7 and accompanying text.

TP6	Test point for monitoring the minumum drive applied to the MOSFET power amplifier on the control grid PCB.
TP7	Test point for monitoring the maximum voltage setpoint.
TP8	Test point for monitoring the maximum emission current setpoint.
TP9	Test point for monitoring the offset that controls the low-voltage range.
TP10	Test point for monitoring the ACTUAL HIGH VOLTAGE signal, which is output to the meter on the HV control unit and to the vacuum system.
TP11	Test point for monitoring the TOTAL POWER SUPPLY CURRENT signal, which is output to the HV control unit and to the vacuum system.
TP12	Text point for checking the frequency of the clock pulse supplied to U10 pin 1 and U11 pin 1 by U13 pin 3; must be set at 500 Hz.

CONTROL/ DISPLAY FEATURE	FUNCTION
R6	Potentiometer for setting the frequency of the clock pulse output by U13 pin 3.
R10 R15	Pots for zeroing (R15) and calibrating (R10) the TOTAL POWER SUPPLY CURRENT signal.
R16 R21	Pots for zeroing (R16) and calibrating (R21) the ACTUAL HIGH VOLTAGE signal.
R35	Pot for adjusting the minimum drive supplied to the MOSFET power amplifier on the Control Grid PCB.
R51	Pot for adjusting the maximum voltage setpoint.
R54	Pot for adjusting the maximum emission current setpoint.
R75	Pot for adjusting the offset that controls the low-voltage range.
R85	When the current measurement circuitry is properly adjusted, this pot can be used to adjust the reading on the digital meter on the HV CONTROL panel.

GUN INTERFACE FRONT PANEL

The only control/display feature on the front panel of the gun interface chasses (see Figure 3-6) is the ON/OFF switch for the 110-V ac power, which is supplied to the gun interface by the control transformer in the power module. This switch must be in the ON position before the gun can be switched on.

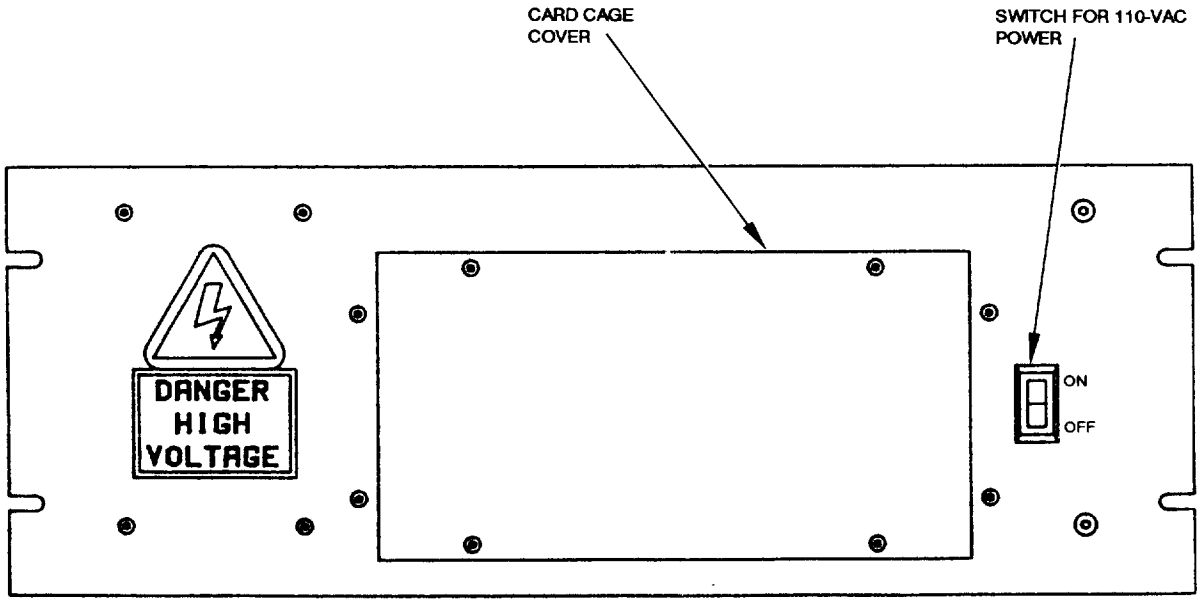


Figure 3-6. Gun Interface Front Panel

FRONT-EDGE COMPONENTS ON GUN CONTROL AND POSITION PCBS

The gun control PCB(s) and the position PCB(s) stand just behind the removable cover in the gun interface front panel. Removing this panel provides easy access to the adjustment pots, status LEDs, and test points on the front edges of both boards.

WARNING
The removal of the gun interface top cover can expose the user to dangerous or lethal voltages.

The silkscreening on the removable cover indicates the locations of these front-edge components. Their functions are described below in the order (from top to bottom) in which the components are arranged on the boards.

Gun Control PCB Front-Edge Components

COMPONENT	FUNCTION
DS1	Lights to indicate that all the gun interlocks (INT COVERS, VAC GAUGE, and POSITION) are made.
DS2	Lights to indicate that the OFF pushbutton on the gun control unit is not being pressed and and that the external GUN OFF signal is being supplied.
DS3	Lights to indicate that either the ON pushbutton on Gun Control panel has been pressed or the external ON signal has been supplied.
DS4 DS5	Indicate which current range the gun is in.

LED's LIT	RANGE
NONE	1
DS5	2
DS4	3
BOTH	4

DS6	Lights to indicate that the high voltage is in regulation and that the gun should be able to operate normally over its entire current range. If this LED is not lit, the filament current should be cut back to its bias level.

COMPONENT	FUNCTION
DS7	Not used
DS8	Mimics the Gun OFF*/Enabled LED on the Gun Control unit. Should light only if both DS1 and DS2 are lit. When all three are lit, it indicates that the gun is ready to be switched on.
R16 R17	Used for zeroing and calibrating the ACTUAL EMISSION CURRENT signal sent to the gun control unit and the vacuum system.
R18	Used for adjusting current range 1. (See the procedure described below, under "SETTING UP CURRENT RANGES.")
R19	Used for adjusting current range 2.
R20	Used for adjusting current range 3.
R21	Used for adjusting current range 4.
R22	Used for calibrating the filament current meter reading.

Position PCB Front-Edge Components

COMPONENT	FUNCTION
DS1	Lights when the longitudinal coil current is within the set limits.
R18	Used for setting the upper limit for longitudinal coil current.
R19	Used for setting the lower limit for longitudinal coil current.
R20	Used for zeroing the position current readout on the Gun Control unit's front panel meter (selector in **POS** position).
R21	Used for adjusting the full-scale reading of the value measured at TP4 (ACTUAL POSITION CURRENT, conditioned); nominally, 10 V = 3 A.

COMPONENT	FUNCTION
R22	Used for calibrating the position current readout on the Gun Control unit's front panel meter.
TP1	Test point for circuit ground.
TP2	Test point for the circuit's +15 V dc supply.
TP3	Test point for the circuit's -15 V dc supply.
TP4	Test point for the conditioned ACTUAL POSITION CURRENT signal.
TP5	Test point for use in zeroing the output of R20.
TP6	Test point for the unconditioned ACTUAL POSITION CURRENT signal.
TP7	Test point for the POSITION CURRENT REQUEST signal from the Gun Control panel.
TP8	Test point for the square waveform generated by the switching power supply.
TP9	Test point for the triangular waveform generated by the switching power supply.

INITIAL OPERATION

Preliminary Checkout

Before performing this procedure, make sure that:

* the external interlocks are installed
* the three-phase utility power is available (± 10%).

DANGER

All statements regarding safety for the operator and equipment are void if the external interlocks are not correctly installed.

Follow the procedure described below as you switch on the power supply for the first time.

CAUTION

If any indicator or meter reads abnormally, stop at once. Switch off the power supply and refer to the appropriate subsection(s) of Section 5, "TROUBLE-SHOOTING."

STEP	ACTION
1	Open then power module's circuit breaker panel and switch on the **MAIN** (80-A) circuit breaker. Then press the red **RESET** BUTTON. The green **PWR ON** indicator on the front of the power module should now be lit. If this indicator does not light, switch off the main circuit breaker and check the input power. Also, check to see that a connection is made across pins 3 and 4 of the system EMO/EPO circuit connector on the rear of the power module (see instructions on pages 2-14 and 2-15.).
2	Once the **PWR ON** indicator is lit, switch on the **CONTROL** circuit breaker. The **PWR ON, AIR,** and **DOORS** LEDs on the HV control unit should now be lit. If none of them is lit, check the **120 V MAIN** circuit breaker on the circuit breaker panel. If only the **PWR ON** LED is lit, check the **BLOWER** circuit breaker on the circuit breaker panel.

STEP	ACTION
3	If the **AIR** LED on the HV control unit is lit, you should be able to hear the blower that provides cooling air to the tetrode tube. If you cannot, check the **BLOWER** circuit breaker.
4	Turn the keylock to the **ON** position. The **PCBS/KEY** LED and the **OFF LED** on the HV control unit should now be lit.

WARNING
DO NOT switch on the high voltage.

5	Check to see whether the **REMOTE** LED on the HV control unit is lit. For the purposes of this test, this LED should not be lit. If the **REMOTE** LED is lit, simply turn the Remote/Range switch on the HV control unit counterclockwise one notch.
6	Turn the HV keylock to the **OFF** position and remove the key.
7	Make sure that the switch on the front panel of the gun interface chassis is in the **ON** position.
8	Check to see whether the **REMOTE** LED on the gun control unit is lit. For the purposes of this test, this LED should not be lit, even if you have implemented remote current control. If the **REMOTE** LED is lit, turn the gun control unit's Remote/Range switch all the way counterclockwise, selecting current range #1. Neither of the two **RANGE** LEDs on the gun control unit should be lit at this point.

STEP	ACTION
9	The **INT COVERS** LED on the gun control unit should now be lit. If it is not, check to see that the cover on the gun control chassis is correctly secured.
10	Once the **INT COVERS** LED on the gun control unit is lit, check to see whether the gun control unit's **TANK** LED is lit. If this LED is not lit, make sure that the vacuum system's bell jar or product chamber door is closed and that all interlocked vacuum cubicle access doors are closed.
11	Once the **TANK** LED is lit, pump down the vacuum system. As soon as the ion gauge comes on, the **VAC GAUGE** LED on the gun control unit should light. Verify that the **VAC GAUGE** indicator goes out when the ion gauge is switched off.
12	If you are using the auxiliary interlock, check to see that the gun control unit's **AUXILIARY** LED lights when the interlock is made. If you are not using the auxiliary interlock, the indicator should be jumpered on, either at pins 18 and 19 on the gun control unit's rear panel connector (J2) or at JP1 on the gun control unit's display PC board.
13	Turn on the gun cooling water, if it is not on already. Then check to see that the **GUN WATER** LED on the gun control unit is lit. If it is not, check to see that the water lines have proper pressure and that the flowmeter is functioning.
14	Once all the gun interlock LEDs are lit, check to see that the LED above the gun control unit's **OFF** button is lit.
15	Turn the selector switch next the meter on the gun control unit to the **FIL**ament position, if it is not in that position already.
16	Press the **ON** button on the gun control unit. The LED above this pushbutton should then light, and the **OFF** LED should be extinguished.
17	The gun control unit's meter should show a filament current reading of 70-90 mA, a factory-set bias level. Make a note of this bias setting.

STEP	ACTION
18	Turn the **BIAS** control clockwise and check to see that the reading on the meter increases.
19	Turn the **BIAS** control counterclockwise until the meter shows the original bias value.

WARNING

The bias adjustment should NEVER be left higher than the bias level (i.e., just below the filament current level required to generate a beam to when the HV is on), as damage to the filament could result. To set the bias level, follow the instructions provided below, under "SETTING THE FILAMENT CURRENT BIAS LEVEL."

20	Press the **OFF** button on the gun control unit. The LED above the **ON** pushbutton should go out, and the LED above the **OFF** pushbutton should be lit.
21	If your system does not include a beam sweep controller for the gun controlled by this gun control unit, turn the selector switch for the gun control unit's meter to the **POS** position. If your system does have a sweep controller for this gun, skip this step and step 22.
22	Slowly turn the gun control unit's **POSITION** control clockwise. As you do so, check to see that the meter reading increases and that the **POSITION** interlock LED on the gun control unit is extinguished when the reading increases beyond a factory-set value.
23	Repeat steps 8 through 22 for any other gun(s) powered by the power supply.
24	Make sure that all guns are OFF.
25	Turn the keylock on the HV control unit to the **ON** position.
26	Turn the meter selector switch on the HV control unit to the **VOLT** position, if it is not already in that position.
27	Press the HV **ON** pushbutton. The LED above the HV control unit's **OFF** button should go out, and the LED above the **ON** button should be lit. In addition, the

STEP	ACTION
	green **HV ON** light on the power module's front panel should now be lit.
28	Turn the **HV ADJ** control clockwise. Check to see that the HV meter's reading increases. Then set the high voltage for -10 kV, if you are operating in the normal range, or -7 kV, if you are operating in the low-voltage range.
29	Press the **OFF** button on the HV control unit. The HV meter should now read zero. The green **HV ON** light on the power module and the LED above the HV control unit's **ON** button should both be extinguished. The LED above the **OFF** pushbutton should now be lit, indicating that the high voltage is enabled. All interlock LEDs on the HV and gun control units should still be lit.
29	Turn the keylock to the **OFF** position. The **PCBS/KEY** LED and the LED above the HV **OFF** pushbutton should now be extinguished. The remainder of the interlock LEDs should remain lit, however.

Initial Operating Procedure

Follow the procedure described below in obtaining emission for the first time after installing the power supply. Before performing this procedure, be sure that

* the electron beam gun(s) are correctly installed and have evaporant materials in their crucibles
* cooling water is flowing in the electron beam gun(s) you are about to operate.

STEP	ACTION
1	If the power supply is not switched on already, open the power module's circuit breaker panel, switch on the **MAIN** circuit breaker, and press the red **RESET** button.
2	Switch on the **CONTROL** circuit breaker on the circuit breaker panel and the **110 VAC** switch on the gun interface front panel.

STEP	ACTION
	NOTE **If the system is in a safe condition for operation, all interlock indicators should now be lit, except for the** PCBS/KEY **LED and possibly the** POSITION **LED.**
3	Turn the HV keylock to the **ON** position. The **PCBS/KEY** LED and the HV **OFF** LED should now be lit.
4	Press the **ON** button on the HV control unit.
5	Adjust the **HV ADJ** control for the desired operating voltage.
6	If gun #1 is not under the control of an external beam sweep controller, turn the display selector switch on the gun control panel for gun #1 to the **POS** position.
7	If your system does not have a beam sweep controller for the gun controlled by this gun control unit, adjust the **POSITION** control on that unit until the meter on that panel indicates 0.5 A. If this gun is under the control of an external beam sweep controller, disable the sweep function. Then adjust that unit's longitudinal current output for 0.5 A and turn the lateral beam position control to zero amperes.
8	Turn the display selector switch on the gun control unit to the **EMISS** position, turn the **CURRENT** control all the way counterclockwise, and press the gun control unit's **ON** button.
9	Slowly turn the **CURRENT** control up (clockwise) until a low reading appears on the meter.
	WARNING **DO NOT exceed 0.05 A emission current during this step.**
10	As you continue to slowly increase the emission current, observe the gun through a viewport. Turn the **CURRENT** control up (clockwise) just far enough that a beam can be seen striking the material in the crucible or a part of the gun. If the beam cannot be seen with 0.05 A emission current, slowly turn the **POSITION** control on the gun control unit (or the sweeper's position control) while watching for the beam. If the beam still cannot be seen, follow the procedure

STEP	ACTION

described on page 3-32. If you still cannot obtain a beam, refer to Section 5, "TROUBLESHOOTING."

WARNING
Do not attempt to find the beam by increasing the emission current above 0.05 A. Severe damage to the vacuum system may result.

11 Once you have observed the beam, adjust the **POSITION** control to center the beam in the crucible pocket.

12 If this gun is not controlled by a sweeper, turn the gun control unit's **POSITION** control in one direction until the beam is extinguished. Then turn the control in the other direction until the beam comes on again and is then extinguished on the other side of the crucible. In both cases the beam should be extinguished when it is as close as possible to the edge of the evaporant material without risking damage to the crucible. (These limits depend on the material in the crucible and on the power level you will be using during the evaporation process.) If the beam is not extinguished at the appropriate points, perform the procedure described below, under "SETTING THE LONGITUDINAL COIL CURRENT LIMITS."

13 If this gun is controlled by a sweeper, check the longitudinal sweep limits in the same way, using the sweeper's position control. If the sweep limits need adjustment, perform the procedure described in section 2.6 of the Programmable Sweep manual.

14 Increase the emission current to the desired operating level.

NOTE
The current is internally limited to 1.5 A.

15 Recheck the POSITION interlock limits.

16 If this gun's beam position is controlled by a programmable sweep, set up the desired sweep pattern(s), following the procedure described in section 3.2 of the programmable sweep manual.

17 Press the **OFF** button on the gun control unit.

STEP	ACTION
18	Perform the procedure described below, under "SETTING THE FILAMENT CURRENT BIAS LEVEL."
19	If you wish to implement the power supply's multiple current range feature, perform the procedure described below, under "SETTING UP CURRENT RANGES."
20	Repeat steps 6 through 19 for the other gun(s) powered by the power supply.
21	Switch off the gun and the high voltage.

SETTING THE LONGITUDINAL COIL CURRENT LIMITS

The POSITION interlock is designed to prevent damage to the gun by preventing the beam from going beyond user-settable longitudinal position limits. If the longitudinal deflection coil current exceeds either of the set limits, the POSITION interlock is lost, and the gun is switched off. Set the POSITION limits so that the beam remains on until it is as close as possible to the edge of the crucible without causing damage to the crucible due to excessive heat. The appropriate limits are process dependent, varying with the evaporant material and the emission current level.

NOTE

Perform this procedure only if your system does not have a programmable sweep for this gun. If there is a sweeper for this gun, perform the procedure described in section 2.6 of the programmable sweep manual.

Follow these steps in setting the POSITION interlock limits:

STEP	ACTION
1	Switch on the main power, if it is not on already.
2	Switch on the high voltage, if it is not on already.
3	Select the desired current range on the appropriate gun control unit.
4	Turn the this gun control unit's **CURRENT** control all the way counterclockwise.
5	Press **ON** button on this gun control unit.
6	Check to see whether the **POSITION** interlock LED is lit. If not, adjust the **POSITION** pot until the LED lights. If you cannot get this LED to light, perform the procedure on page 3-32 before repeating this step.
7	Slowly turn the **CURRENT** control clockwise as you look for a faint beam striking the evaporant material or an adjacent part of the gun.

CAUTION

DO NOT exceed 0.05 A emission current during this procedure.

STEP	ACTION
8	Use the **POSITION** pot on the gun control unit to move the beam to the center of the crucible. If the POSITION interlock is lost as you attempt to do this, perform the procedure on page 3-32 before repeating this step.
9	Once you have moved the beam to the center of the crucible, turn the **POSITION** control counterclockwise until the beam reaches the desired limit position on far side of the crucible (i.e., the side of the crucible farthest away from the emitter assembly).
10	If the POSITION interlock switches the gun off before the beam reaches the desired spot, find the LOW LIMIT pot (R19) on the position PC board and turn it counterclockwise until you can move the beam to the desired spot.
11	Once you have moved the beam to the desired limit position, turn R19 clockwise until the interlock is lost and the gun is switched off. Then turn R19 counterclockwise 1/4 turn.
12	Turn the **POSITION** control clockwise until the beam reaches the desired limit position on the near side of the crucible (i.e., the side of the crucible nearest to the emitter assembly).
13	If the POSITION interlock switches the gun off before the beam reaches the desired spot, find the HIGH LIMIT pot (R18) on the position PC board and turn it clockwise until you can move the beam to the desired spot.
14	Once you have moved the beam to the desired limit position, turn R18 counterclockwise until the interlock is lost and the gun is switched off. Then turn R18 clockwise 1/4 turn.

If it proves impossible to obtain a beam or center it in the pocket without losing the POSITION interlock, follow the procedure described below to reset the current limits.

STEP	ACTION
1	Switch off the high voltage and the gun, if they are on.
2	Install a jumper at JP2 on the display PC board in the gun control unit you have been working with.

WARNING

Remove this jumper as soon as you have completed this setup procedure. NEVER operate or test the gun with this jumper in place. Doing so can result in the destruction of the gun.

3	Turn the **CURRENT** control on this gun control unit all the way counterclockwise.
4	Switch on the high voltage and the gun.
5	Turn the **CURRENT** control clockwise until a faint beam is visible.
6	Use the **POSITION** control to center the beam in the crucible.
7	Find DS1 (the POSITION OK indicator) on the position PC board; this LED should be unlit.
8	Turn the LOW LIMIT pot (R19) on the position PCB down (counterclockwise) two turns. Watch for DS1 to light as you do this.
9	If turning R19 down has not lit DS1, try turning the HIGH LIMIT pot (R18) on the same board clockwise two turns.
10	Repeat steps 8 and 9 until DS1 lights.
11	Switch off the high voltage and the gun.
12	Remove JP2 from the display PCB.
13	Switch on the high voltage and the gun.
14	Resume the procedure above at the step at which you left it.

SETTING THE FILAMENT CURRENT BIAS LEVEL

The filament current bias level is just below the current level needed to cause emission when the high voltage is on. The bias setting determines the filament current drive when the emission current request is zero, which includes periods when the gun is automatically cut back due to arcing or other out-of-regulation conditions. Setting the bias level properly helps prevent filament damage and facilitates smooth emission current control, especially at low current levels.

WARNING

Ensure that the POSITION interlock limits are set correctly before setting the bias level. Performing this procedure without setting the POSITION interlock correctly can result in serious gun damage.

Follow the procedure described below in setting the bias level.

STEP	ACTION
1	Switch on the high voltage and confirm that it is at the desired level.
2	Check to see that the gun control unit for the gun in question is NOT in remote mode. If the **REMOTE** LED on the gun control unit is lit, simply turn the Remote/Range switch on the HV control unit counterclockwise one notch. If you have implemented automatic voltage range switching, turn the Remote/Range switch counterclockwise one notch counterclockwise to select low-range (-3 to -7 kV) operation or two notches counterclockwise to select normal (-7 to -10 kV) operation. The HV control unit's **RANGE** LED lights when low-range operation is selected.
	NOTE **The** RANGE **LED is not lit or extinguished to indicate high- low-range operation if automatic range switching is not implemented.**
3	Turn the **CURRENT** control all the way counterclockwise.
4	Turn the gun control unit's display selector switch to **EMISS.**

STEP	ACTION
5	Switch on the gun. If no beam is visible, turn the **BIAS** control clockwise until a faint beam is visible.
6	Once a beam is visible in the chamber, turn the **BIAS** control counterclockwise until the beam just disappears.
7	Switch off the gun and the high voltage.

SETTING UP CURRENT RANGES

Follow the procedure described below in setting up emission current ranges. Note that ranges 1 and 2 can be programmed for maximum emission current levels as high as 1.5 A, the power supply's maximum. Ranges 3 and 4 cannot be programmed for maximum levels above 0.75 A.

STEP	ACTION
1	Using the Remote/Range switch on the gun control unit in question, select the range you want to set.
2	Make sure the display selector switch on this gun control unit is set to **EMISS**.
3	Turn the **CURRENT** control on the this gun control unit all the way clockwise (i.e., to its maximum setting).
4	Find the gun control PC board for this gun control unit.
5	Find the range adjustment pot on this PC board that controls the range you selected in step 1 (R18 = range 1, R19 = range 2, R20 = range 3, and R21 = range 4).
6	Turn this adjustment pot all the way counterclockwise.
7	Switch on the high voltage, if it is not already on.
8	Switch on the gun, if it is not already on.
9	Slowly rotate the range adjustment pot clockwise until the desired maximum emission current for that range is indicated on the meter.
10	Slowly turn the **CURRENT** control counterclockwise. The meter's reading should track the change in this pot's setting all the way to zero.
11	Switch off the gun and the high voltage.

SECTION 4
THEORY OF OPERATION

SECTION OVERVIEW

The Simba 2 power supply is designed to generate and regulate: (1) a low-voltage alternating current used to heat the filament of an electron beam source (the filament current), and (2) a high (-10 kV) dc voltage that is superimposed on the filament current (see Figure 4-1). When these two forms of energy are supplied at adequate levels to a filament under high vacuum, electrons are emitted from the filament, producing a dc emission current through the high-voltage circuit.

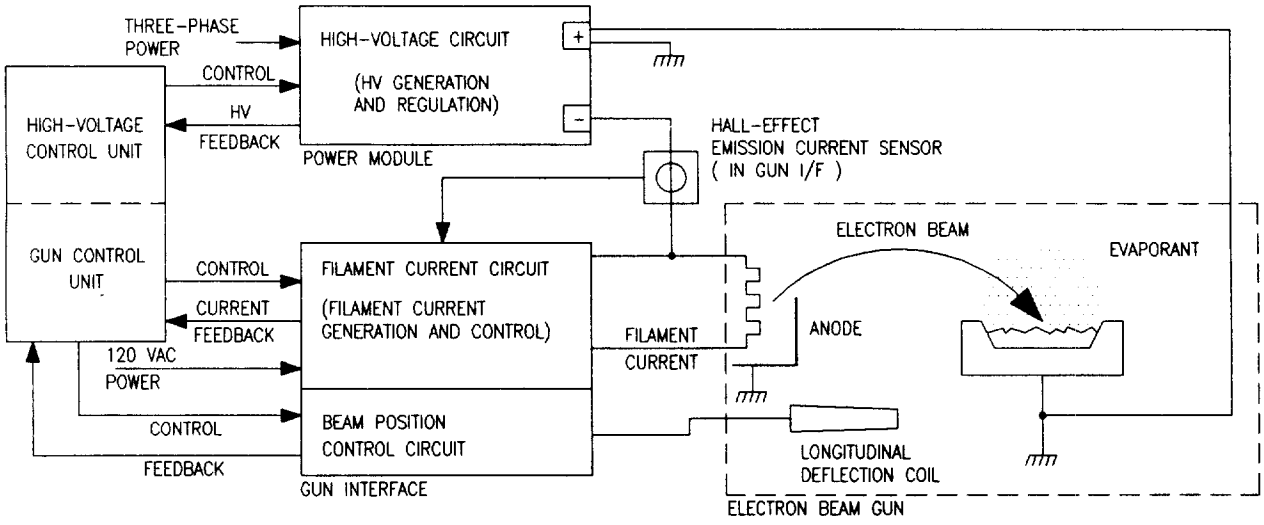


Figure 4-1. Block Diagram, Simba 2 Power Supply and Electron Beam Gun

The topics covered in this section are:

* High-Voltage Generation and Regulation
* Filament Current Generation
* Emission Current Control
* Beam Position Control
* HV and Gun Control Units

The first subsection describes the operation of the high-voltage circuit. The second subsection explains how the filament current is generated, and the third subsection describes the feedback loop that matches emission current to demand by varying the filament current. The fourth subsection describes how the power supply's position PCB controls beam motion in the longitudinal axis to ensure that the beam does not overrun the target material. The last subsection covers the HV/gun control unit.

HIGH-VOLTAGE GENERATION AND REGULATION

The active elements of the high-voltage circuit occupy the power module (see schematic 040-6733). The high-voltage section of the gun interface contains only relays and current-sensing devices. The high-voltage circuit generates and regulates the dc high-voltage (see Figure 4-2). Essentially, unregulated ac is rectified to produce high-voltage dc, which is regulated by a large tetrode tube.

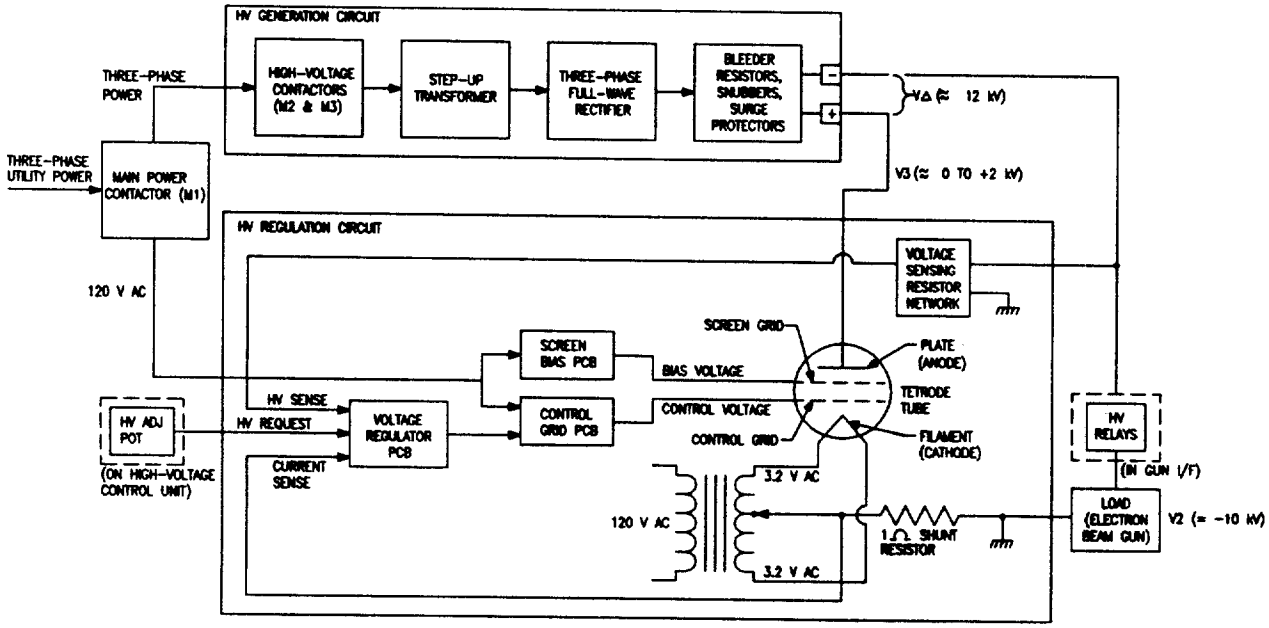


Figure 4-2. Block Diagram, High-Voltage Circuit

High-Voltage Generation

As Figure 4-3 shows, ac high voltage is produced by a step-up transformer whose primary winding is supplied with three-phase ac via the high-voltage contactors. The output of the transformer's secondary winding is snubbed to eliminate transients and passed through a three-phase full-wave rectifier. The rectifier's dc output is filtered and then passed through surge-limiting resistors.

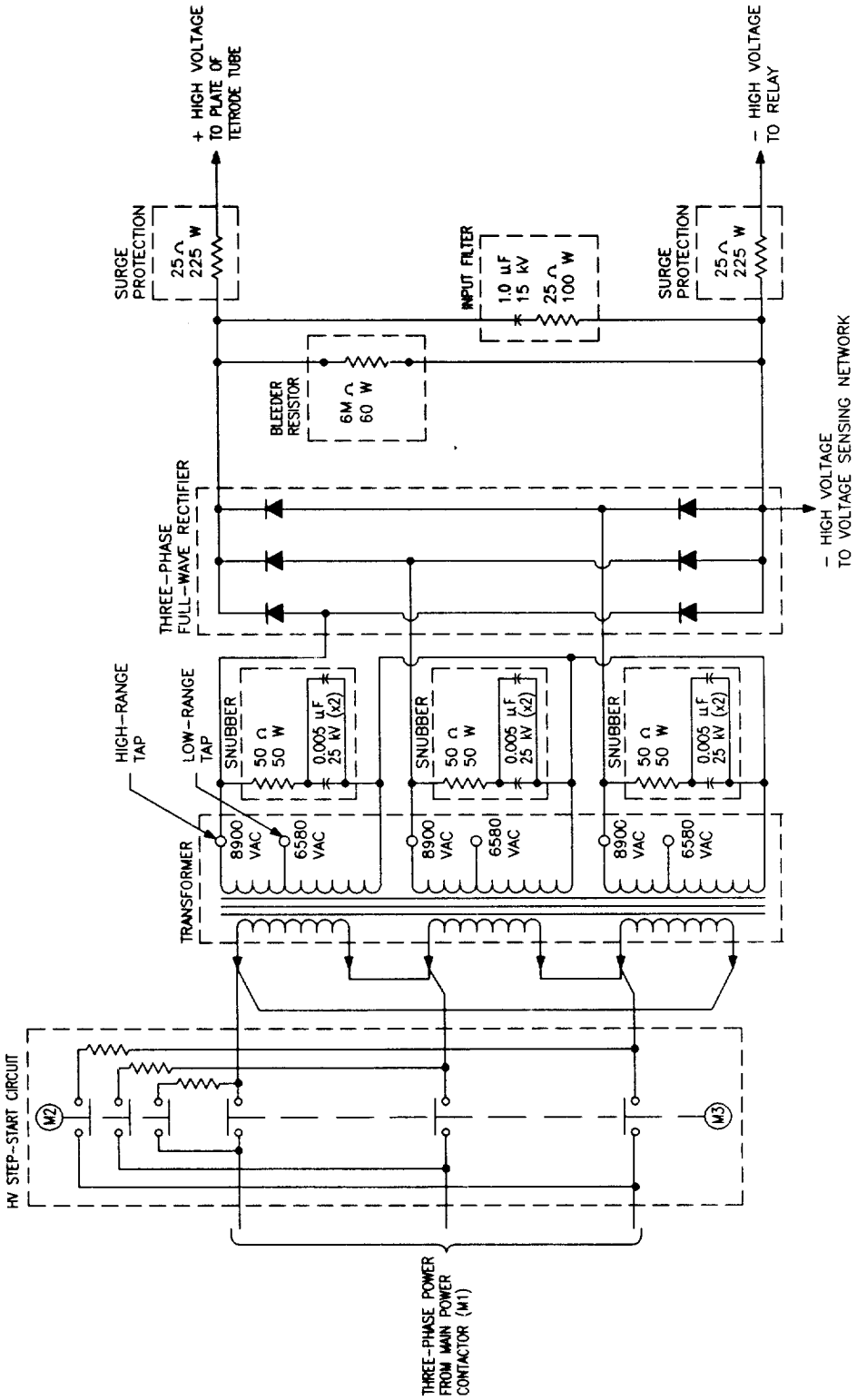


Figure 4-3. High-Voltage Generation

Dual-Range Output

The Simba 2 produces dc output in either of two operating ranges (-3 kv to -7 kV and -6 kV to -10 kV). Dual output taps on the transformer secondary winding and an offset on the HV regulator PCB provide this capability.

High-Voltage Safety Interlock

Voltages on the order of 12 kV are extremely dangerous. To eliminate much of this danger, a high-voltage interlock relay serves as the power module's final output. Until this relay is energized, the supply's high-voltage circuit is open, and its output line is grounded via a 1 kOhm resistor. The relay can only be energized if:

1. The high voltage is on in the power module, which means that all HV interlocks are made.
2. The signal ANY GUN IS ON is high.

These two conditions can be satisfied in either order. The gun interface sends ANY GUN IS ON when the first gun is being switched on and keeps it high as long as any gun in on.

High-Voltage Tetrode Tube Regulation

The high-voltage regulation circuit, illustrated in Figure 4-2, regulates the high voltage and limits total power supply current to a preset maximum. The tube functions as a series regulator. It behaves like a giant variable resistor in the high-voltage circuit, dropping varying amounts of voltage in order to regulate the voltage dropped across the load to within 1% of the desired value. The HV circuit's total unregulated dc voltage (V in Figure 4-2) is equal to the voltage dropped across the load (V2) plus the voltage dropped across the tube (V3). A voltage-divider network senses V2 and sends a VOLT SENSE signal to the voltage regulator PCB, which controls the voltage supplied to the tube's control grid.

The control grid voltage determines the tube's transconductance (and, therefore, how much voltage is dropped across it). When the control grid voltage is at its maximum (-350 volts), the tetrode tube is off, and no voltage is dropped across the electron beam gun. As the control grid voltage rises toward zero, the tube becomes increasingly conductive. At zero volts the tube would be fully on, though in practice it never gets to this state. Normally, the control grid voltage remains between -350 and -75 volts.

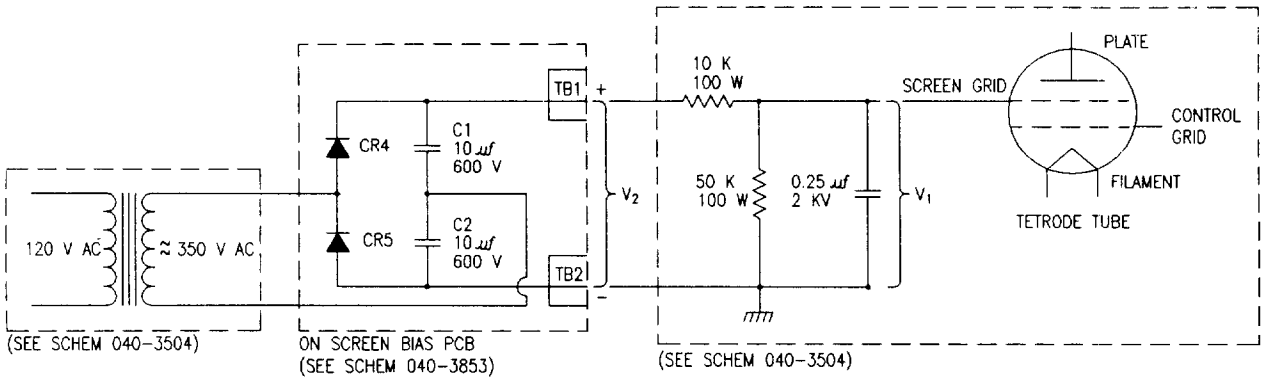
Voltage Sensing

A voltage-divider network of 19 resistors senses the voltage across the load and sends a VOLT SENSE signal to the voltage regulator board. The load voltage is dropped across a string of nine 100-kOhm 1% resistors that are configured to provide a total resistance of 450 kOhms. The voltage is sensed across a 45.3-Ohm 1% resistor, so the network sends 1 V for every 10 kV applied to the load. This resistor network also provides a minimum load for the power supply, so that regulation will continue when the circuit is open.

Details of Tetrode Tube Operation

The functional elements of the tube are an anode plate, a screen grid, a control grid, and a cathode filament. In order for the tube to operate properly, transformer T5 must supply the filament with high-current (70 A) ac power at 7.4 V +/-5%. A voltage regulator in the line that supplies 110-120-V power to T5 (see Figure 4-6) ensures that the voltage across the filament stays within these limits. As Figure 4-2 shows, the superposition of the supply's dc current on this ac current provides the tube's ground reference. Therefore, the voltage between either of T5's output taps and its center tap should be 3.7 V +/-5%.

The screen grid must be biased at 520 to 600 V dc (see tables in Figure 4-4). Figure 4.4 schematically illustrates the voltage-doubler network that supplies this voltage.



V_1 — SCREEN GRID BIAS VOLTAGE:
1. ≈ 55 V DC WITH TETRODE FILAMENT ON, HV OFF
2. ≈ 590 V DC WITH TETRODE FILAMENT OFF
3. ≈ 580 V DC WITH HV ON, NO LOAD
4. ≈ 530 V DC WITH HV ON, UNDER LOAD

V_2 — VOLTAGE ACROSS TB1, TB2:
1. ≈ 600 V DC WITH TETRODE FILAMENT ON, HV OFF
2. ≈ 700 V DC WITH TETRODE FILAMENT OFF
3. ≈ 700 V DC WITH HV ON, NO LOAD
4. ≈ 685 V DC WITH HV ON, UNDER LOAD

Figure 4-4. Simplified Schematic, Screen Grid Power Supply

Figure 4.5 shows the circuitry that supplies the voltage to the control grid. A step-up transformer produces a 230-V ac output from single-phase 120-V ac power. This output is then full-wave rectified to produce approximately 350 V dc, which is supplied to the MOSFET power amplifier on the control grid PCB. A signal (labeled CONTROL GRID CONTROL in Figure 4-5) from the voltage regulator PCB determines how much of this voltage is passed by the MOSFET to the control grid. (Note: This signal is labeled TO HIGH VOLTAGE DRIVER PCB on the voltage regulator PCB schematic, 040-6624).

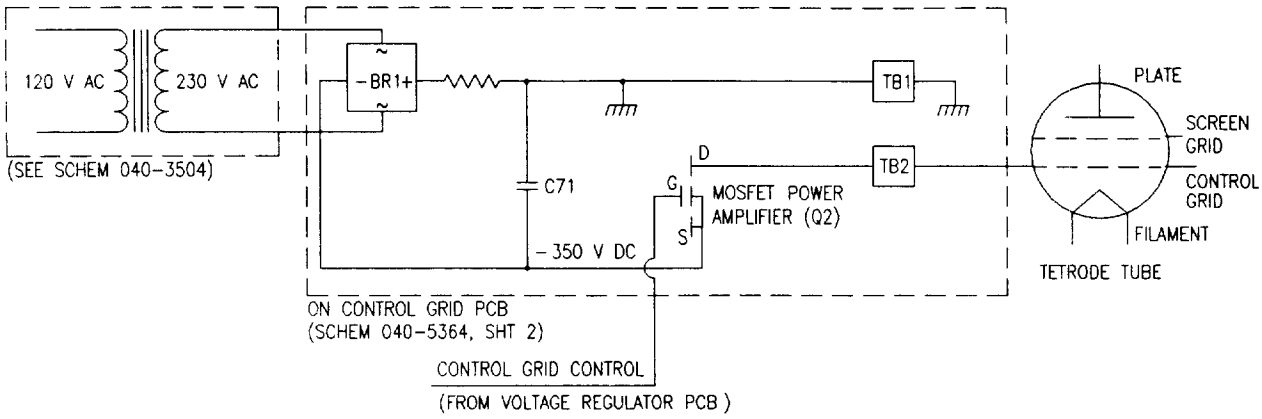


Figure 4-5. Simplified Schematic, Control Grid Power Supply

Control Grid Control, Normal Mode

Figure 4-6 illustrates the high-voltage regulation circuit in normal operation as well as in overvoltage/overcurrent mode. When the power supply is operating normally, the CONTROL GRID CONTROL output is determined by that of summing amplifier U31 on the voltage regulator PCB. U31 receives the VOLT SENSE signal (designated HV SENSE on the voltage regulator PCB schematic) from the voltage sensing resistor network and sums that signal with the HV REQuest signal from the HV ADJust pot on the high-voltage control unit. The result of this summation is a U31 output that adjusts the control grid voltage as needed to match HV SENSE to HV REQuest.

Control Grid Control, Overvoltage/Overcurrent Mode

As Figure 4-6 shows, an analog priority gate controls the CONTROL GRID CONTROL line. This priority gate consists of

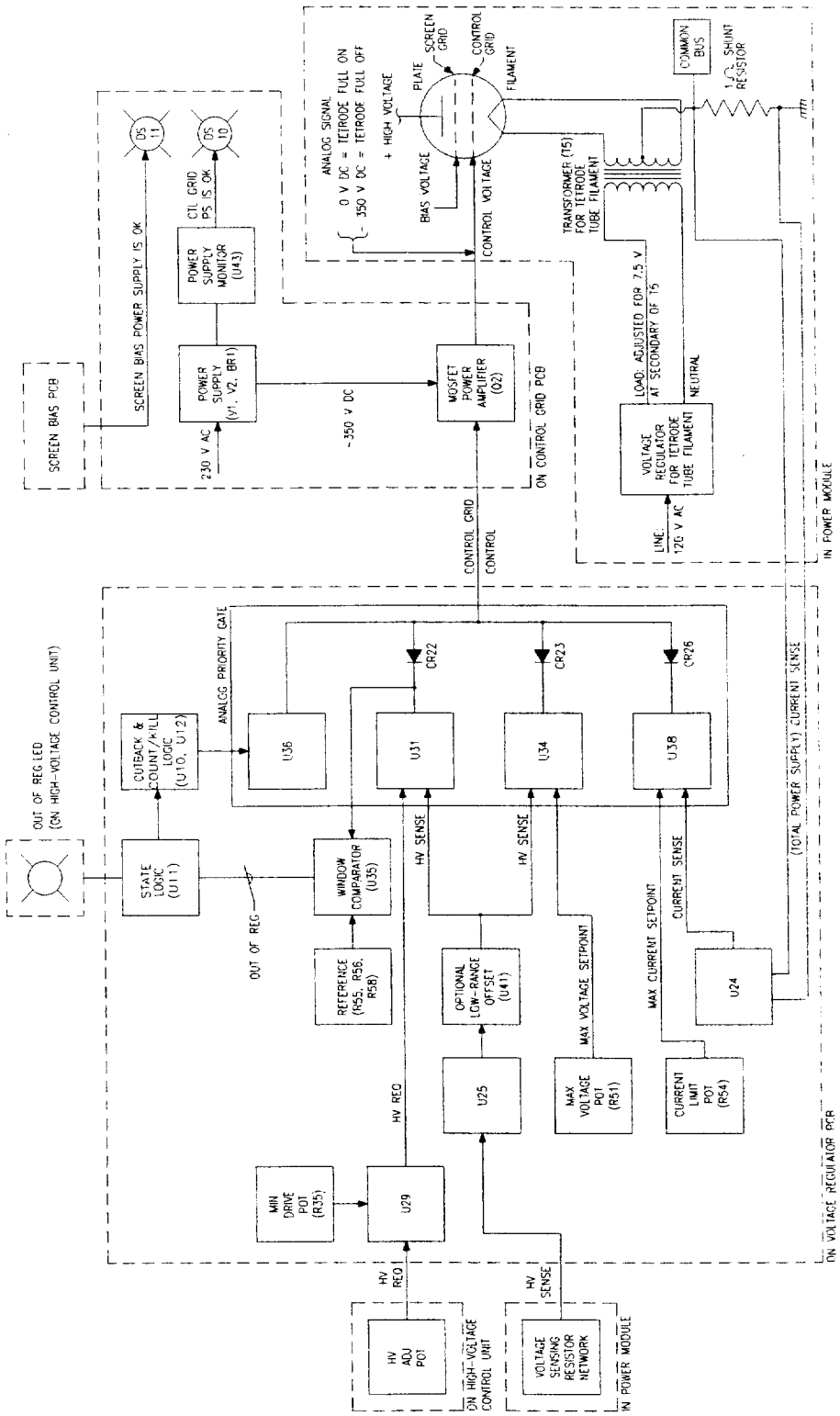


Figure 4-6. Block Diagram, High-Voltage Regulation Circuit

amplifier-diode pairs U31-CR22, U34-CR23, and U38-CR26 and open collector U36. U31's function is discussed above. U34 compares HV SENSE with a signal from the board's MAX VOLTAGE pot (R51). U38 compares the CURRENT SENSE signal (indicating total power supply current) with a signal from the CURRENT LIMIT pot (R54). The function of U36, which comes into play in the out-of-regulation sequence, is discussed below under that heading.

The priority gate is configured so that an overvoltage or overcurrent condition always results in either U34 or U38 gaining control of the CONTROL GRID CONTROL line. When this occurs, the CONTROL GRID CONTROL signal drives the MOSFET power amplifier (Q2) to raise the control grid voltage to its maximum negative value, cutting off the tube's current and the gun's high voltage.

If the overcurrent or overvoltage condition is momentary and/or small in magnitude, the power supply will recover and return to normal operation. If not, the difference between HV SENSE (now 0 volts) and HV ADJust will result in the issuance of an OUT OF REGULATION signal, initiating the sequence described below.

The OUT OF REGULATION signal is triggered by window comparator U35, which constantly senses the output of U31. When the difference between HV SENSE and HV REQuest exceeds approximately 5%, U31's output will exceed the comparator's +10 V window. When this occurs, U35 will trigger an OUT OF REGULATION signal.

A low-voltage condition can also cause the comparator to trigger an OUT OF REGULATION signal. However, a low-voltage condition usually results from a short, which leads to an overcurrent condition.

Out-of-Regulation Sequence

An OUT OF REGULATION signal initiates the sequence of events illustrated in Figure 4-7. Briefly:

1. The OUT OF REG LED on the HV control unit's front panel becomes illuminated.

2. A series of power cutbacks is effected in an attempt to clear the fault causing the out-of-regulation condition.

3. If the cutback series does not clear the fault, the gun and the high voltage are switched off.

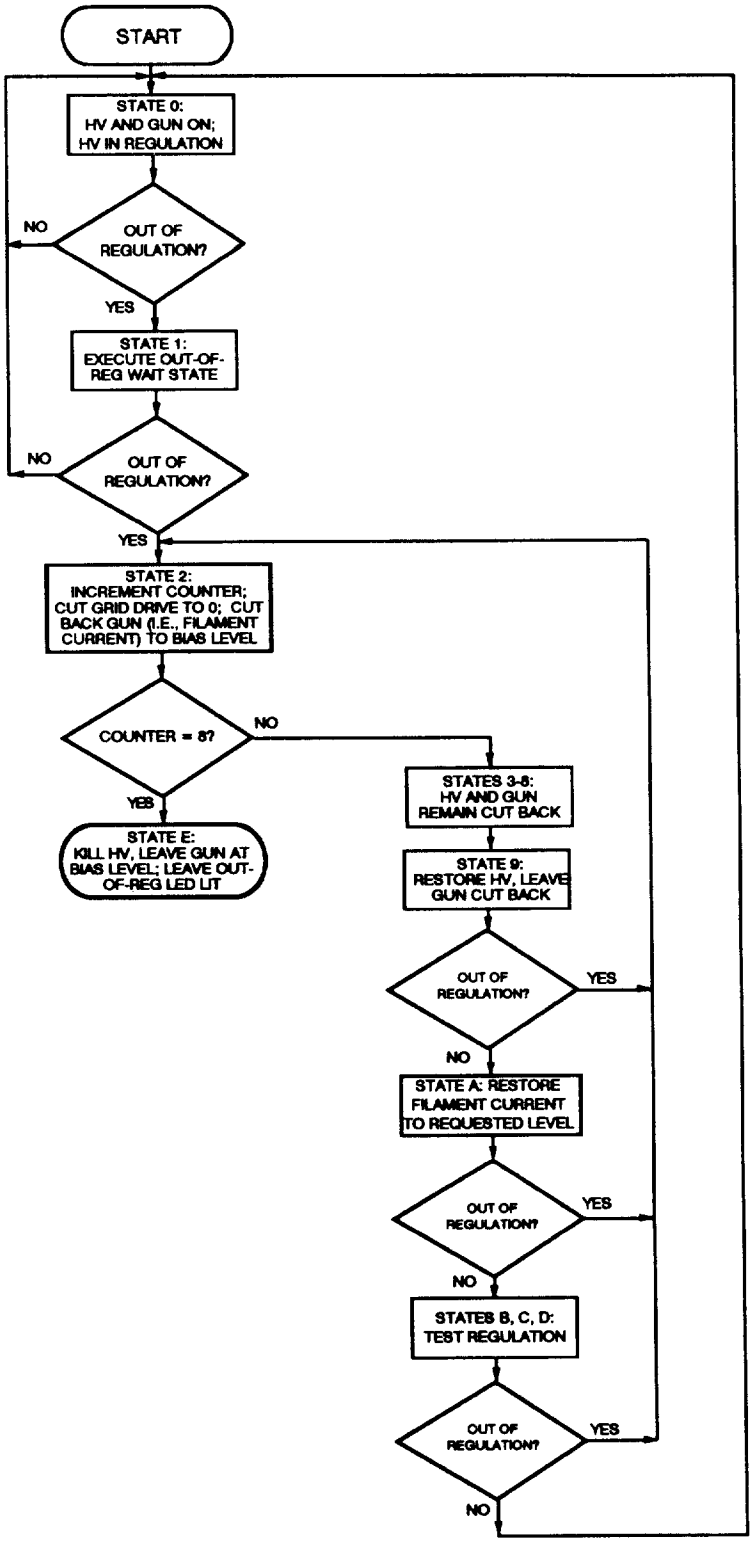


Figure 4-7. Flowchart, Cutback and Count Series

When the gun and high voltage are switched off following the cutback series, the OUT OF REG LED remains lit to indicate the cause of the shutdown to the operator. Under these conditions, neither the gun nor the high voltage can be switched on again until the OFF pushbutton on the high-voltage control panel is pressed or until the external ON signal (if any) is dropped.

This sequence of events can be triggered by arcing to ground because of a component failure in the gun, by a damaged external high-voltage cable, or by other fault conditions. In such cases the power supply is switched off to protect both equipment and personnel. Within the power supply, the major component endangered by out-of-regulation conditions is the tetrode tube. Continued operation under such conditions would result in large amounts of power being dissipated across the tube and consequent tube failure. Depending on the fault causing the out-of-regulation condition, components in the vacuum system or the gun interface might also dissipate large amounts of power and so be damaged if the power supply were not switched off.

Other Fault Conditions

Logic circuits on the voltage regulator PCB and the control grid PCB monitor the screen bias voltage and the voltage supplied to the MOSFET power amplifier on the control grid PCB. Unless both voltages are at their correct levels, the logic disables the main interlock string, switching the tube off.

FILAMENT CURRENT GENERATION

One filament transformer per gun is supplied to produce the alternating current that heats the gun filament(s). This 10/1 step-down transformer is mounted at the vacuum cubicle and produces a low-voltage, high-current output in its secondary from the 120 V line current in its primary. The actual filament current value at any given time depends on the emission current request and the high-voltage level. While the filament current can range as high as 70 A, filament current levels of 6 A to 15 A will generally yield the desired emission current levels.

EMISSION CURRENT CONTROL

The Simba 2 provides separate emission current control for each of the guns (up to three) that it powers. Active circuitry for the three control circuits is provided on the three gun control PCB-gun driver PCB pairs in the gun interface.

NOTE

When tracing signals to and from these boards, refer to the gun control backplane PCB schematic (040-2684) as well as to the schematic for the two boards (040-5404) and the gun interface chassis schematic (040-3834).

Circuitry on the gun control PCB enables the user to define up to four emission current ranges for each gun, and the CURRENT pot on each gun control unit provides linear control within any range selected. However, emission current is not directly controlled by this pot. Emission control is actually effected through the interaction of three current loops:

1. The gun filament transformer primary circuit;
2. The gun filament transformer secondary circuit, which supplies the ac filament current;
3. The dc emission current, which is superimposed on the filament current.

As noted earlier, electron emission results from the application of two very strong energies to the gun filament: (1) the -10 kV bias of the dc high voltage and (2) the thermal excitation produced by the ac filament current. The dynamics of beam deflection require the high voltage to be held constant to keep the beam in the crucible. Therefore, the

filament current is the only variable available to control emission current. This mode of control is effective because the emission current is very sensitive to the filament temperature, a function of filament current.

The filament current, the output of the filament transformer secondary, is a function of the current in the filament transformer primary. As Figure 4-8 shows, emission current feedback and current-request inputs are used to control the filament transformer primary current directly, resulting in indirect control of the emission current. CR20 on the gun driver PCB, a zero-crossing triac, passes a 120 V ac input to the filament transformer primary for some fraction of each ac cycle. The triac control circuit, U26 and U27 on the gun control PCB, determines the triac's conduction angle (i.e., what that fraction of a cycle will be). The triac's conduction angle, in turn, determines the current level in the filament transformer primary.

Under normal operating conditions, the triac control circuit is controlled by the CURRENT REQUEST signal from the gun control unit. However, the gun control PCB's circuitry operates in two other modes, soft start mode and bias mode.

Normal Operation

In the high-voltage section of the gun interface, multiple loops of a wire carrying the emission current are wound around a Hall-effect current sensor, which produces a low-level dc output proportional to the current flowing through it. This (emission) CURRENT SENSE signal is sent to summing amplifier U2 on the gun control PCB. Under normal operating conditions, U2 sums the CURRENT SENSE signal with the output of the Current Request/Range Select loop (U12, U19, and resistors R18-R21). U2's output is amplified and used to control the triac control circuit.

CAUTION

The returns (-) of the Hall-effect sensor's input and output should never be tied together, as damage to the device can result from doing so.

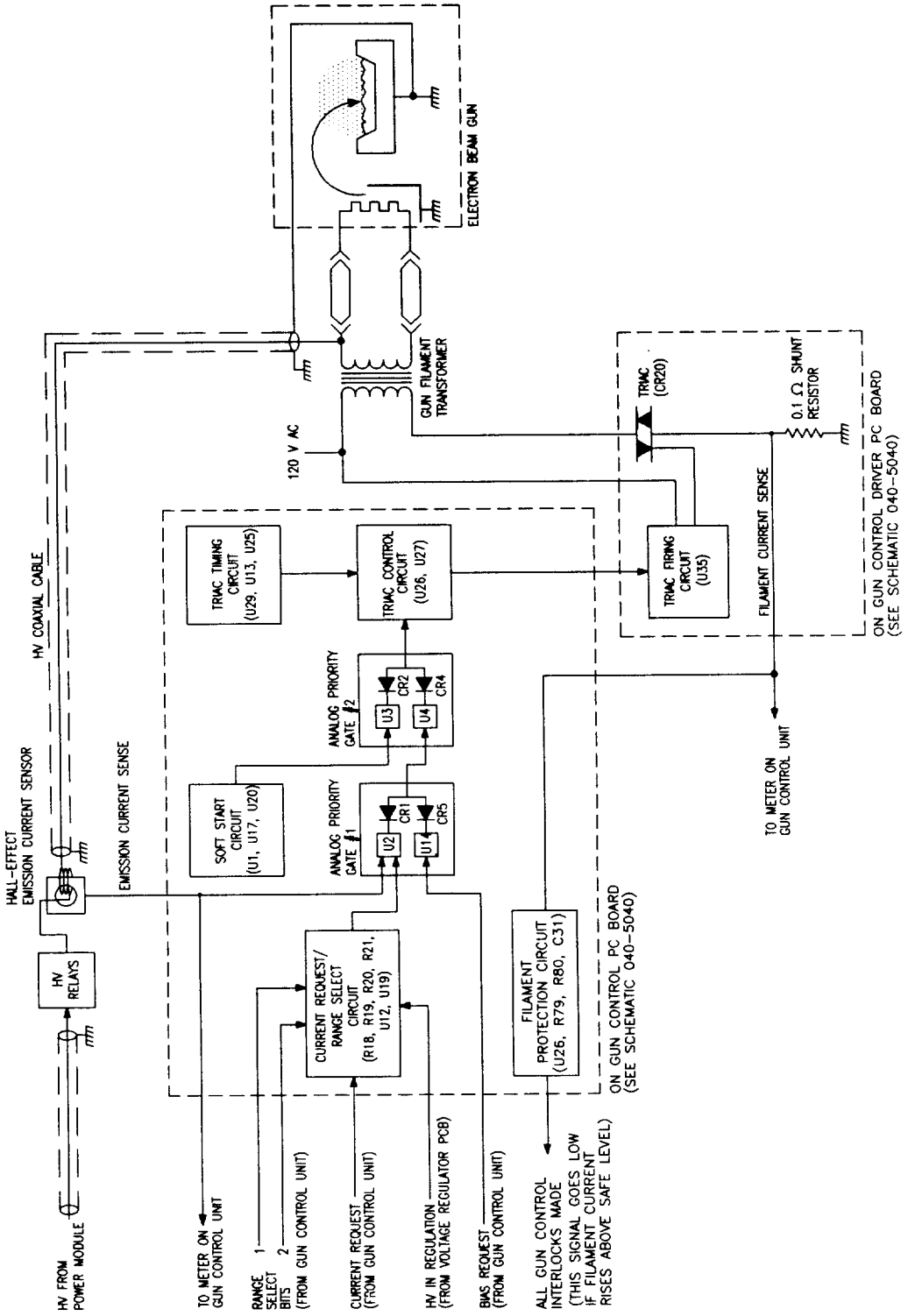


Figure 4-8. Emission Current Control

Current Request/Range Select Loop

The (emission) CURRENT REQUEST signal (0 to _+10 V dc) can come from either the gun control unit or an external, customer-supplied rate monitor. The two RANGE SELECT bits serve to direct the CURRENT REQUEST signal through either R18, R19, R20, or R21, which control the gain of U19. Varying this gain varies the CURRENT REQUEST voltage that U2 sums with the CURRENT SENSE signal.

Range selection is accomplished via the unlabeled five-position rotary switch near the center of the gun control front panel. Four of the positions on this switch control the two binary-coded range-select bits, which determine range selection as shown below. (The other switch position selects remote range and emission current control.)

Bit #2	Bit #1	Range	Resistor
0	0	1	R18
0	1	2	R19
1	0	3	R20
1	1	4	R21

R18 through R21 can be individually adjusted to limit emission current to some value below 1.5 A. R18 and R19, controlling ranges 1 and 2, can be used to define emission current ranges with upper limits as high as 1.5 A. R20 and R21, controlling ranges #3 and #4, can be used to define ranges with upper limits as high as 0.75 A.

Emission current control within reduced ranges remains linear. For example, in an unrestricted range the maximum (10 V) current request will yield a 1.5 A output, a 50% (5 V) request will produce 0.75 A, and so forth. If R21 is set for a 67% maximum, then a maximum request in range 3 will yield 1.0 A, a 50% request will yield 0.50 A, and so forth.

Soft Start Mode

When the filament current is switched on, an analog priority gate on the gun control PCB gives control of the triac firing circuit to the soft-start circuit. This priority gate consists of amplifier-diode pairs U3-CR2 and U4-CR4 and associated resistors. The soft-start circuit consists of U1, U17, U20, Q1 and associated resistors and capacitors. By bringing the power up slowly after the gun is switched on, this circuit protects

the filament against thermal shock, which can cause rapid filament wear or even damage. The soft start cycle takes approximately 1/2 second and is reset when the gun is switched off. After the soft start cycle, the gun control PCB operates in the normal mode (outlined above), responding instantly to varying current requests, cutbacks to bias current levels, and terminations of such cutbacks.

Bias Mode

The HV IN REGULATION signal issued by the voltage regulator PCB is used to switch on the Current Request/Range Select loop. If HV IN REGULATION is not asserted, U19 sends no current request voltage to U2. When this is the case, the BIAS REQUEST signal gains control of triac control circuit and cuts the filament current back to its bias level. The bias level is the current level required to keep the filament just below its emitting temperature when the high voltage is on. Cutting the filament current back to this level, rather than to 0 A, extends filament life by preventing it from undergoing a full temperature cycle every time emission ceases, which occurs when HV IN REGULATION is dropped.

Together with amplifier-diode pair U14-CR5, amplifier U2 and diode CR1 function as parts of an analog priority gate that gives control of the triac control circuit to the BIAS REQUEST signal when HV IN REGULATION is dropped. This priority gate, like those discussed above, is configured so that the signal with the lowest voltage wins control of the circuit. With no CURRENT REQUEST input, the output of U2-CR1 may rise as high as +15 V dc. When this occurs, the BIAS REQUEST signal, still at some negative value, wins control of the triac control circuit.

NOTE

The power module and the gun interface exchange HV IN REGULATION and ANY GUN IS ON through rear panel connectors J4 and J2 on the HV/gun control unit. The wires carrying these signals cross directly from one connector to the other; they are not wired into anything else in the HV/gun control unit.

BEAM POSITION CONTROL

The three position PCBs provide longitudinal beam position control for guns not controlled by beam sweep controllers. These boards are mounted on the gun control backplane PCB in the gun interface, along with the three gun control PCBs and the three gun driver PCBs. Each position PCB performs four functions in its beam position control circuit:

(1) Controlling the longitudinal coil current by pulse width modulating an unregulated dc voltage across the coil

(2) Sending longitudinal coil current feedback to the gun control unit's meter

(3) Providing high and low setpoints for this current and comparing them to the actual current value

(4) Supplying the POSITION OK signal to the POSITION interlock in the gun control unit when the actual current value is within the set limits.

Figure 4-9 illustrates the board's circuitry. Summing amplifier U7 receives the POSITION ADJUST signal from the POSITION pot on the gun control panel. U7 sums this signal with the actual-current feedback and sends a drive request to U2, which compares the request with a triangular waveform generated by U8. U2 sends the resulting PWM (pulse-width modulated) waveform to power MOSFET Q3, which actually controls the longitudinal coil current.

Coil current feedback is provided to the rest of the circuit via R16. The maximum value of this current is 3 A, and R16 is 0.1 Ohm, so R16 sends a maximum 0.3 V signal. U4, R20, and R21 are used to turn this signal into a 0 to +10 V signal (designated ACTUAL CURRENT in Figure 4-10). This signal is filtered and sent to:

1. U7, where it is summed with the POSITION ADJUST signal;

2. The gun control panel meter, via amplifer U6 and variable resistor R22, which is used to calibrate the meter;

3. U1, which compares the ACTUAL CURRENT signal with the HIGH LIMIT and LOW LIMIT signals set via R18 and R19.

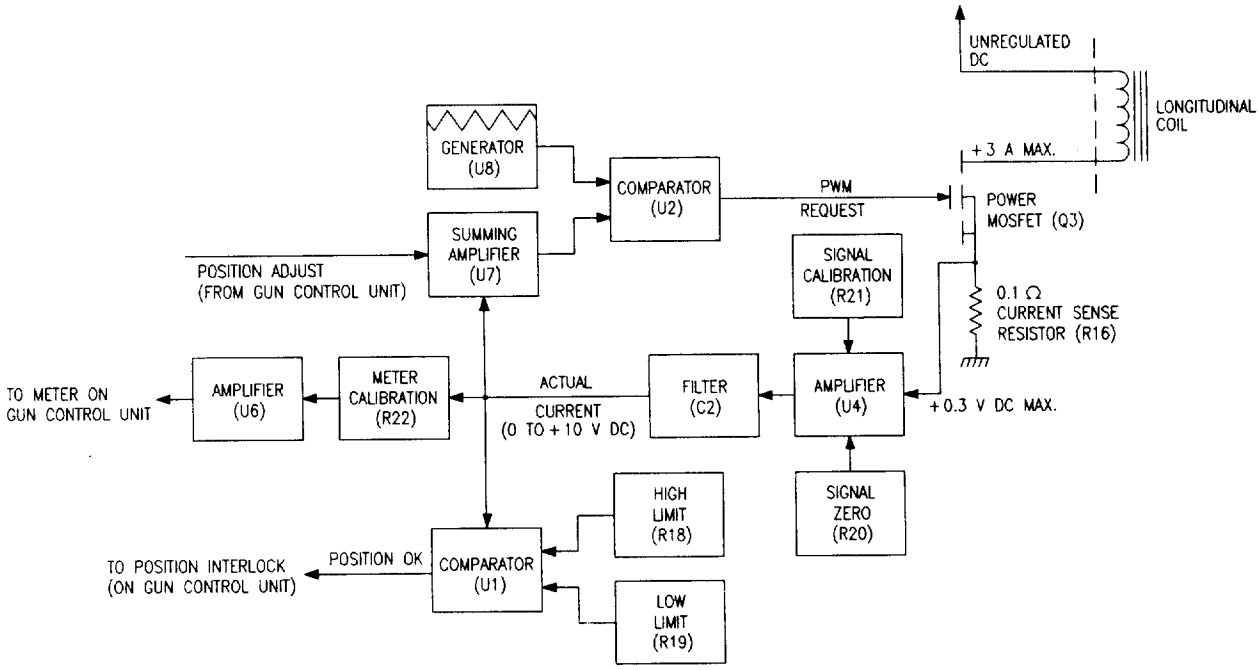


Figure 4-9. Block Diagram, Position PCB

If the ACTUAL CURRENT signal is within these limits, the POSITION OK signal is supplied to the POSITION interlock. If the longitudinal coil current is outside these limits, due to either a fault or an attempt to set the current too high or too low, the POSITION OK signal will be dropped. When this occurs, the gun control unit switches off the filament current.

THE HV AND GUN CONTROL UNITS

The HV and gun control units compromise the main control/display interface. The control units' front panel features and their functions are described in Section 3. Signal processing for these front panel features is performed by two nearly identical display PCBs, one inside the HV section and one inside the gun control section. The same schematic (040-4843) applies to any display PCB, whether it serves an HV control function or a gun control function.

The display PCB acts primarily as a patch panel for the signals passing between the front panel control/display features and the rear panel ports, which connect the unit to the other components of the power supply and to the controlling system. (See Section 2 for illustrations that detail these signals.)

GUN CONTROL Interlock Circuit

There are six LEDs that indicate interlock status on the GUN CONTROL front panel. These LEDs are labeled, from left to right, **INT COVERS, TANK, VAC GAUGE, AUX, GUN WATER,** and **POSITION I/L** (see Figure 3-2 and the accompanying description).

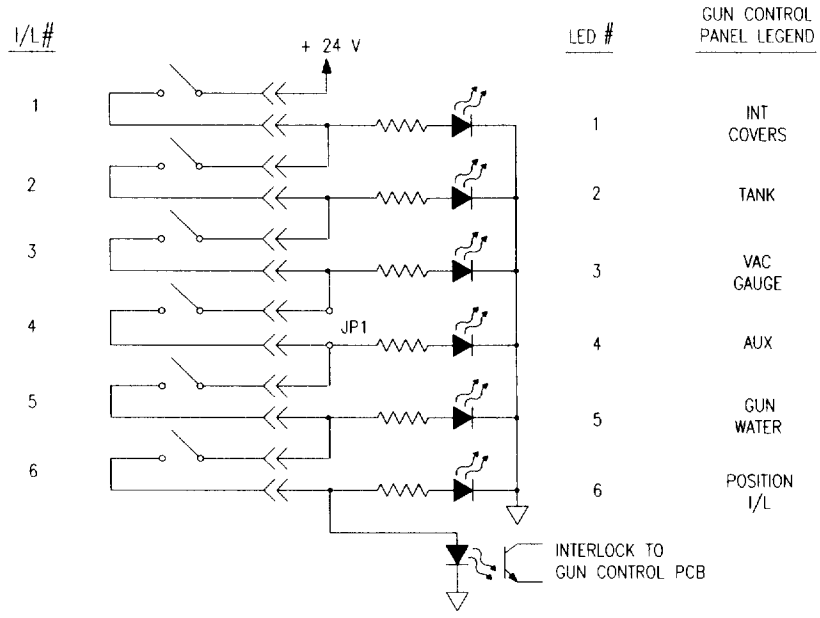


Figure 4-10. GUN CONTROL Interlock Circuit

As Figure 4-10 illustrates, these six LEDs are ANDed together so that a failure of any one of them will always switch off its LED and the LEDs to its right. The failure of any interlock will also interrupt the interlock signal that is sent to the gun control PCB, switching off the filament current, or preventing it from being switched on.

Note that the circuit for LED #4 can be jumpered at JP1 if the external AUXiliary interlock is not used.

HV CONTROL Interlock and OUT OF REG LED Circuit

The analogous circuit on the display PCB in the HV section of the HV/gun control unit functions slightly differently. The HV CONTROL front panel has five LEDs, labeled **OUT OF REG, PWR ON, AIR, DOORS,** and **PCB'S/KEY** (see Figure 3-1 and the accompanying description). As Figure 4-11 shows, only the last four of these LEDs are ANDed together to form an interlock string. The **OUT OF REG** LED only lights to indicate an out-of-regulation condition, and the lighting of this LED does not in itself affect the power supply's functioning. (However, an out-of-regulation condition can result in the power supply switching itself off, in which case the **OUT OF REG** LED will remain lit.)

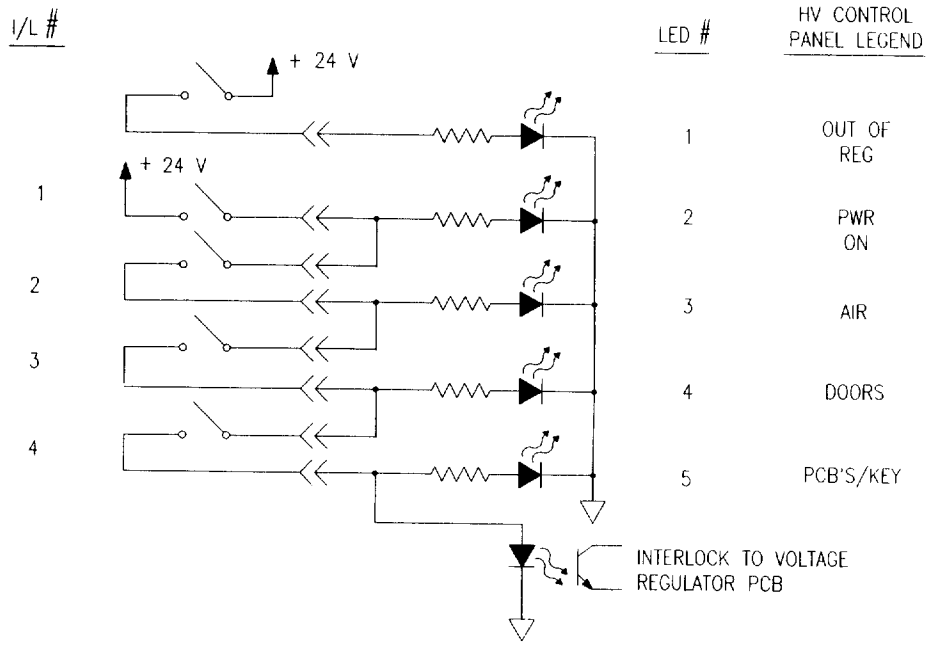


Figure 4-11. HV CONTROL Interlock and OUT OF REG LED Circuit

As in the GUN CONTROL panel's interlock circuit, the HV interlocks are ANDed together so that a failure of any one of them will extinguish its LED and those to the right of it. In addition, the interlock signal that is sent to the voltage regulator PCB will be interrupted, disabling the high voltage.

SECTION 5
TROUBLESHOOTING

GENERAL TROUBLESHOOTING GUIDELINES

Use the circuit descriptions in Section 4 as aids in tracking faults to specific circuits. When tracing signals exchanged between components in the power module or between the power module and either the gun interface or the HV and gun control units, refer to Table 5-1 (p. 5-15).

Follow these general guidelines when troubleshooting the power supply:

* If there is an apparent primary power malfunction, check to see that a connection is made between pins 3 and 4 of the system EPO/EMO circuit connector on the rear of the power module (see pages 2-14 and 2-15 for full instructions).

* Remember that except for the **OUT OF REG** LED, the indicator LEDs are ANDed together from left to right. Therefore, if one or more LEDs are out, check the interlock indicated by the unlit LED farthest to the left. For example, if the **AIR**, **DOORS**, and **PCB'S/KEY** LEDs are off, but the other LEDs are on, check the air flow switch on the tetrode tube. The interlock LEDs to the right of the **AIR** LED cannot be energized until the AIR interlock is satisfied.

* Check the circuit breaker panel in the power module for tripped circuit breakers. If a circuit breaker is tripped, reset it and proceed with normal operation. In a high-power system, transients can trip circuit breakers even if there is no actual malfunction. Assume that there is trouble only if the circuit breaker fails to remain closed after three attempts to reset.

  NOTE

  Another frequently overlooked source of trouble is the electron beam gun installation. Excessive arcing, loose connections, cracked or fouled insulators, and poor grounding can all be responsible for apparent power supply problems.

* **DO NOT** unplug or install PC boards with the power on. Unplugging and reinstalling PC boards with the power on is very likely to damage on-board devices.

* Always observe proper antistatic procedures when handling PC boards.

Guidelines for Troubleshooting the High-Voltage Circuit

Follow these guidelines when troubleshooting the high-voltage circuit:

NOTE

Only trained personnel should be trouble-shooting the high voltage.

IMPORTANT

Read the high-voltage safety precautions on page vii of this manual.

DANGER

1. **After turning off the high voltage, ALWAYS attach a grounding hook to the high-voltage circuit before touching any part of it. The grounding hook must be permanently attached to the system ground (see Section 2).**

2. **NEVER put a probe or external meter on the high voltage. A high-voltage meter is provided on the HV control panel, and high voltage can arc over a considerable distance. You need not be in physical contact with a live terminal in order for an arc to occur that will send a lethal high voltage discharge through your body.**

3. **Even in the control grid PCB, there are dangerous voltages (up to -350 volts DC). All personnel should take great care when working around the high-voltage circuit. Follow all safety precautions.**

* If a high-voltage problem develops, check the physical appearance of the feedthrough insulators. Also check for tight connections with the high voltage OFF.

* Consistent failure of the HV generation or regulation circuits may indicate radio-frequency arcing problems, which can be corrected by installing a better low-impedance system ground. Refer to Section 2 for details.

* Leave the power module's covers in place unless your troubleshooting absolutely requires their removal. For instance, it is not necessary to remove the power module's side covers when you are troubleshooting or adjusting the high-voltage regulation circuit.

TROUBLESHOOTING GUIDE, HIGH-VOLTAGE CIRCUIT

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
1) PWR ON light and all HV control panel LEDs are off.	**1a)** Three-phase utility power supply not supplied.	**1a)** Check utility power.
	1b) Connection not made between pins 3 and 4 of system EMO/EPO circuit connector on rear of power module (see Fig.2-5).	1b) Jumper these pins together or connect them to normally-closed contacts in external EMO/EPO circuit. (See pp. 2-14 and 2-15 for full instuctions.)
	1c) The 15-A **120V MAIN** circuit breaker on the power module breaker panel is off or tripped.	1c) If tripped, check tetrode tube filament transformer (T2) and its wiring.
2) Some interlock indicators LEDs are not lit.	**2)** Interlock indicated by unlit LED farthest to the left is not made.	**2)** Check this interlock.
3) Power module fan comes on but no interlock lights come on.	**3a)** The 3-A **AUX P.S.** circuit breaker on the power module circuit breaker panel is off or tripped.	**3a)** If this breaker is tripped, look for a short in the power wiring or the interlock wiring.
	3b) Cable connecting power module to HV/gun control unit is not plugged in.	**3b)** Make sure 50-pt cable is plugged into power module receptacle and HV/gun control rear panel connector J3.

High-voltage circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
4) Some interlock LEDs are on, but the three fans in the lower part of the power module are not operating.	**4)** Either the **FANS** or the **BLOWER** circuit breaker is off or tripped. (Both are on the power module's circuit breaker panel.)	**4)** If either of these breakers trips repeatedly, look for a short in wiring or for a faulty component (e.g., the three power module fans, the tetrode blower, etc).
5) HV **ON** LED will not light or will not stay lit; HV **OFF** (ready) LED is on.	**5a)** HV ON signal must be asserted for at least 300 milliseconds.	**5a)** Verify that the HV ON remote signal stays on this long.
	5b) Bad relay (K4) in power module.	**5b)** Replace faulty relay.
6) Keylock switch is in the **ON** position, but the HV **OFF** LED is not lit; all interlock LEDs are on except **PCB's/KEY.**	**6a)** Defective keylock.	**6a)** Check and replace if faulty.
	6b) Voltage regulator PCB is unplugged.	**6b)** Check voltage regulator PCB connectors.
	6c) Screen bias PCB is unplugged.	**6c)** Check screen bias PCB connectors.

High-voltage circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
6) (continued)	**6d)** Screen bias power supply voltage is low.	**6d)** Check the power module's **SCREEN BIAS** circuit breaker. Check SCREEN BIAS PS IS OK LED (DS11) on control grid PCB. Replace screen bias PCB if necessary.
	6e) Fuse F1 on control grid PCB is blown or missing.	**6e)** If blown, check for defective power supply or shorted wiring.
	6f) Control grid power supply voltage is low.	**6f)** Check the power module's **CONTROL GRID** circuit breaker. Check CONTROL GRID PS IS OK LED (DS10) on control grid PCB; replace control grid PCB if necessary.

High-voltage circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
7) HV **ON** LED lights, but high-voltage meter reads zero. Emission current meter reads 2 A for approximately 1 second, then supply switches off, leaving **OUT OF REG** LED lit.	**7)** Shorted or fouled vacuum tank insulators or shorted high-voltage coaxial cable; short in emitter assembly of electron beam gun.	**7)** With main circuit breaker OFF and grounding hook in place, check with ohm meter. **NOTE** **The output HV cable from the gun interface must be disconnected before a short fault can be discovered. The high-voltage relays in the gun interface normally ground the electron beam gun when the main power is off.**
8) No high-voltage regulation. The **OUT OF REG** LED is on or flickering. Voltage shown on meter is below proper value, or indicated voltage may be fluctuating a lot.	**8a)** Power supply current is being limited.	**8a)** Verify that current is below the limit set via the CURRENT LIMIT pot (R54) on the voltage regulator PCB.
	8b) Power supply is at limit.	**8b)** Check maximum-voltage adjustment.
	8c) If meter is fluctuating a lot, frequent arcs may be occurring because of outgassing,etc.	**8c)** Check vacuum integrity.

High-voltage circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
8) (continued)	**8d)** Voltage of three-phase utility power is too low, or a phase is missing.	**8d)** Check input voltage and voltage tap on main power transformer.
	8e) Unstable operation of voltage regulator PCB.	**8e)** Check the test points on the board with a scope; replace the board if necessary.
	8f) Tetrode is faulty or week.	**8f)** Check tetrode operation and replace if necessary.
	8g) Control grid drive circuit or power MOSFET shorted.	**8g)** Check for shorts.
	8h) Voltage-sensing resistor network is faulty.	**8h)** Check resistance of resistors.
9) No high-voltage regulation; voltage is higher than the proper value.	**9a)** Shorted tetrode.	**9a)** Check tetrode.
	9b) Voltage regulator PCB is faulty or unstable.	**9b)** Check test points on voltage regulator PCB.
	9c) Power supply that provides ±15 V dc to voltage regulator PC board is defective.	**9c)** Check voltages; replace power supply is necessary.
10) Main circuit breaker trips repeatedly.	**10a)** Voltage of three-phase utility power is too low.	**10a)** Check voltage.

High-voltage circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
10) (continued)	**10b)** High voltage on secondary of main transformer or on wiring of high-voltage rectifier is arcing to ground or producing corona discharge.	**10b)** With power off, check for obvious signs of arcing. **DANGER** **Use a grounding hook before approaching any high-voltage component.**
	10c) Tetrode tube has an internal short.	**10c)** With power off, check tetrode tube.
	10d) Shorted components in high-voltage generation circuit (see Figure 4-3 and 040-6733).	**10d)** With power off, check components.
	10e) One phase of the three-phase utility power is missing.	**10e)** Check to see whether all three phases are live.
11) Minimum high-voltage level is too high; operation is otherwise normal.	**11)** Minimum voltage limit set too high on voltage regulator PCB.	**11)** Check adjustment of minimum voltage on voltage regulator PCB.
12) Arcing inside power module or gun interface.	**12a)** Pinched high-voltage wire.	**12a)** Check high voltage wiring.
	12b) Excessive accumulation of dirt.	**12b)** Clean component in question.

TROUBLESHOOTING GUIDE, GUN AND GUN CONTROL CIRCUIT

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
1) Gun control panel **OFF** (ready) LED will not illuminate; all gun control interlock LED's are on.	**1a)** Switch in gun control unit that controls this OFF signal is faulty.	**1a)** Replace switch if necessary
	1b) Remote OFF signal is not being supplied to pins 5 and 6 gun of control rear panel connector J2.	**1b)** Either the external OFF signal must be supplied to pins 5 and 6, or the two pins must be jumpered together. Check to see that one of these conditions is met.
2) Gun control **ON** LED will not light or will not stay on; **OFF** (ready) LED is on.	**2)** Switch controlling the **ON** LED is faulty; filament control latching relay may also be faulty.	**2)** Replace switch or relay (both in gun interface) if necessary.
3) Gun control **ON** LED lights, but meter indicates there is no emission current; filament is dark, and meter indicates zero filament current.	**3)** Open in filament or connecting wires, in filament transformer or connections, in triac, or in triac drive circuits.	**3)** Replace filament if necessary. Check connections from filament transformer to gun. Check for ±15 V dc on gun control PCB. Check PCB-mounted fuses. Check drive signal to gate of triac with a scope.

Emission Control Circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
4) No emission current; filament is dark; high current indicated with meter in **FIL**ament position.	**4)** Filament or connecting wires are shorted; filament transformer or high-voltage cable are shorted.	**4)** Check filament, cathode blocks, beam former and its insulator for shorts.
5) No emission current indicated; filament lit but no beam is visible; meter indicates a normal level of filament current.	**5a)** Five-position switch that selects local/remote control (and current ranges) may be set for remote when local control is being attempted, or vice versa. Current limits in the range selected may not be correctly set.	**5a)** Check switch position; check current limits set via R18, R19, R20, and R21 on gun control PCB.
	5b) Voltage sensing resistor network is open.	**5b)** Check network for continuity. Also check to see that the high voltage is being regulated.
	5c) High voltage is not being applied to gun filament.	**5c)** With high voltage OFF, check the operation of the HV relays in the gun interface and the HV relay at the output of the power module.

Emission Control Circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
6) Poor or no emission current regulation; current in normal range.	**6a)** Triac bias is adjusted too high.	**6a)** Check bias; see bias adjustment procedure in Section 3.
	6b) The gun filament is installed backwards.	**6b)** Check clearance between the filament and the beam former, which should be approximately 0.015". If the gap is much larger, follow the instructions in the gun manual in removing the filament and reinstalling it the right way around.
	6c) If emission current increases radically when the **CURRENT** control is turned only slightly, wiring to the Hall-effect current sensor may be open, or the sensor may be defective.	**6c)** Check wiring to the current sensor for continuity; check sensor with a current source.
	6d) If filament current jumps to its maximum when the gun arcs, a number of components on the gun control PCB may be defective.	**6d)** Check Q2, U9, U17, and U18 on the gun control PCB.

Emission Control Circuit (Cont.)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
7) No emission current indicated on meter; beam is visible.	**7)** Front panel meter or meter switch in gun control unit may be defective.	**7)** Check connections to meter and switch with a DVM.
8) Emission current indication reversed or erratic.	**8)** The Hall-effect current sensor may be wired incorrectly.	**8)** Check sensor wiring.
9) The 10-A **GUN INTERFACE** circuit breaker on the power module's circuit breaker panel trips repeatedly, but filament lights for some period of time.	**9)** Triac is shorted or is being turned full on.	**9)** Check triac with an ohmmeter. If shorted, replace the gun control driver PCB; if not, replace the gun control PCB.
10) The 10-A **GUN INTERFACE** circuit breaker on the power module's circuit breaker panel trips, and filament does not light.	**10a)** Filament or some other part of the emitter assembly is shorting, causing the filament leads to break down.	**10a)** Clean the emitter assembly; replace the filament if necessary.
	10b) The windings of the gun filament transformer have shorted.	**10b)** Check gun filament for shorts; replace if necessary.

TROUBLESHOOTING GUIDE, BEAM POSITION CONTROL CIRCUIT

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
1) Beam is not centered laterally.	**1a)** Gun is out of alignment.	**1a)** Refer to the section of the gun's instruction manual that covers the emitter assembly.
	1b) Magnetic interference from a second gun.	**1b)** If there is a second electron beam gun in the same vacuum chamber, consult Temescal service department.
	1c) Shorted lateral position coil.	**1c)** Check continuity of the position coils. The longitudinal and lateral coils should have infinite resistance with respect to each other and to ground. If either coil does not, replace it.
2) Beam cannot be located; all other conditions are normal.	**2)** If the gun has permanent magnet deflection, the magnet is installed backwards. If not, the longitudinal coil leads are reversed.	**2)** Install the permanent magnet the right way around, or reverse the longitudinal coil leads (see gun manual).

Beam Position Control Circuit (Cont.)

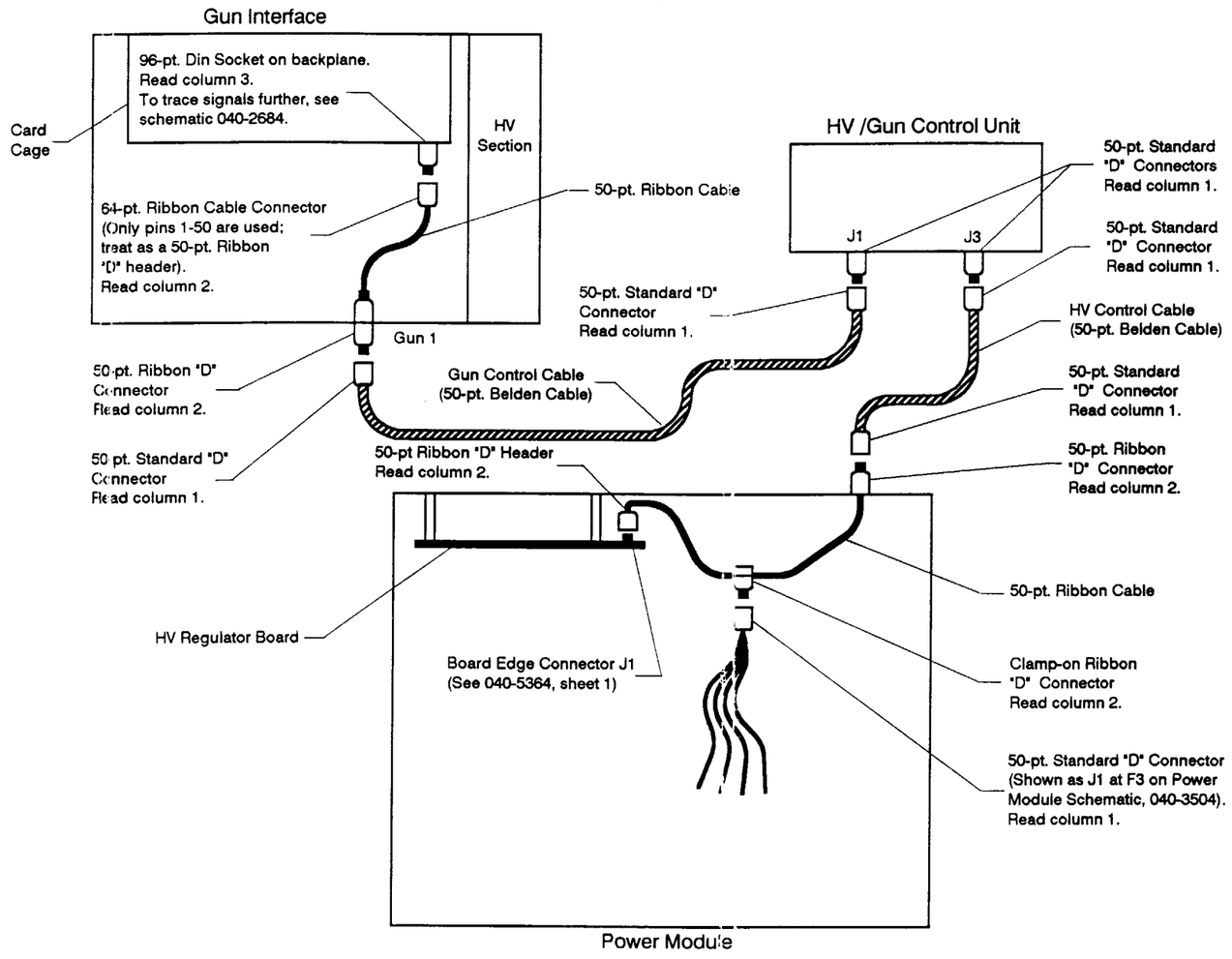
SYMPTOM	POSSIBLE CAUSE	PROCEDURE
3) POSITION interlock LED is off.	**3a)** Longitudinal current is not within the set limits.	**3a)** Check longitudinal position current. If the system has no beam sweep controller, check the limit set via R18 and R19 on the position PCB. If the system has a sweep controller, check the limits set via that unit (see beam sweep controller manual).
	3b) Open longitudinal coil or associated wiring.	**3b)** Check with ohmmeter.
	3c) Faulty wiring between beam sweep controller and longitudinal coil or between gun interface and longitudinal coil.	**3c)** Check wiring.
	3d) No longitudinal coil current.	**3d)** Check 24 V dc fuse (F1) on position PCB.
4) Longitudinal current will not go down to 0.0 A.	**4)** Control signal is not properly zeroed on position PCB.	**4)** Measure TP5 adjust R20 on the position PCB.

TABLE 5-1. SIMBA CONNECTOR CROSS-REFERENCE TABLE

Pins on Standard "D" Connectors	Pins on Ribbon Cable "D" Connectors or Ribbon Cable Headers	Pins on 96-Pin Din Socket in Gun Interface Backplane
1	1	1C
34	2	1A
18	3	2C
2	4	2A
35	5	3C
19	6	3A
3	7	4C
36	8	4A
20	9	5C
4	10	5A
37	11	6C
21	12	6A
5	13	7C
38	14	7A
22	15	8C
6	16	8A
39	17	9C
23	18	9A
7	19	10C
40	20	10A
24	21	11C
8	22	11A
41	23	12C
25	24	12A
9	25	13C
42	26	13A
26	27	14C
10	28	14A
43	29	15C
27	30	15A
11	31	16C
44	32	16A
28	33	17C
12	34	17A
45	35	18C
29	36	18A
13	37	19C
46	38	19A
30	39	20C
14	40	20A
47	41	21C
31	42	21A
15	43	22C
48	44	22A
32	45	23C
16	46	23A
49	47	24C
33	48	24A
17	49	25C
50	50	25A

26 C&A through 32 C&A not on ribbon cable

Figure 5-1. **SIMBA 2 CONNECTOR GUIDE**
(Use with Table 5-1)



SECTION 6
CONFIGURATION AND MAINTENANCE PROCEDURES

This section contains configuration, calibration, and maintenance procedures. The subsections are:

* Reconfiguring the Power Module to Switch Voltage Ranges
* Calibrating Gun Control PC Boards.

DANGER

Only qualified service personnel should perform the procedures described in this section. Read the the safety instructions on page vii of this manual before beginning any of these procedures, and observe all of these instructions while working on the power supply.

RECONFIGURING THE POWER MODULE TO SWITCH VOLTAGE RANGES

The Simba 2 power supply is capable of operating in either the normal voltage range (-7 to -10 kV) or in a low-voltage range (-3 to -7 kV). Follow the procedure described below to change from normal-range operation to low-voltage operation or vice versa.

Follow these steps to manually reconfigure the power module for low-range operation when it is configured for normal operation:

STEP	ACTION
1	Switch off the power supply's three-phase power at the service box.
2	Remove the power module front cover.
3	Touch a properly connected grounding hook to each of the six output taps on the side of the transformer nearest you (see Figure 6-1).
4	Disconnect the leads that are attached to the upper set of taps (marked **8900**) and connect them to the lower set of taps (marked **6580**).
5	Replace the power module front cover.
6	Install a jumper across JP1 (range select) on the voltage regulator board.

CAUTION

After you have installed this jumper, DO NOT switch on the high voltage unless you have moved the main power transformer's output leads to the lower set of taps. Operating the power supply with the transformer wired for high-range output and the voltage regulator board configured for low-range operation will result in severe damage to the power module from overheating.

To return to high-voltage operation, follow the same steps, with the following variations:

* In step 4, disconnect the leads from the lower set of taps (marked **6580**) and connect them to the upper set of taps (marked **8900**).

* In step 6, remove the jumper at JP1 on the voltage regulator board.

CAUTION

After connecting the transformer's output leads to the upper set of taps, DO NOT switch on the high voltage unless you have removed the jumper previously installed at JP1 on the voltage regulator board. Operating the power supply with the transformer wired for high-range output and the voltage regulator board configured for low-range operation will result in severe damage to the power module due to overheating.

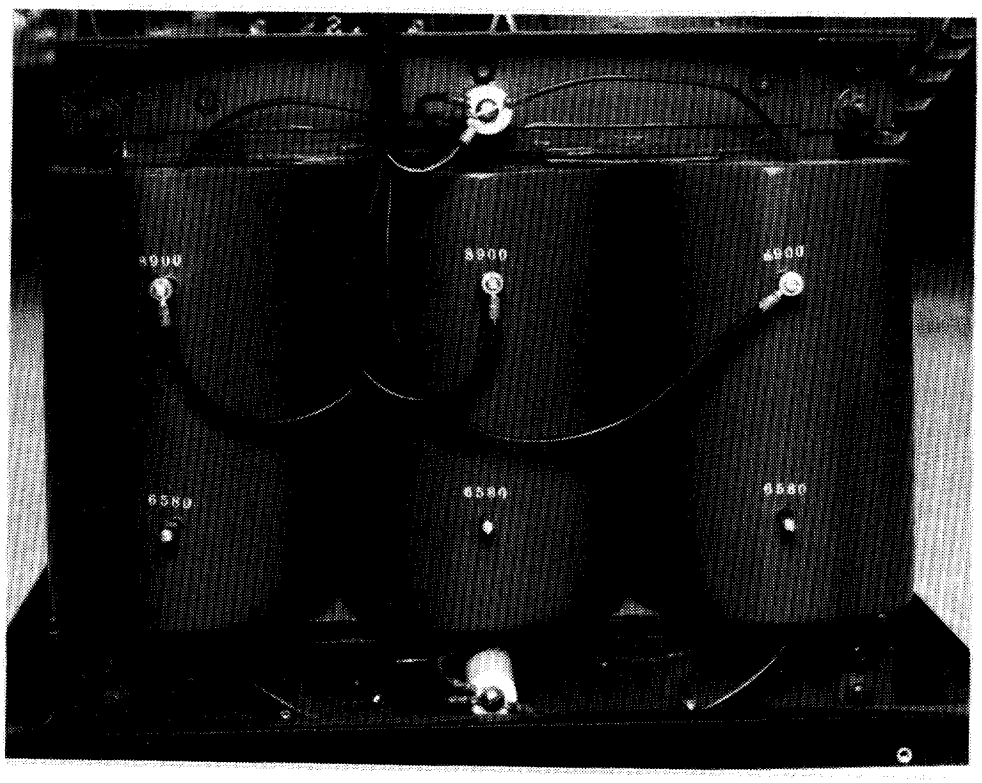


Figure 6-1. High-Voltage Transformer Configured for Normal-Range Output (-7 to -10 kV)

CALIBRATING GUN CONTROL PC BOARDS

The instructions below describe the procedure for calibrating a gun control board to one of the Hall-effect current sensors in the gun interface.

CAUTION

This procedure must be performed whenever a new gun control board is installed or when an existing board is moved to another slot in the same or a different gun interface. Failure to calibrate the board may result in the destruction of a gun filament or one or more on-board components (particularly the triac).

NOTE

In the instructions below, all references to the gun control unit refer to the gun control unit just installed, and all references to the gun control PCB refer to the board just installed. If you installed upgrade kits for second and third guns simultaneously, make sure you adjust the gun control PCB for gun #2 when you are working with the gun control unit for that gun and adjusting the gun control PCB for gun #3 when you are working with the gun control unit for that gun. If the cabling has been done correctly, the gun control PCB controlling gun #2 is installed in the slot in the gun interface card cage labeled GUN CONT P.C.B. 2 **on the card cage cover panel. The gun control PCB controlling gun #3 should be installed in the slot labeled** GUN CONT P.C.B. 3. **Keep in mind that the gun control units are not so labeled.**

STEP	ACTION
1	Make sure the vacuum system is ready for evaporation, with the chamber pumped down to the correct level and material in the crucible.
2	Switch on the main circuit breaker on the power module front panel. Make sure that the circuit breaker on the gun interface front panel and the keylock on the HV control unit are also switched on.
3	Turn the meter select switch on the gun control unit's front panel to **EMISS**ion.

STEP	ACTION
4	Find front panel potentiometer R17 on the gun control PCB; adjust this pot until the gun control unit's meter reads **0.00**.
5	Switch on the high voltage.
6	Turn the **BIAS** potentiometer on the gun control unit's front panel all the way down (i.e., counterclockwise).
7	Turn the gun control unit's **CURRENT** pot all the way counterclockwise.
8	Press the **ON** pushbutton on this gun control unit.
9	Follow the instructions provided in Section 3 of this manual under the heading "SETTING THE FILAMENT CURRENT BIAS LEVEL."
10	Turn the display selector switch on the gun control unit back to **EMISS**.
11	Turn the **CURRENT** pot clockwise until the meter indicates the maximum emission current level that your system will be operating at. This must be a minimum of .25 A.
12	Turn the display selector switch on the HV control unit to the **CURR**ent position, if it is not in that position already.
13	Turn the display selector switch on the gun control unit for this gun to **EMISS**ion.
14	Find front panel pot R16 on the gun control PCB and adjust it until the reading on the HV control unit's meter matches the reading on the gun control unit's meter.

NOTE

The reading that will change as you adjust R16 is the one on the HV control unit's meter, NOT the one on the gun control unit's meter.

15	Switch off the gun and the high voltage and replace the card cage cover on the gun interface front panel.

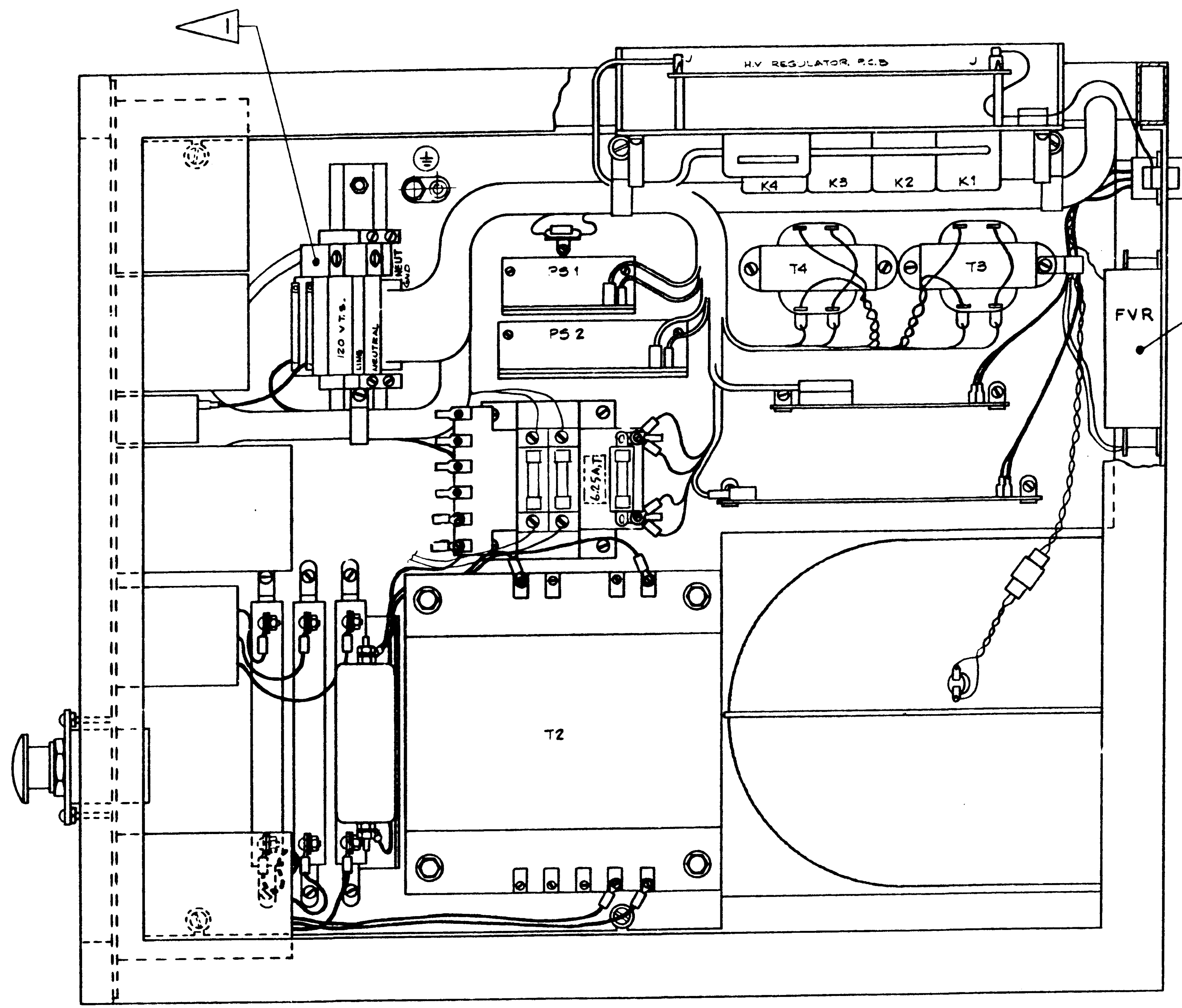
SECTION 7
DRAWINGS

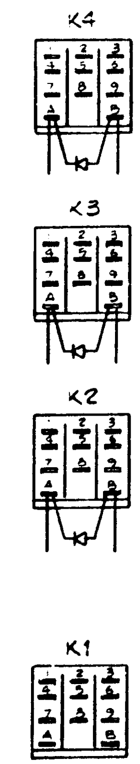
POWER MODULE

GUN INTERFACE

HV/GUN CONTROL UNIT

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.





NOTES:

1. FILAMENT VOLTAGE REGULATOR AND NEUTRAL TERMINAL INSTALLED ON 380 VAC SYSTEMS ONLY.

REV.	DESCRIPTION	BY	DATE	APP'VD
2	ITEM 3 WAS P/N 6921-4251-1, DELETED NATIONAL	GD	8-9-95	
1	UPDATE PER ECN # 484	SH	10/9/11	

UNLESS OTHERWISE SPECIFIED

BREAK ALL EDGES — INTER. RADII

USED ON DWG NO

DO NOT SCALE DRAWING

FINISH √ TOLERANCE .XXX ± ANG ± .XX ± X ±

CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

EDWARDS
A DIVISION OF THE BOC GROUP INC
Berkeley, California
Temescal

DRAWN BY A. JACQUES — DATE 9-24-93 — CHK BY JAS — APP BY — SCALE NONE

SIMBA 2

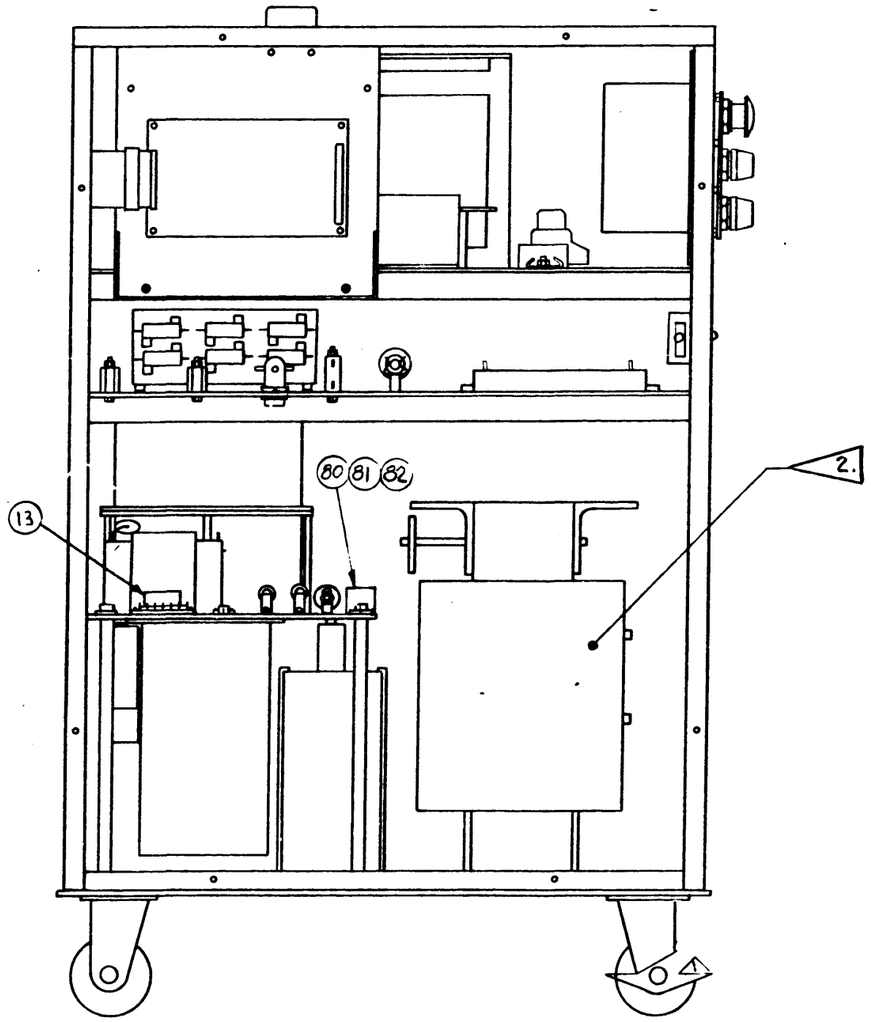
ASSY, POWER MODULE

DRAWING NUMBER: SERIAL 0040-6749 — SIZE 3 — REV D

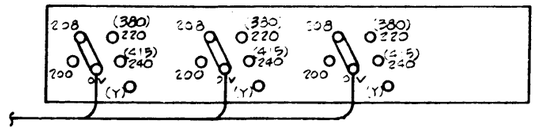
D	REVISED PER ECN # 1072	DC	8-25-96	
3	ADDED FVR AND NEUTRAL T.B. AND FLAG NOTES	GD	3-18-96	

PARTS LIST NO [illegible] — APPLIES SH 1 OF 3

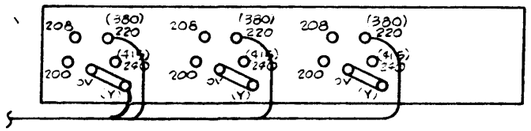
DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.



18.8KVA HI VOLTAGE TRANSFORMER (T6) 50/60HZ
PRIMARY Δ CONNECTIONS 200 - 240VAC



PRIMARY Y CONNECTIONS 380 - 415VAC



NOTES:

1. FOR VARIOUS INPUT LINE VOLTAGES, T1 AND T2 WILL HAVE TO BE CONFIGURED ACCORDINGLY.

2. WHEN ROUTING WIRES TO TRANSFORMER, T6, ENSURE WIRES DO NOT COME IN CONTACT WITH BODY OF TRANSFORMER.

REV.	DESCRIPTION	BY	DATE	APP'VD
	SEE SHEET 1			

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII
USED ON DWG. NO
DO NOT SCALE DRAWING
FINISH √ | TOLERANCE XXX ± ANG ± XX ± X ° | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

EDWARDS
A DIVISION OF THE BOC GROUP, INC
Berkeley, California
Temescal

DRAWN BY	DATE	CHK BY	APP BY	SCALE
A. JACQUES	9-27-90			NONE

SIMBA 2

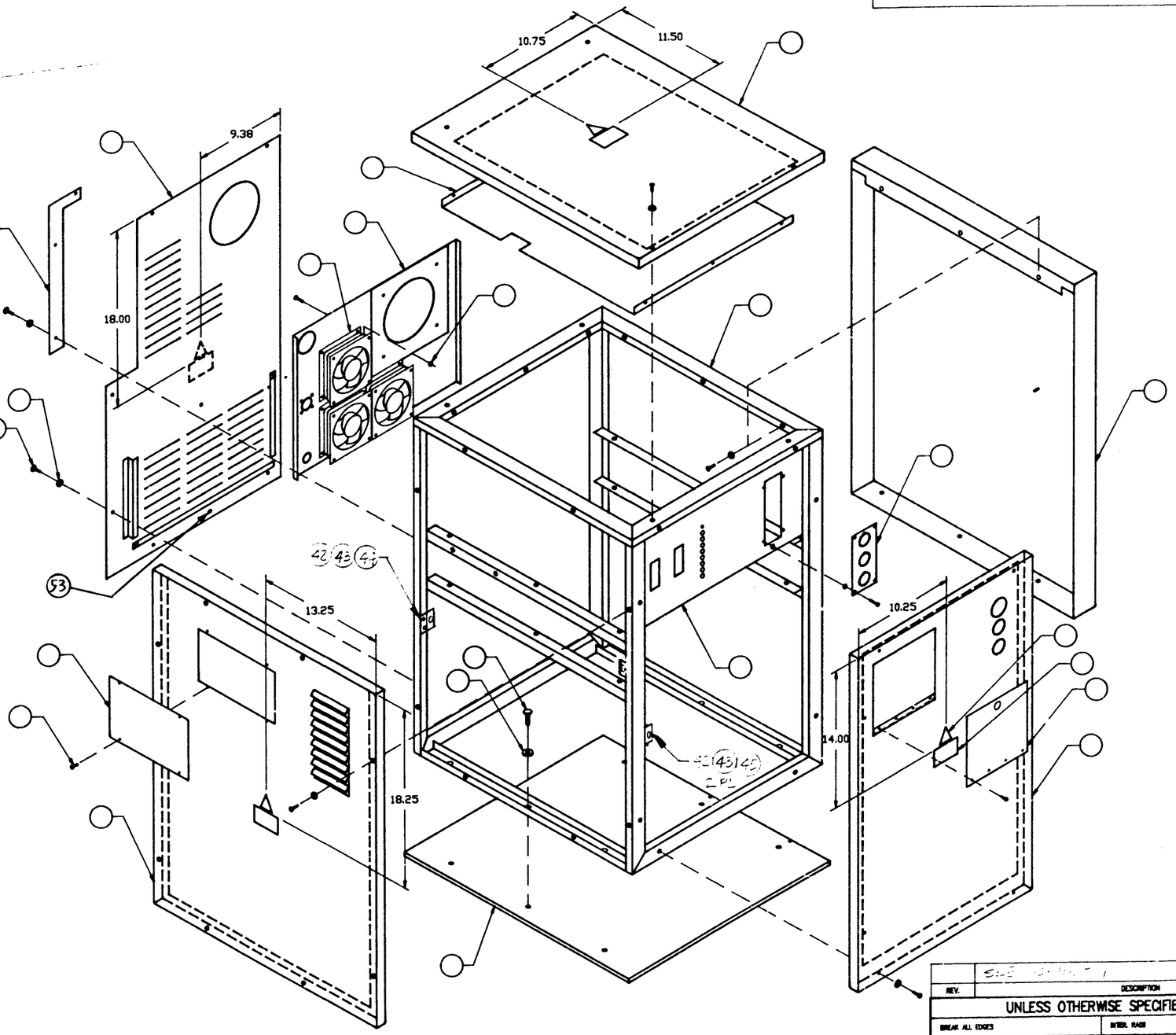
DRAWING NUMBER

SERIAL	SIZE	REV
0040-6743	D	

ASSY. POWER MODULE

PARTS LIST NO | APPLIES

DESCRIPTION	ITEM	PART No.	SUB ASSY	QTY



REV.	DESCRIPTION	BY	DATE	APP'VD
	SEE SHEET 1			

UNLESS OTHERWISE SPECIFIED — USED ON DWG. NO.

BREAK ALL EDGES — INTER. RADII — DO NOT SCALE DRAWING

FINISH √ — TOLERANCE: XXX ± ANG ± / XX ± X ±

CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

TEMESCAL
A DIVISION OF THE BOC GROUP
BERKELEY, CALIFORNIA

DRAWN BY	DATE	CHK BY	APP BY	SCALE
RFA	1/7/91			NONE

SIMBA 2

ASSY, - POWER MODULE

DRAWING NUMBER: 0040-6743 — SIZE: D — REV

SHT 3 OF 3

ITEM	PART NO.	ASSY	QTY	DESCRIPTION

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL WIRES ARE 20 AWG.
2. NOMINAL VOLTAGES AT TUBE GRIDS– SCREEN BIAS (+50V HV OFF, +700V HV ON)
   – CONTROL (–75 TO –350V).
3. IF SYSTEM EPO IS NOT CONNECTED TO SIMBA EPO, THEN EPO EXT-3 AND EPO EXT-4 SHOULD BE JUMPED.
4. MAIN BREAKERS AND FUSES TO BE RATED AS FOLLOWS:
   FOR 208VAC USE 80A FOR F1, F2 USE 15A
   FOR 380VAC USE 50A FOR F1, F2 USE 0.8A
   FOR 480VAC USE 40A FOR F1, F2 USE 0.6A
5. WIRING SHOWN IS WITH FVR. IF FVR IS NOT INSTALLED THEN WIRE FROM 1SL3 TO K4-7.
6. WHEN ROUTING WIRES TO TRANSFORMER T6, ENSURE WIRES DO NOT COME IN CONTACT WITH BODY OF TRANSFORMER.
7. FOR 380 V SYSTEMS: ATTACH WIRE TO NEUTRAL TERMINAL BLOCK AND WIRE TRANSFORMER T6 PER FIGURE 1.
8. JUMPER PINS EXT 5 AND EXT 6 ON 0040-6740-4 ONLY

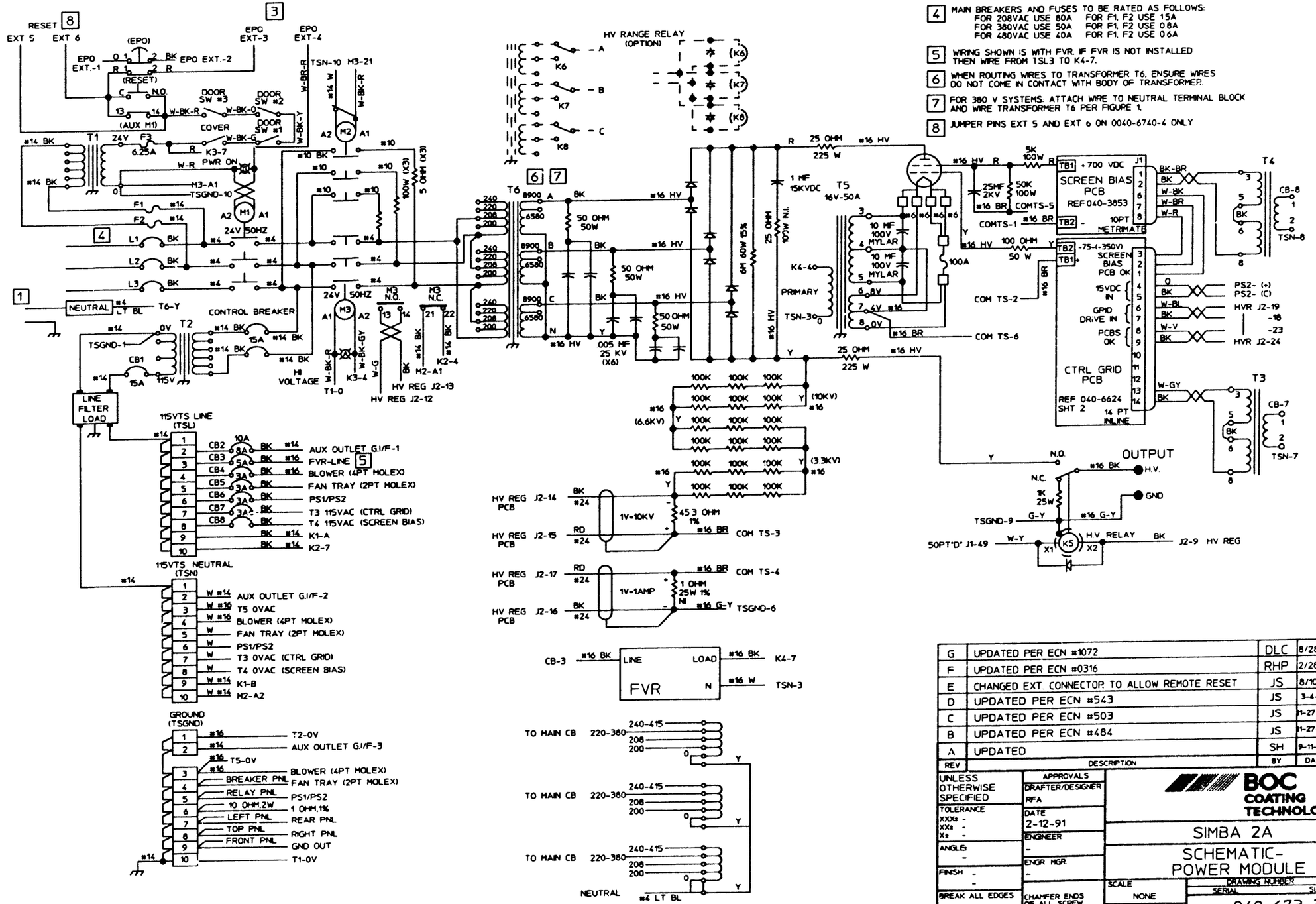
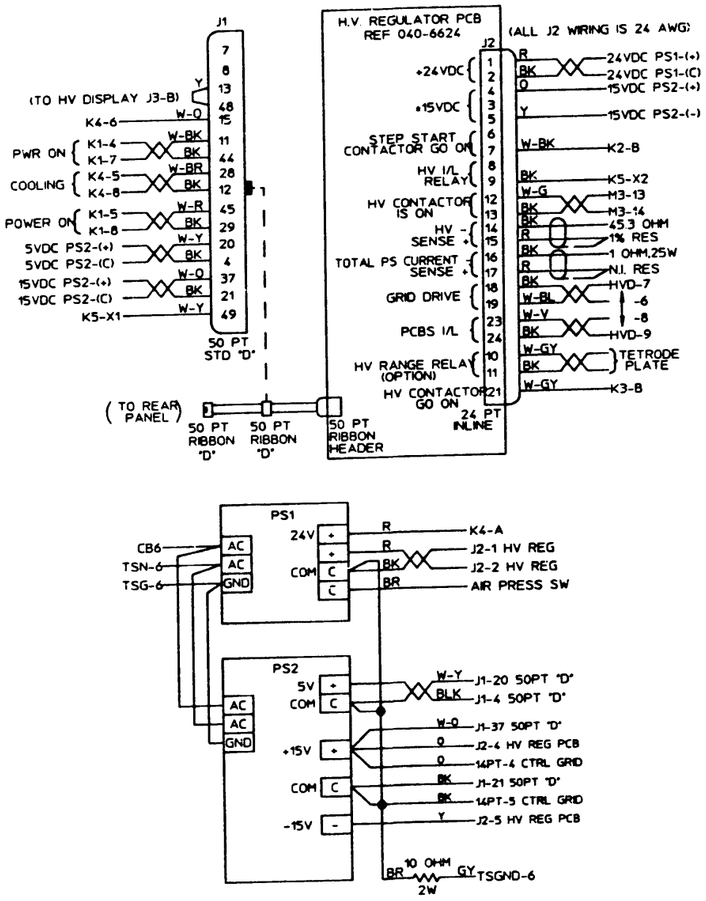


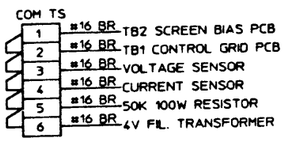
FIGURE 1

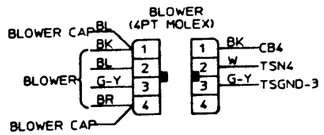
REV	DESCRIPTION	BY	DATE	APP'VD
G	UPDATED PER ECN #1072	DLC	8/28/96	
F	UPDATED PER ECN #0316	RHP	2/28/96	JJ
E	CHANGED EXT. CONNECTOR TO ALLOW REMOTE RESET	JS	8/10/95	MJ
D	UPDATED PER ECN #543	JS	3-4-92	
C	UPDATED PER ECN #503	JS	11-27-91	V²
B	UPDATED PER ECN #484	JS	11-27-91	V²
A	UPDATED	SH	9-11-91	V²

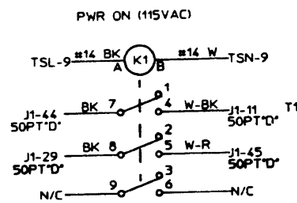
UNLESS OTHERWISE SPECIFIED	APPROVALS	BOC COATING TECHNOLOGY	
TOLERANCE XXX± – XX± – X± –	DRAFTER/DESIGNER RFA	SIMBA 2A	
ANGLES –	DATE 2-12-91	SCHEMATIC– POWER MODULE	
FINISH – –	ENGINEER –		
BREAK ALL EDGES –	ENGR MGR –	SCALE NONE	DRAWING NUMBER SERIAL 040-673 3 SIZE REV G
INTERNAL RADII –	CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2	DO NOT SCALE DRAWING	SHEET 1 OF 2

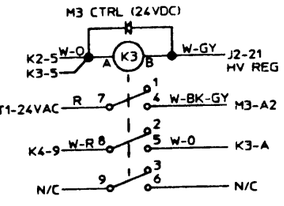
DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY

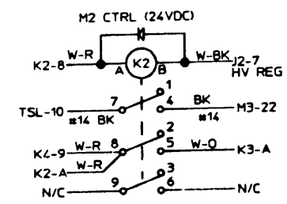


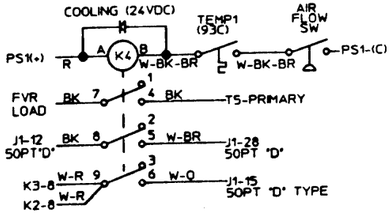








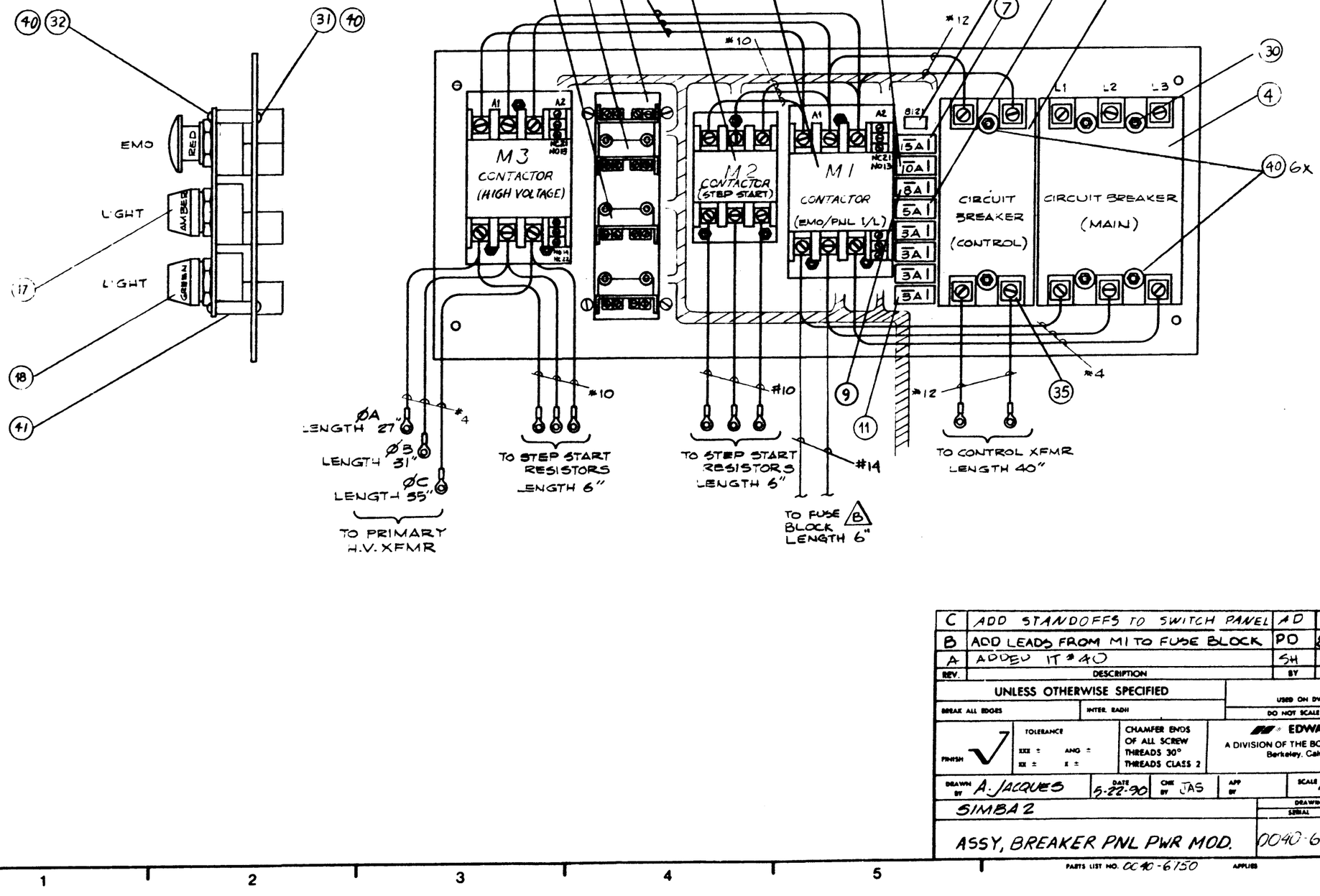




REV	DESCRIPTION	BY	DATE	APP'VD
-	SEE SHEET 1	-	-	-

UNLESS OTHERWISE SPECIFIED	APPROVALS	BOC COATING TECHNOLOGY	
TOLERANCE XXX± - XX± - X± -	DRAFTER/DESIGNER RFA	SIMBA 2A	
ANGLE± -	DATE 2-12-91	SCHEMATIC- POWER MODULE	
FINISH - -	ENGINEER -		
BREAK ALL EDGES -	ENGR. MGR. -	SCALE NONE	DRAWING NUMBER SERIAL 040-673 3 SIZE REV G
INTERNAL RADII -	CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2	DO NOT SCALE DRAWING	SHEET 2 OF 2

ITEM	PART NO.	SUB ASSY	QTY.	DESCRIPTION



REV.	DESCRIPTION	BY	DATE	APP'VD
C	ADD STANDOFFS TO SWITCH PANEL	AD	1-31-91	CM
B	ADD LEADS FROM M1 TO FUSE BLOCK	PD	8-8-91	MM
A	ADDED IT #40	SH	1-19-90	

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII | USED ON DWG. NO. | DO NOT SCALE DRAWING
FINISH √ | TOLERANCE XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

EDWARDS
A DIVISION OF THE BOC GROUP, INC
Berkeley, California
Tamaocal

DRAWN BY A. JACQUES | DATE 5-22-90 | CHK BY JAS | APP BY | SCALE NONE

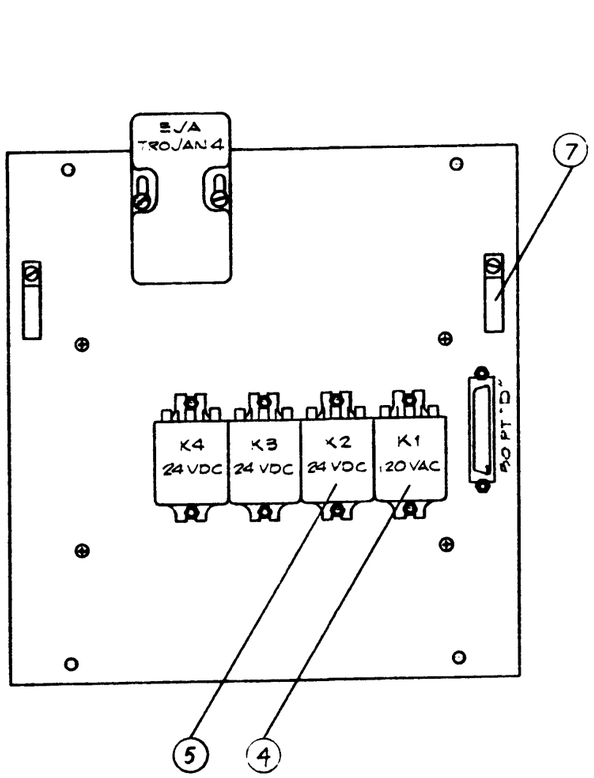
SIMBA 2

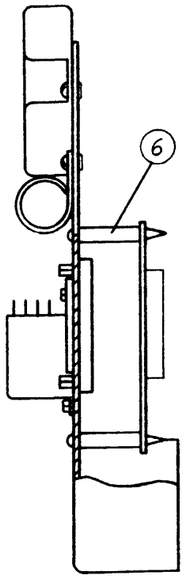
ASSY, BREAKER PNL PWR MOD.

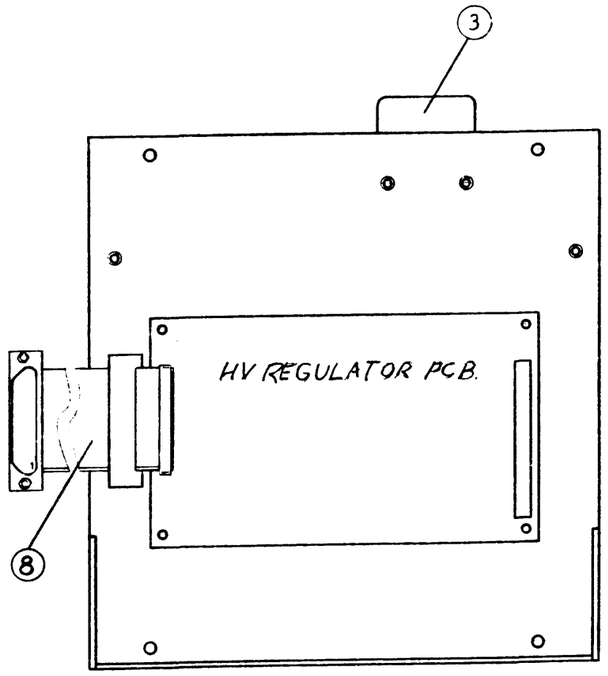
DRAWING NUMBER: SERIAL 0040-6753 | SIZE C | REV

PARTS LIST NO. 0040-6750 APPLIES

ITEM	PART NO.	SUB ASSY	QTY	DESCRIPTION







REV.	DESCRIPTION	BY	DATE	APP'VD

UNLESS OTHERWISE SPECIFIED

BREAK ALL EDGES | INTER. RADII | USED ON DWG. NO. | DO NOT SCALE DRAWING

FINISH √ | TOLERANCE XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

EDWARDS
A DIVISION OF THE BOC GROUP, INC.
Berkeley, California

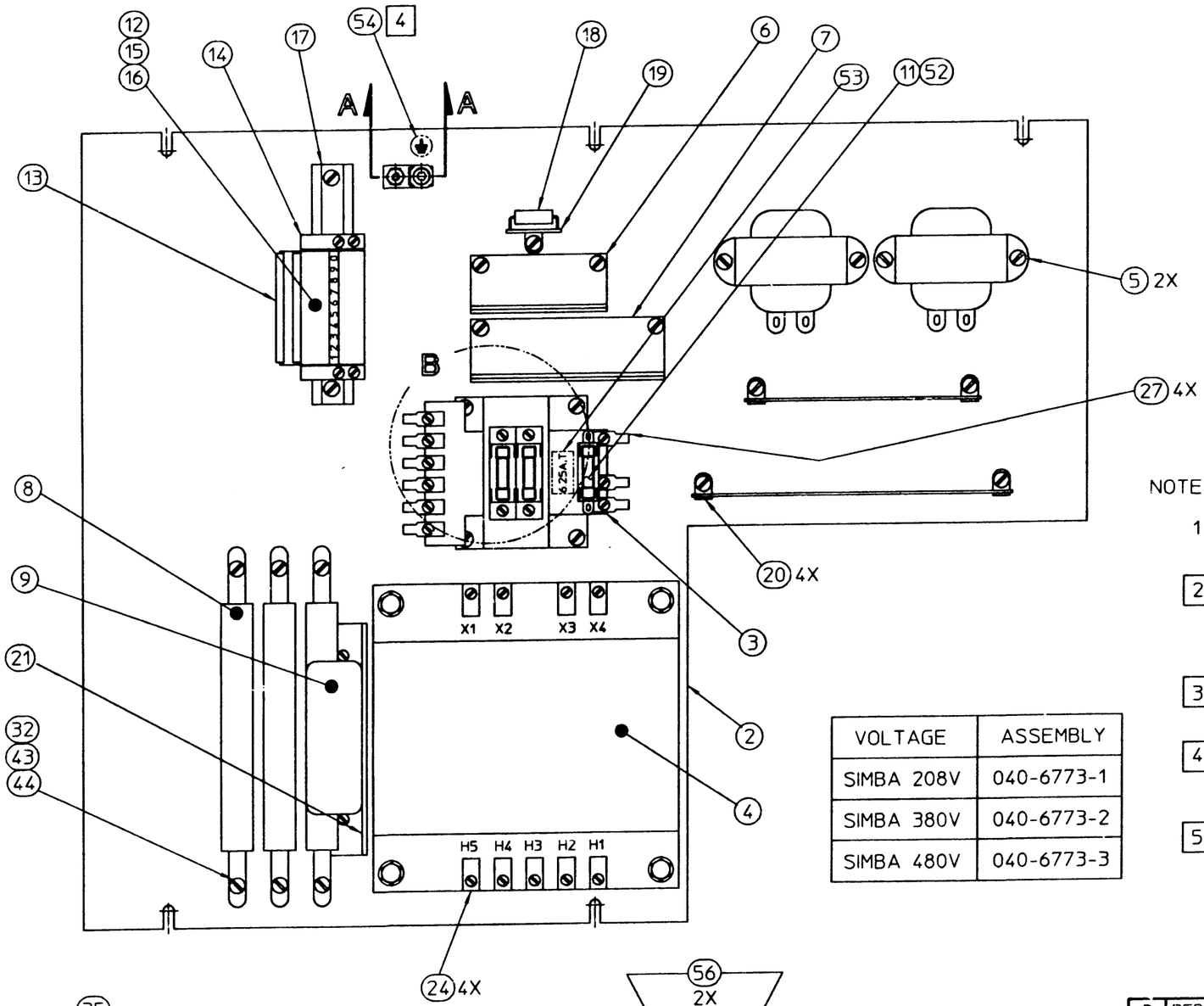
DRAWN BY A. JACQUES | DATE 5-22-90 | CHK BY JAS | APP BY | SCALE NONE

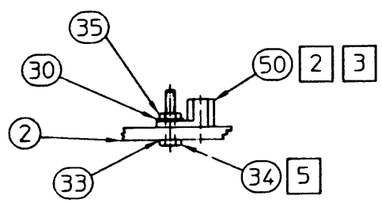
SIMBA 2

ASSY. REG/RELAY PNL PWR MOD. | 0040-6760 | REV

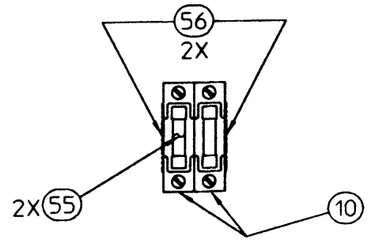
PARTS LIST NO. 0040-6760 APPLIES

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY





SECTION A–A



DETAIL B

VOLTAGE	ASSEMBLY
SIMBA 208V	040-6773-1
SIMBA 380V	040-6773-2
SIMBA 480V	040-6773-3

NOTES: (UNLESS OTHERWISE SPECIFIED)

1 INSTALL ALL BOLTED HARDWARE USING EXTERNAL TOOTH LOCKWASHERS.

[2] GROUND LUG, (ITEM 50), TO BE MOUNTED FLUSH WITH THE PANEL SURFACE AFTER EXPOSING THE PANEL BASE METAL FOR CONTACT WITH THE LUG.

[3] ALL OTHER BONDING CONDUCTORS TO BE MOUNTED ABOVE GROUND LUG, (ITEM 50)

[4] RE-ROUTE EXISTING WIRING TO EXPOSE THE "GROUND SYMBOL LABEL" TO ENSURE ITS VISIBILITY.

[5] APPLY "LOCTITE", (ITEM 33) TO THE THREADS OF (ITEM 34) AND (ITEM 02)

REV.	DESCRIPTION	BY	DATE	APP'VD
B	REDRAWN PER ECN #1072	DLC	8/23/96	

UNLESS OTHERWISE SPECIFIED	
TOLERANCE XXX± - XX± - X± -	
ANGLES -	
FINISH -	
BREAK ALL EDGES -	
INTERNAL RADII -	
APPROVALS	
DRAFTER/DESIGNER	A JACQUES
DATE	5/22/90
ENGINEER	JAS
ENGR MGR	-
CHAMFER ENDS OF ALL SCREW THREADS 30°	
THREADS CLASS 2	

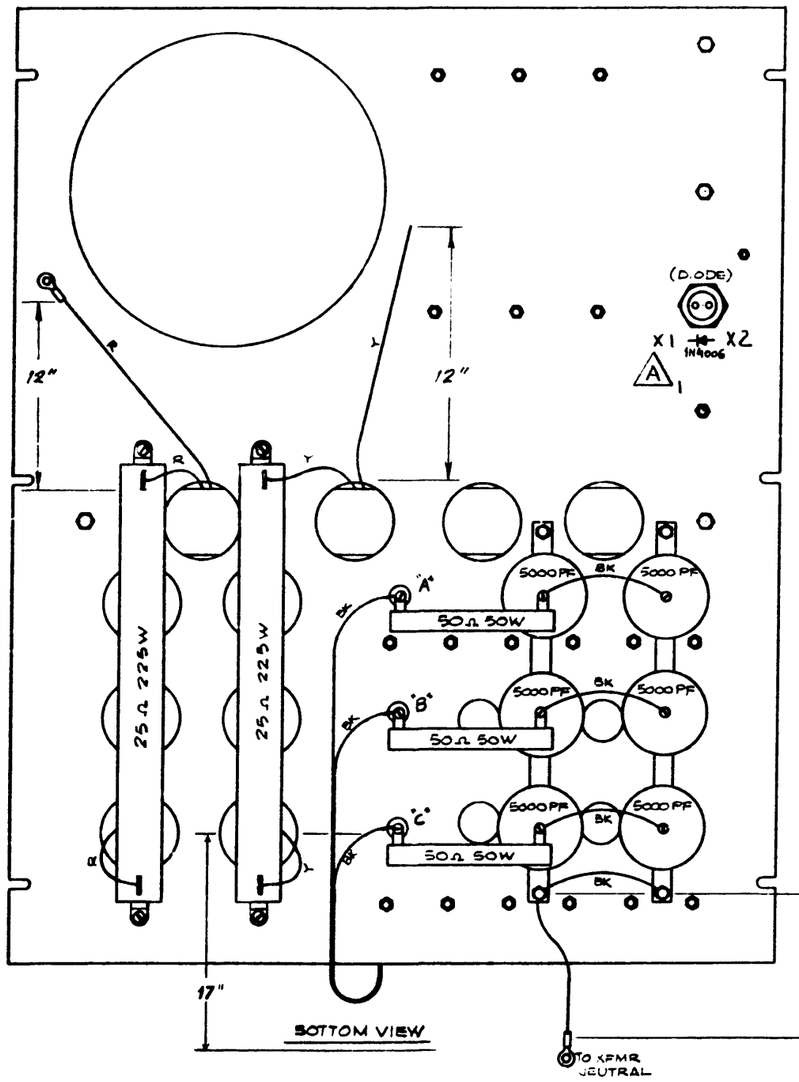
BOC COATING TECHNOLOGY

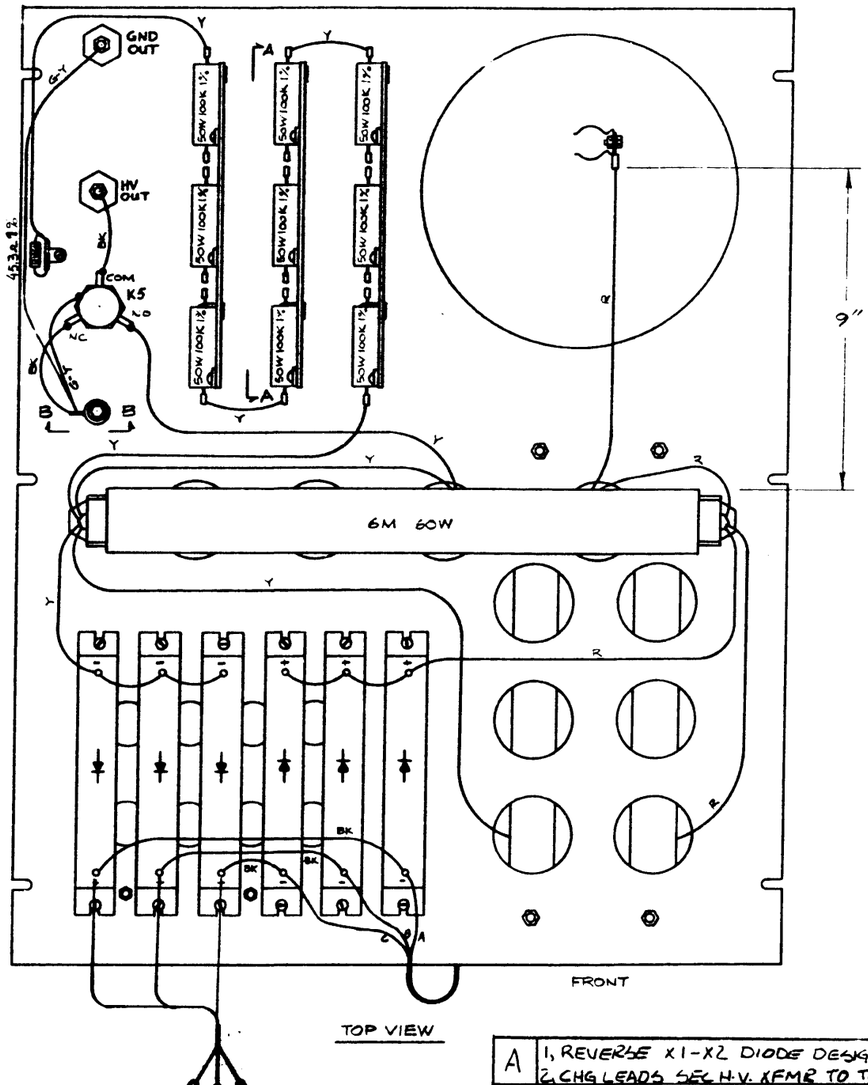
SIMBA 2

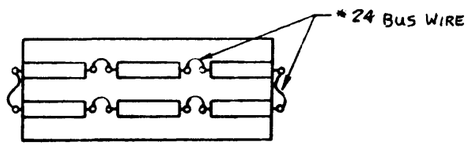
CONTROL PANEL, POWER MODULE ASSEMBLY

SCALE	DRAWING NUMBER / SERIAL	SIZE	REV
12	040-677 3		B
DO NOT SCALE DRAWING	SHEET 1 OF 1		

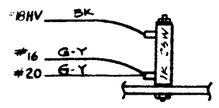
DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.







VIEW A-A
TYP (3)PL



VIEW B-B

REV.	DESCRIPTION	BY	DATE	APP'VD
A	1, REVERSE X1-X2 DIODE DESIGNATORS; 2, CHG LEADS SEC H.V. XFMR TO TOP VIEW	PD	8-89	JVH

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII
USED ON DWG. NO.
DO NOT SCALE DRAWING
FINISH | TOLERANCE XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

EDWARDS
A DIVISION OF THE BOC GROUP, INC.
Berkeley, California
Temescal

DRAWN BY A. JACQUES | DATE 9-22-90 | CHK BY JAS | APP BY | SCALE NONE

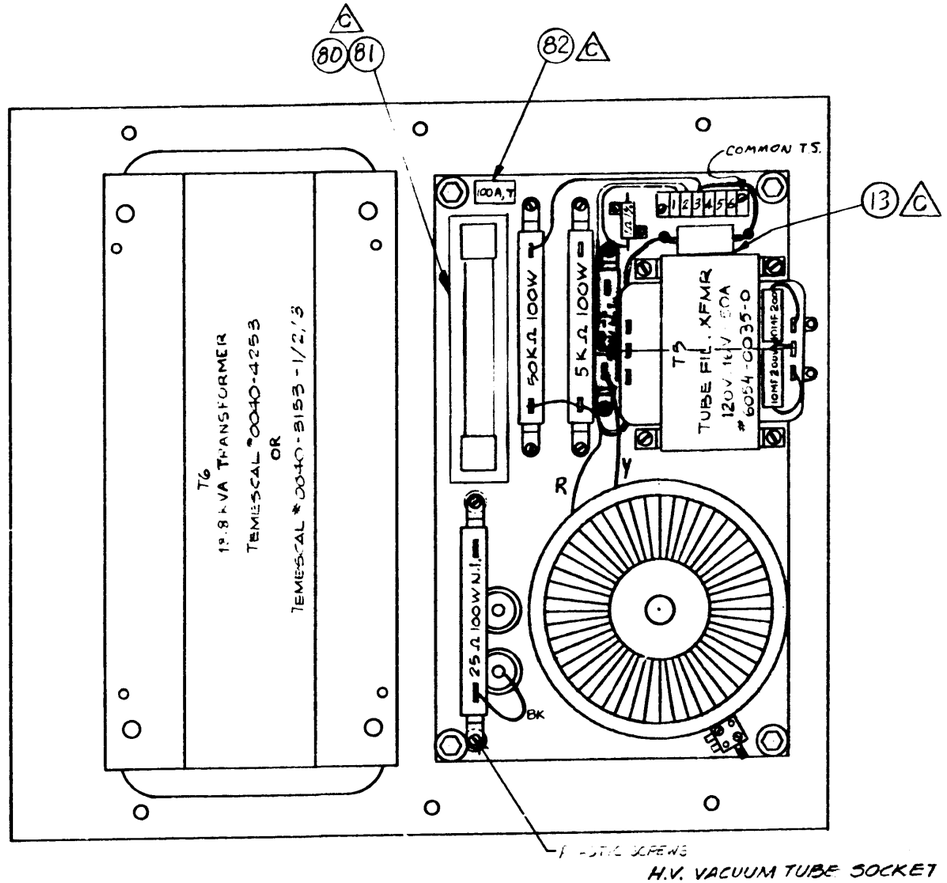
SIMBA 2

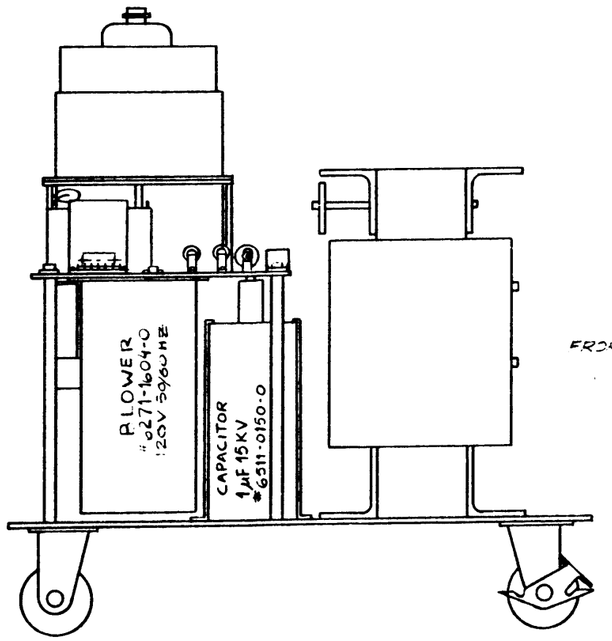
ASSY, H.V. RECT./RES. PNL PWR MOD.

DRAWING NUMBER: SERIAL | SIZE | REV
0040-6783 | A

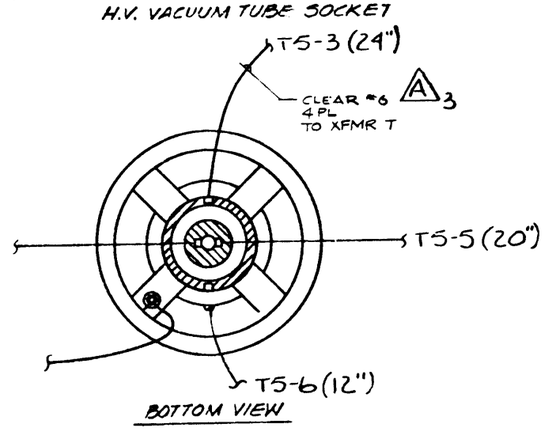
PARTS LIST NO. 0040-6780 APPLIES

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.





H.V. VACUUM TUBE SOCKET



BOTTOM VIEW

NOTES:

1. INSTALL ALL HARDWARE WITH EXTERNAL TOOTH LOCK WASHERS.

REV.	DESCRIPTION	BY	DATE	APP'VD
C	REVISED PER ECN # 1072	RE	8-25-96	JJE
B	ITEM-13 WAS PN, 6505-9412-0	GD	8-2-95	
A	1, REMOVE TOP & SIDE VIEW OF SIGNAL XFMR, 2, MOVE 100 OHM RESISTOR, 3, ADD DETAIL TO H.V. VACUUM TUBE SOCKET BOTTOM VIEW.	PD	8-8-91	

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII
USED ON DWG NO
DO NOT SCALE DRAWING
FINISH | TOLERANCE XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

EDWARDS
A DIVISION OF THE BOC GROUP INC
Berkeley, California
Temescal

DRAWN BY A. JACQUES | DATE 5-22-90 | CHK BY JAS | APP BY | SCALE NONE

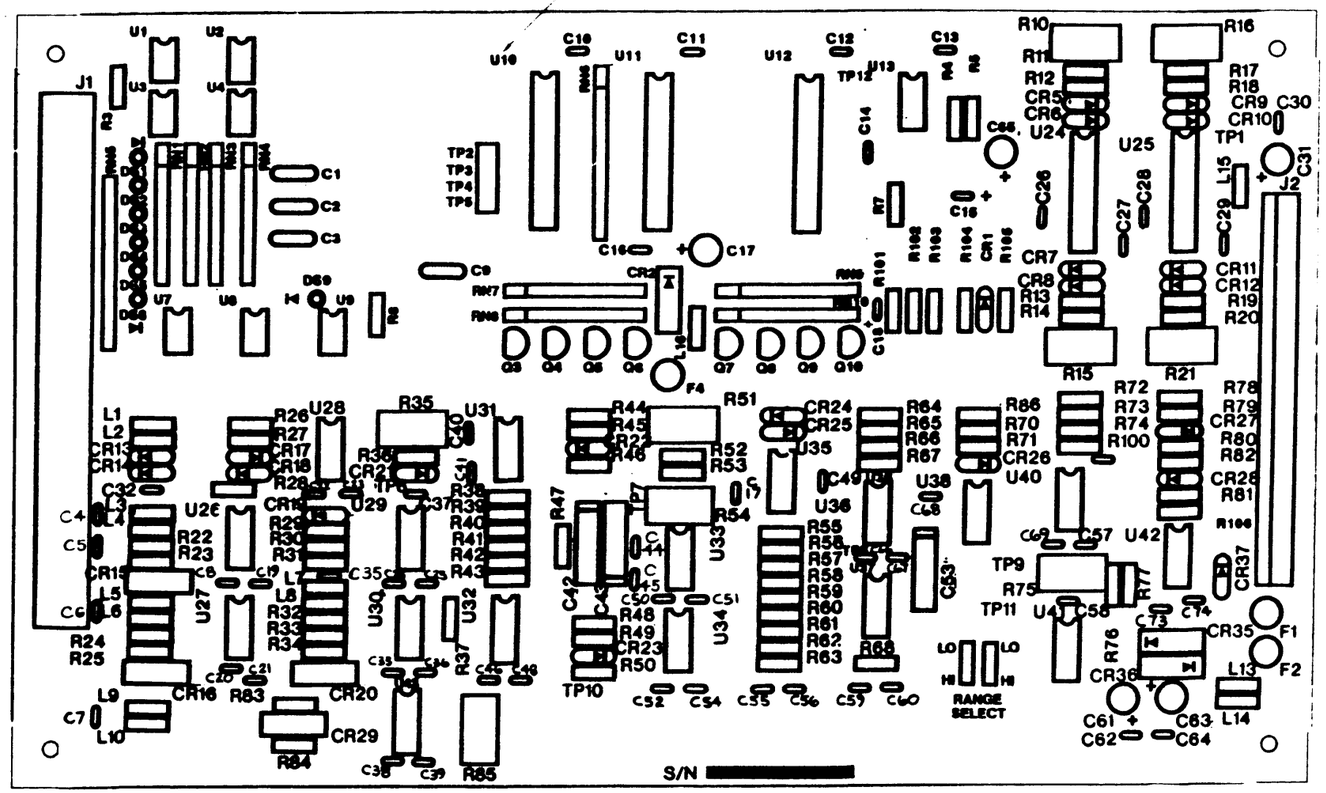
SIMBA 2

ASSY, BASE/TETRODE PNL PWR MOD.

DRAWING NUMBER 0040-6793 | SIZE C | REV

PARTS LIST NO. 0040-6790 APPLIES

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY



ATTENTION
Contents
Static-Sensitive

THIS PRODUCT HAS BEEN MANUFACTURED UNDER STRICT STATIC CONTROL CONDITIONS TO PREVENT DAMAGED TO SENSITIVE COMPONENTS. PLEASE USE STATIC CONTROL PRECAUTIONS IN SERVICING OF THIS EQUIPMENT. FIELD SERVICE OR MAINTENANCE PERSONNEL SHOULD BE PROPERLY GROUNDED BEFORE SERVICING.

NOTES:

1. ALL UNMARKED CAPACITORS ARE .1/50V.
2. SCHEMATIC DWG. 040-6624.
3. R44, R46, C42 & C43 ARE NOT USED.
4. TRIM POT PIN 1 TO SQUARE PAD.
5. DS1-6, DS9 SHORT LEAD WITH ANGLE (CATHODE) TO SQUARE PAD.
6. FAB. DWG. 040-6643.
7. INSTALL SOCKETS U10, U11 & U12.
8. ARTWORK DWG. 040-6633.

9. PALS REQUIRE PROGRAMMING PRIOR TO TESTING. MASTER CHIP SET IS LOCATED IN THE STORAGE CABINET BIN MARKED "SIMBA", LOCATED IN THE ENGINEERING SOFTWARE LAB. MASTER CHIPS ARE LABLED HRV-U10-5E96, HRV-U11-4FA, HRV-U12-AF46. REMOVE U10, U11, U12 AND PROGRAM USING DATA I/O PROGRAMMER, ATTACH PRE-MADE LABELS AND REINSTALL I.C.'S.

REV	DESCRIPTION	BY	DATE	APP'VD
E	ADDED MISSING CAPACITORS PER DCR #7381	JAR	12-26-95	[illegible]
D	REVIEW & UPDATE PER DCR #7093	JP	8-5-94	[illegible]
C	UPDATED PER DCR #4317	JS	10-2-92	LLW
B	UPDATED PER ECN #503 & #513	JS	12-12-91	VV
A	UPDATED PER ECN #308	JAS	2-7-91	-

UNLESS OTHERWISE SPECIFIED
TOLERANCE XXX± - XX± - X± -
ANGLE± -
FINISH -
BREAK ALL EDGES -
INTERNAL RADII -

APPROVALS
DRAFTER/DESIGNER: A. JACQUES
DATE: 3-29-90
ENGINEER: MN JR
ENGR. MGR.: -
CHAMFER ENDS OF ALL SCREW THREADS 30°
THREADS CLASS 2

BOC COATING TECHNOLOGY

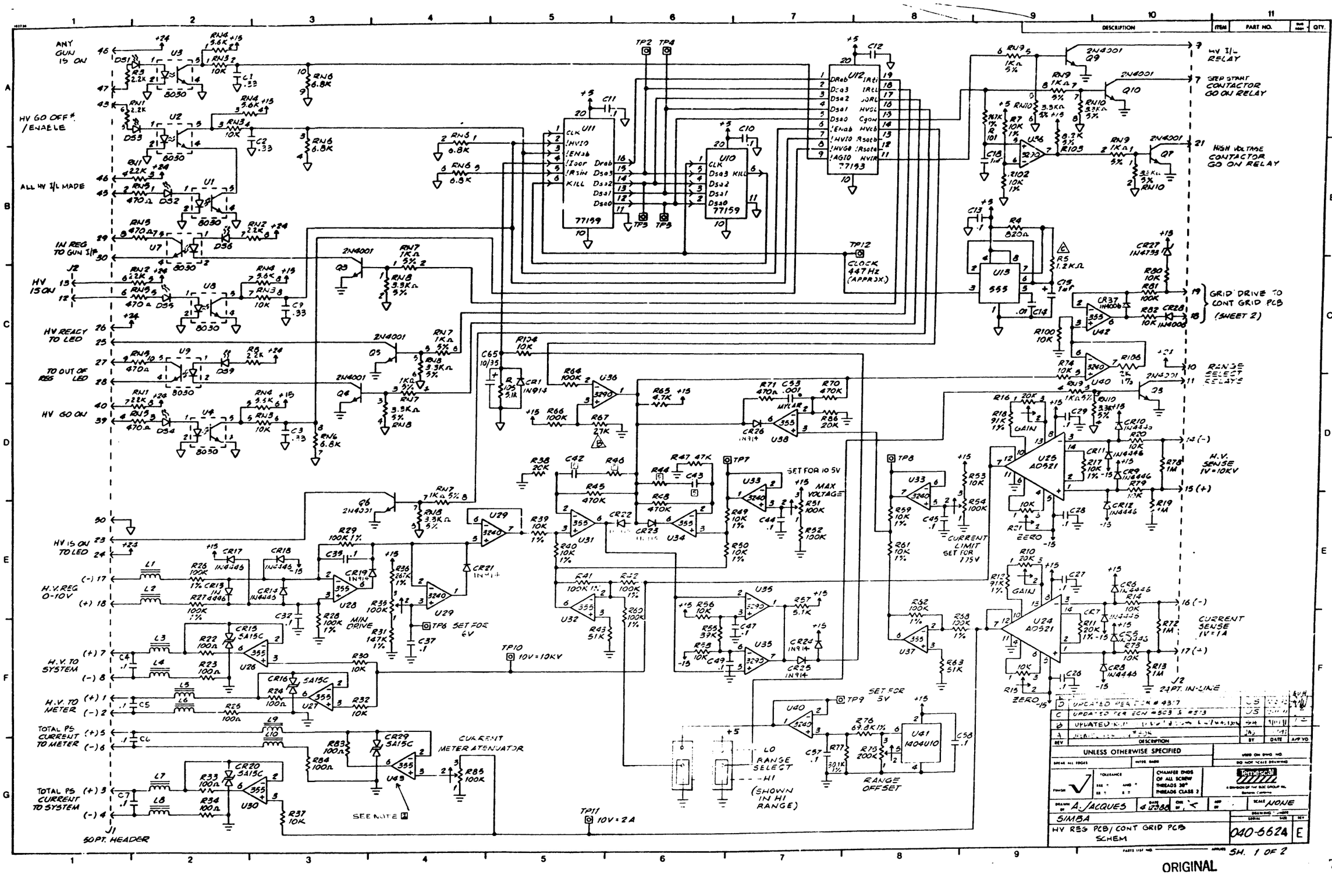
SIMBA 2

ASSY PCB H.V. REGULATOR

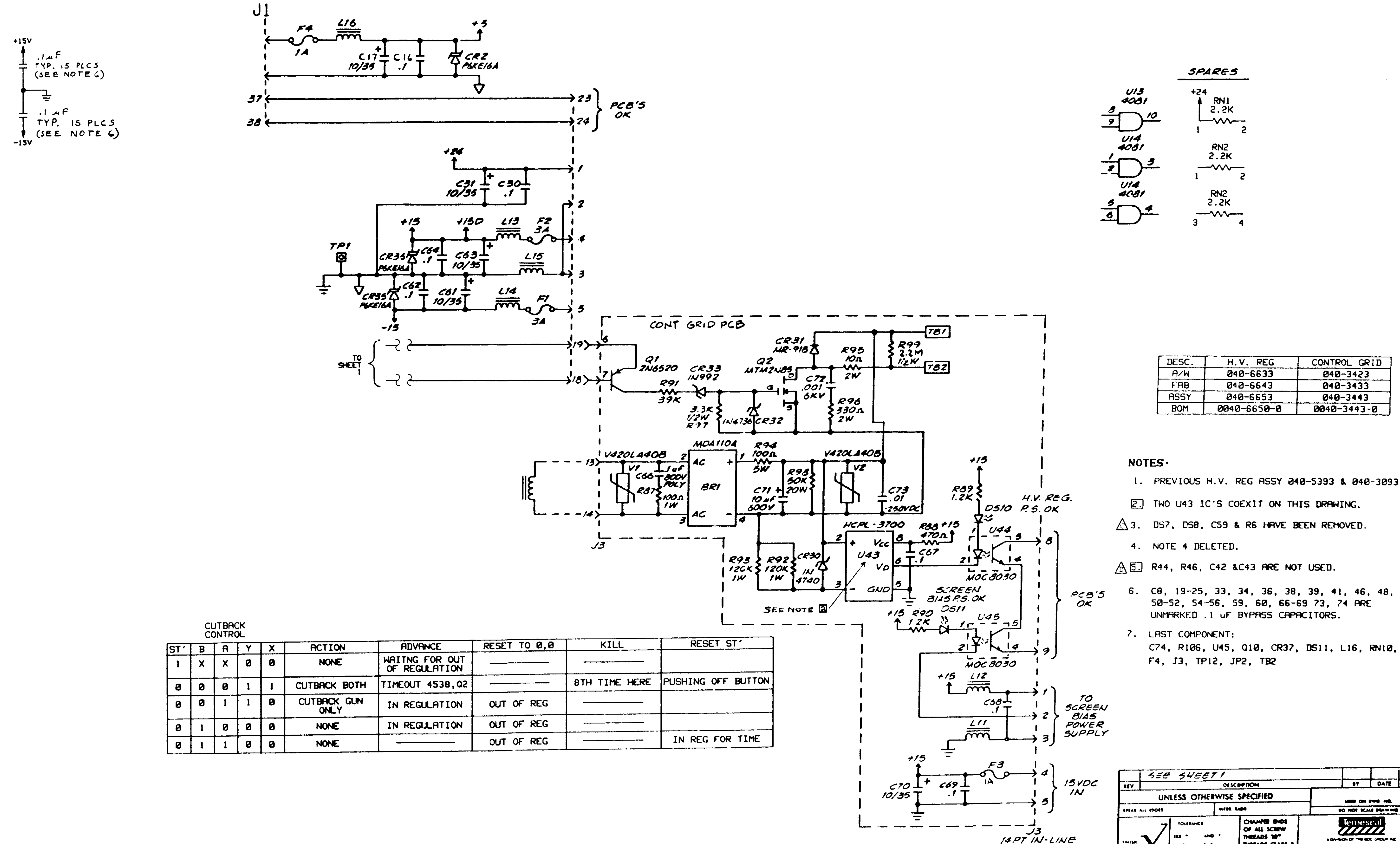
SCALE: NOT OT SCALE
DO NOT SCALE DRAWING

DRAWING NUMBER: SERIAL SIZE: 040-665 3 — REV: E

SHEET 1 OF 1


ANY GUN IS ON
HV GO OFF*/ENABLE
ALL HV I/L MADE
IN REG TO GUN I/L
HV IS ON
HV READY TO LED
TO OUT OF REG LED
HV GO ON
HV IS ON TO LED
H.V. REG 0-10V
H.V. TO SYSTEM
H.V. TO METER
TOTAL PS CURRENT TO METER
TOTAL PS CURRENT TO SYSTEM
J1 SOPT. HEADER
MIN DRIVE
SET FOR 6V
TP10 10V=10KV
TP11 10V=2A
CURRENT METER ATTENUATOR
SEE NOTE 4
CLOCK 447Hz (APPROX)
SET FOR 10.5V MAX VOLTAGE
SET FOR 5V
LO RANGE SELECT
-HI (SHOWN IN HI RANGE)
RANGE OFFSET
CURRENT LIMIT SET FOR 1.75V
GAIN
ZERO
HV I/L RELAY
SEQ START CONTACTOR GO ON RELAY
HIGH VOLTAGE CONTACTOR GO ON RELAY
GRID DRIVE TO CONT GRID PCB (SHEET 2)
RANGE SELECT RELAYS
H.V. SENSE 1V=10KV
CURRENT SENSE 1V=1A
24PT. IN-LINE
DESCRIPTION
UPDATED PER ECN # 4317
UPDATED PER ECN #5013 & #5113
UNLESS OTHERWISE SPECIFIED
SIMBA
HV REG PCB/CONT GRID PCB SCHEM
040-5624 E
SCALE NONE
SH. 1 OF 2

ORIGINAL



CUTBACK CONTROL

ST'	B	A	Y	X	ACTION	ADVANCE	RESET TO 0,0	KILL	RESET ST'
1	X	X	0	0	NONE	WAITING FOR OUT OF REGULATION	———	———	
0	0	0	1	1	CUTBACK BOTH	TIMEOUT 4538, Q2	———	8TH TIME HERE	PUSHING OFF BUTTON
0	0	1	1	0	CUTBACK GUN ONLY	IN REGULATION	OUT OF REG	———	
0	1	0	0	0	NONE	IN REGULATION	OUT OF REG	———	
0	1	1	0	0	NONE	———	OUT OF REG		IN REG FOR TIME

DESC.	H.V. REG	CONTROL GRID
A/W	040-6633	040-3423
FAB	040-6643	040-3433
ASSY	040-6653	040-3443
BOM	0040-6650-0	0040-3443-0

NOTES:

1. PREVIOUS H.V. REG ASSY 040-5393 & 040-3093.
2. TWO U43 IC'S COEXIT ON THIS DRAWING.
3. DS7, DS8, C59 & R6 HAVE BEEN REMOVED.
4. NOTE 4 DELETED.
5. R44, R46, C42 & C43 ARE NOT USED.
6. C8, 19-25, 33, 34, 36, 38, 39, 41, 46, 48, 50-52, 54-56, 59, 60, 66-69 73, 74 ARE UNMARKED .1 uF BYPASS CAPACITORS.
7. LAST COMPONENT: C74, R106, U45, Q10, CR37, DS11, L16, RN10, F4, J3, TP12, JP2, TB2

SEE SHEET 1

UNLESS OTHERWISE SPECIFIED

DRAWN BY A. JACQUES

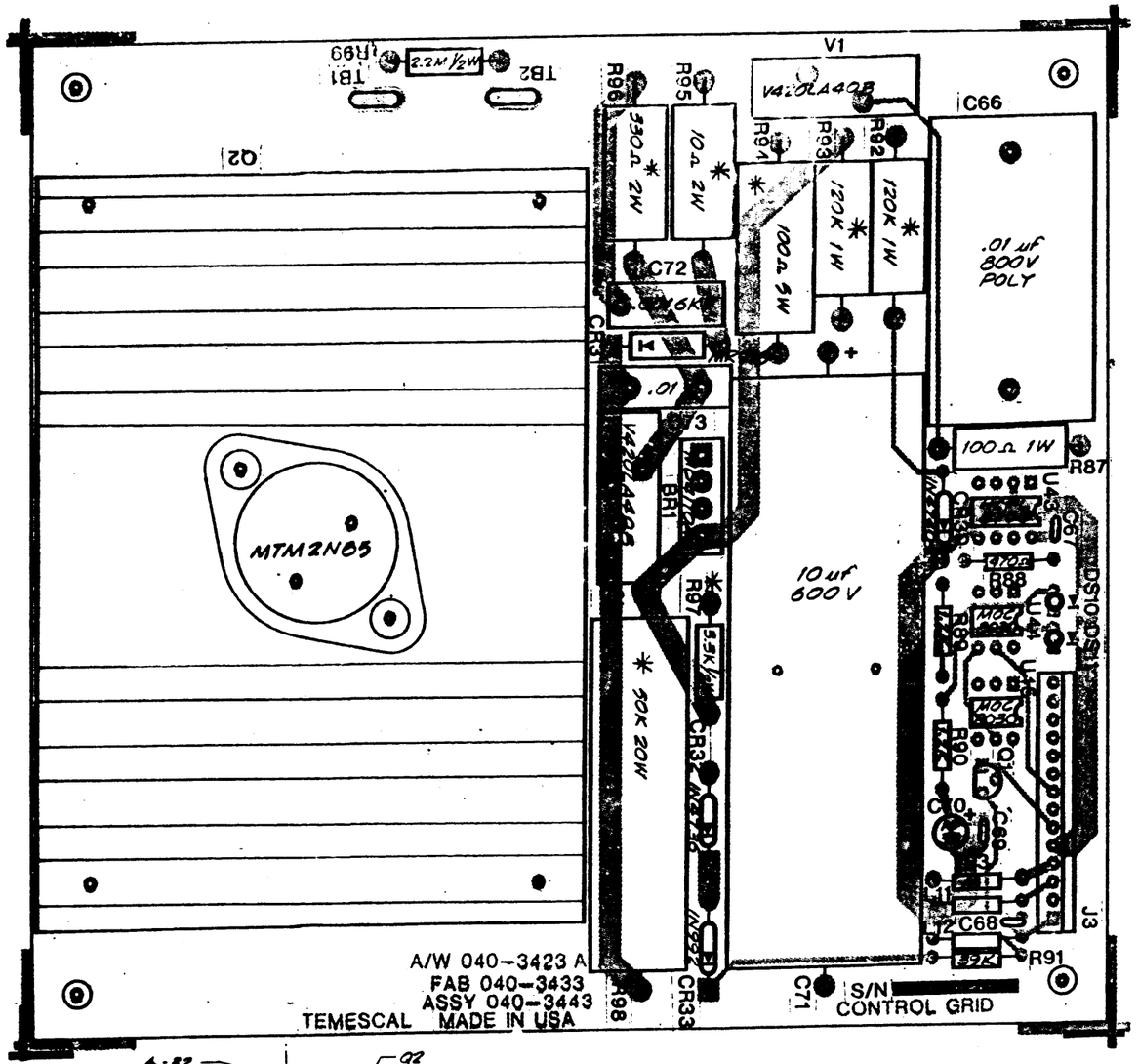
SIMBA

HV REG PCB / CONT GRID PCB SCHEM

040-6624 E

SH 2 OF 2

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.



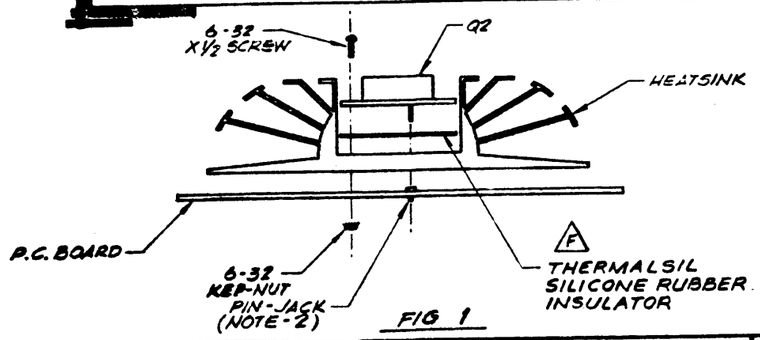


FIG 1

NOTES:

1. SEE FIG. 1 FOR Q2 MOUNTING CONFIG.
2. SOLDER PIN-JACKS INTO P.C. BOARD (2 PL)
3. SCHEMATIC REF. 040-5364, SHEET 2
4. CLEAN PCB BEFORE MOUNTING HEATSINK & TRANSISTOR. (SEE FIG. 1)
5. STANDOFF RESISTOR * BODY ¼" ABOVE PCB
6. DS10 & DS11, INSTALL SHORT LEAD WITH ANGEL (CATHODE) TO SQUARE PAD

DESC.	PART NO.	REV.
FAB	040-3433	A
ARTWORK	040-3423	A

REV.	DESCRIPTION	BY	DATE	APPVD
F	MODIFIED INSULATOR NOTE	JS	11-9-93	
E	NOTE CH3 PER RFA 2790	MB	3-20-90	
D	R89, R90 WERE 10K	A.J.	9-20-89	
C	BOARD SIZE WAS 5.50X5.00	A.J.	6-5-89	

UNLESS OTHERWISE SPECIFIED

BREAK ALL EDGES | INTER. RADII | USED ON DWG. NO. | DO NOT SCALE DRAWING

FINISH √ | TOLERANCE XXX ± AND ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

Temescal — A DIVISION OF THE BOC GROUP INC. Berkeley, California

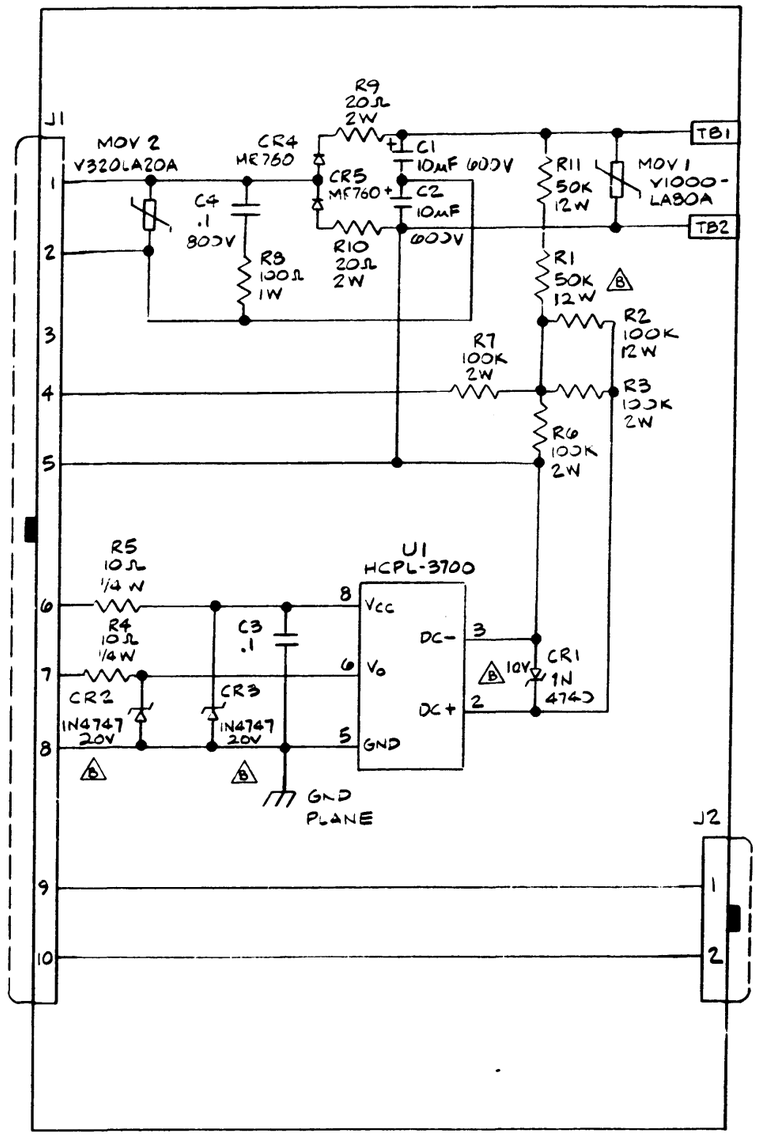
DRAWN BY A. JACQUES | DATE 6-5-89 | CHK BY JW | APP BY JW | SCALE 2:1

SIMBA

CONTROL GRID P.C.B ASSY | DRAWING NUMBER 040-3443 | REV F

PARTS LIST NO. | APPLIES

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.



NOTES: UNLESS OTHERWISE SPECIFIED

B 1. ASSY. DWG. REF. 610-1653
FAB. DWG. REF. 610-1643

2. ALL CAPACITORS ARE IN μF.

REV.	DESCRIPTION	BY	DATE	APP'VD
B	ADDED NOTES PER DCR #7469; DELETED PART NO'S. & VALUES; ADDED TO CR2 & CR3, 20V; ADDED 10V CR1, 10V; R1 WAS 10W.	JP	11-21-95	
A	UPDATED PER RFA 1927	AJ	6-3-70	

UNLESS OTHERWISE SPECIFIED — 0610-1653-0 USED ON DWG. NO.

BREAK ALL EDGES — INTER. RADII — DO NOT SCALE DRAWING

FINISH — TOLERANCE: XXX ± ANG ±, XX ± X ± — CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

BOC COATING TECHNOLOGY

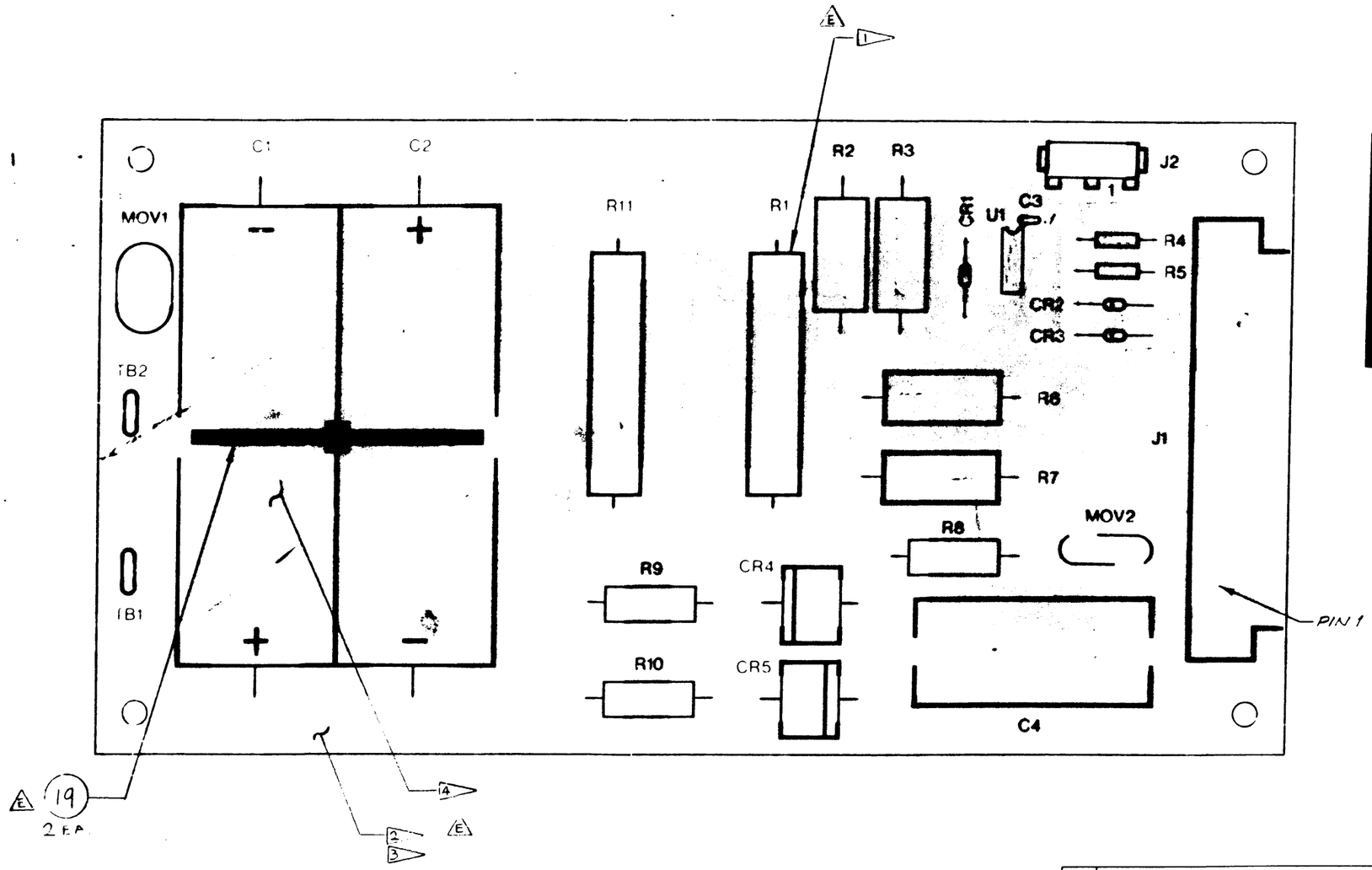
DRAWN BY M. BOSWELL — DATE 10.11.88 — CHK BY — APP BY BOK. — SCALE

SIMBA/CV-20

SC-EM, SCREEN BIAS PS PCB

DRAWING NUMBER: SERIAL 040-3353 — SIZE B — REV

PARTS LIST NO. ——— APPLIES



CAUTION

This product has been manufactured under strict static control conditions to prevent dam[illegible] to static sensitive compons. . Please use static control precautions in servicing of this equipment. Field service or maintenance personnel should be properly grounded before servicing equipment.

DOC.	DWG NO.
SCHM	610-1533
A/W	610-1533
FAB	610-1553

NOTES:

1. MOUNT RESISTORS R1-3,6,7 & 11 OFF BOARD BY .250.
2. APPLY APPLICABLE REV. LEVEL & S/N WITH INDELIBLE INK. FARSIDE.
3. APPLY DATE OF MANUFACTURE WITH INDELIBLE INK USING DATE FORMAT MMYY. FARSIDE.
4. APPLY TEST LABEL OR STAMP AFTER COMPLETION OF TEST. FARSIDE.
5. PARTS LIST REF. 0610-1653-0.

E	CHG'D. TITLE TO: ASSY., SCREEN BIAS P.C." PER DCR #7469; ADDED NOTES 1 THRU 5 & ASSOCIATED DELTA'S. REMOVED PART NO.'S & VALUES; ITEM 19 (2 EA.) WAS TIE WRAP.	JP	11-20-95	
D	ADDED IT# 19 BOM PER ECN# 137	SH	7-15-91	
C	UPDATED PER ECN # 22	A.J.	3.3.90	
B	CR4 & CR5 WERE UNITRODE KK-15	MB	8.4.28	
A	REDRAWN; ADDED R11; R1 WAS 100K, 10W	A.J.	3-14-86	

UNLESS OTHERWISE SPECIFIED

BOC COATING TECHNOLOGY

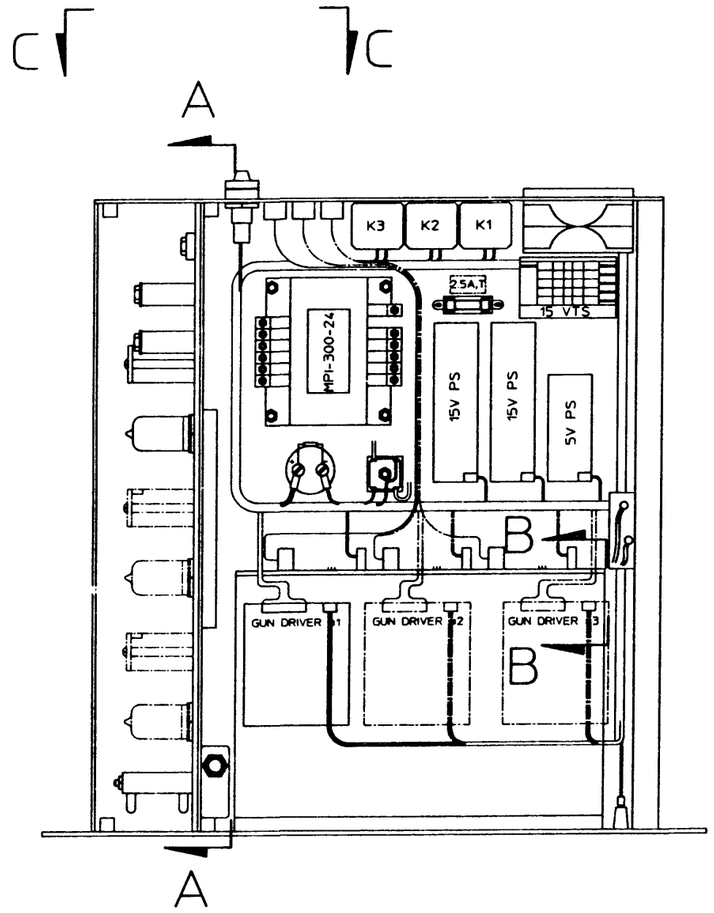
P. ELLIOTT | [illegible]36 | RB | 2X

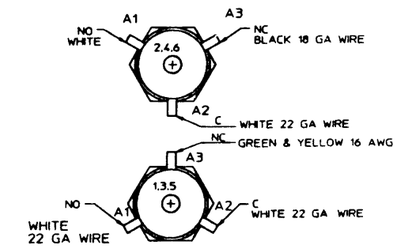
CV-20 POWER SUPPLY

ASSY., SCREEN BIAS P.C. 610-1653 E

0610-1653-0

DESCRIPTION	ITEM	PART NO	REV.	QTY





ALL HV RELAY CONNECTOINS ARE SOLDERED
REMOVE ONE INCH OF INSULATION FROM HV HIRE
TIN WIRE. WRAP AROUND POSTON RELAY 1 1/2 TIMES
THEN SOLDER.

DETAIL 1

(SEE SHEET 2 FOR SECTIONS)

REV	DESCRIPTION	BY	DATE	APP'VD
D	REVISED PER ECN # 1072	DLC	8/21/96	JHE
C	REVISED PER ECN # 0257	JS	1/31/96	-
B	REMOVED ITEM 72, restored (ALIAS 828-7473)	GD	2/3/95	-

UNLESS OTHERWISE SPECIFIED
TOLERANCE XX'xx -, XXx -, Xx -
ANGLES -
FINISH -
BREAK ALL EDGES -
INTERNAL RADII -

APPROVALS
DRAFTER/DESIGNER: JOSE BENTANCOURT
DATE: 5/28/91
ENGINEER: -
ENGR MGR: -
CHAMFER ENDS OF ALL SCREW THREADS 30°
THREADS CLASS 2

BOC COATING TECHNOLOGY

SIMBA

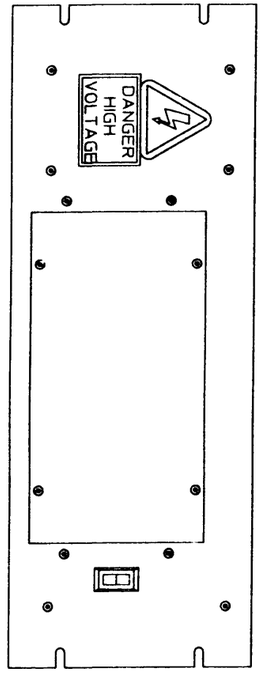
ASSEMBLY
GUN I/F

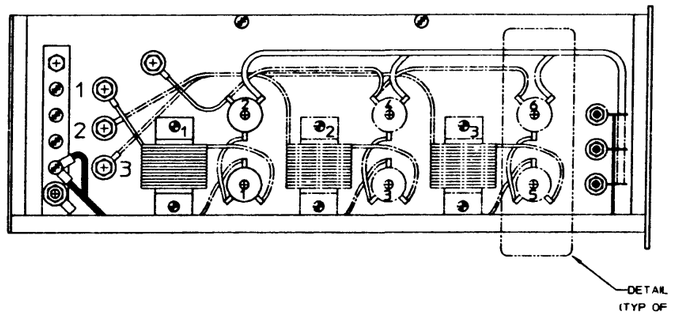
SCALE 1:4 & AS NOTED
DO NOT SCALE DRAWING

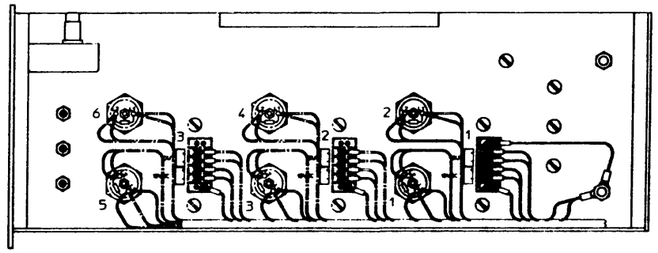
DRAWING NUMBER
SERIAL SIZE
040-704 4
REV D

SHEET 1 OF 2

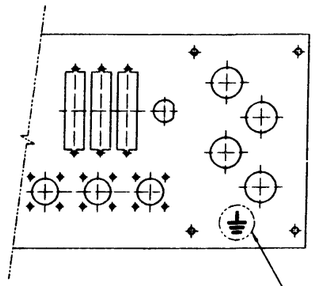
DESCRIPTION	ITEM	PART NO	M.	QTY





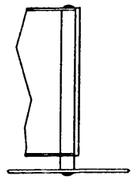


SECTION **A–A**



CLEAN SURFACE AND APPLY
GROUND SYMBOL STICKER.
P/N 6641-6010-0

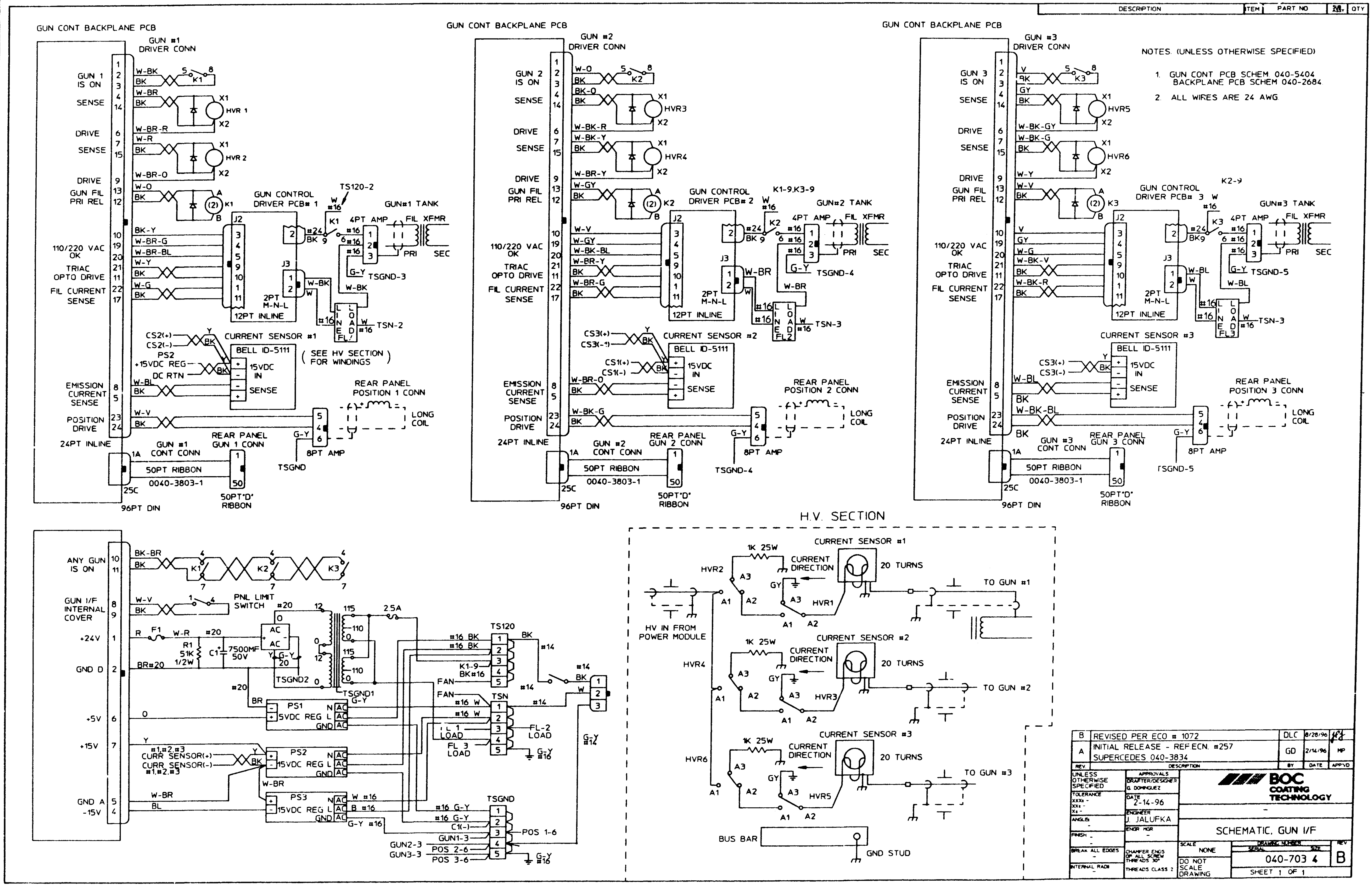
VIEW **C–C**

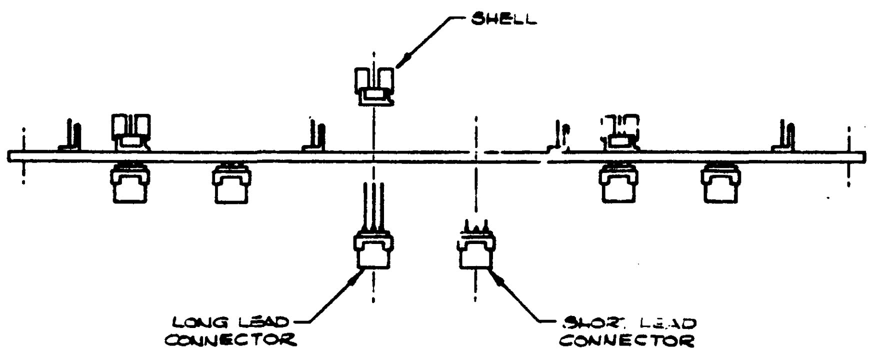


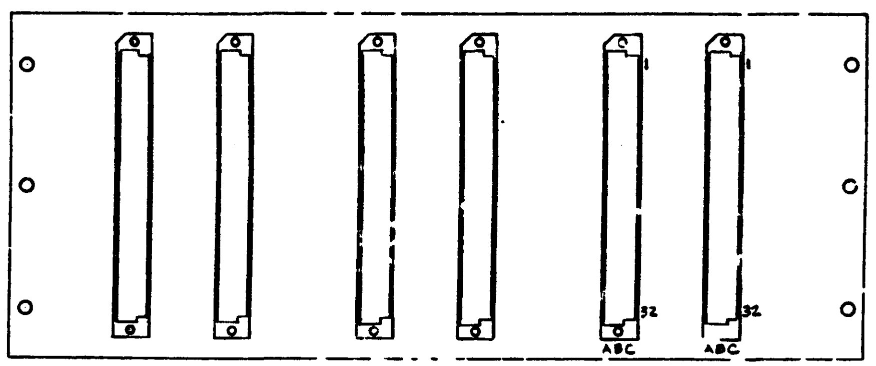
SECTION **B–B**

-	SEE SHEET 1	-	-	-
REV	DESCRIPTION	BY	DATE	APP'VD

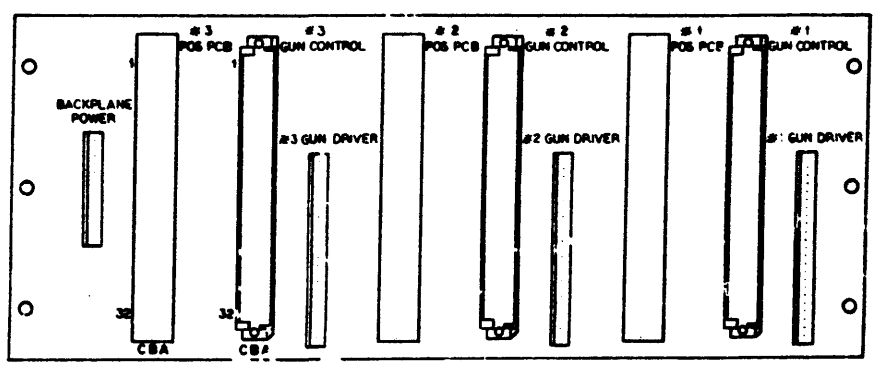
UNLESS OTHERWISE SPECIFIED TOLERANCE XXX± - XX± - X± - ANGLES - FINISH - BREAK ALL EDGES - INTERNAL RADII -	APPROVALS DRAFTER/DESIGNER JOSE BENTANCOURT DATE 5/28/91 ENGINEER - ENGR MGR - CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2	BOC COATING TECHNOLOGY SIMBA ASSEMBLY GUN I/F SCALE 1:4 & AS NOTED DO NOT SCALE DRAWING DRAWING NUMBER SERIAL SIZE 040-704 4 REV D SHEET 2 OF 2


DESCRIPTION
ITEM
PART NO
QTY
GUN CONT BACKPLANE PCB
GUN #1 DRIVER CONN
GUN #2 DRIVER CONN
GUN #3 DRIVER CONN
NOTES. (UNLESS OTHERWISE SPECIFIED)
1. GUN CONT PCB SCHEM 040-5404
BACKPLANE PCB SCHEM 040-2684
2. ALL WIRES ARE 24 AWG
GUN 1 IS ON
GUN 2 IS ON
GUN 3 IS ON
SENSE
DRIVE
GUN FIL PRI REL
110/220 VAC OK
TRIAC OPTO DRIVE
FIL CURRENT SENSE
EMISSION CURRENT SENSE
POSITION DRIVE
24PT INLINE
HVR 1
HVR 2
HVR3
HVR4
HVR5
HVR6
GUN CONTROL DRIVER PCB# 1
GUN CONTROL DRIVER PCB# 2
GUN CONTROL DRIVER PCB# 3
TS120-2
K1-9,K3-9
K2-9
GUN#1 TANK
GUN#2 TANK
GUN#3 TANK
4PT AMP
FIL XFMR
PRI
SEC
TSGND-3
TSGND-4
TSGND-5
2PT M-N-L
12PT INLINE
LINE FL1
LOAD
TSN-2
TSN-3
CURRENT SENSOR #1
CURRENT SENSOR #2
CURRENT SENSOR #3
BELL ID-5111
15VDC IN
SENSE
(SEE HV SECTION FOR WINDINGS)
REAR PANEL POSITION 1 CONN
REAR PANEL POSITION 2 CONN
REAR PANEL POSITION 3 CONN
LONG COIL
8PT AMP
TSGND
GUN #1 CONT CONN
GUN #2 CONT CONN
GUN #3 CONT CONN
REAR PANEL GUN 1 CONN
REAR PANEL GUN 2 CONN
REAR PANEL GUN 3 CONN
50PT RIBBON
0040-3803-1
50PT"D" RIBBON
96PT DIN
ANY GUN IS ON
GUN I/F INTERNAL COVER
PNL LIMIT SWITCH
+24V
GND D
+5V
+15V
GND A -15V
PS1 5VDC REG
PS2 15VDC REG
PS3 15VDC REG
CURR SENSOR(+)
CURR SENSOR(-)
TS120
TSN
TSGND
FAN
FL-2 LOAD
FL 1 LOAD
FL 3 LOAD
POS 1-6
GUN1-3
GUN2-3
GUN3-3
POS 2-6
POS 3-6
7500MF 50V
H.V. SECTION
CURRENT SENSOR #1
CURRENT SENSOR #2
CURRENT SENSOR #3
1K 25W
CURRENT DIRECTION
20 TURNS
TO GUN #1
TO GUN #2
TO GUN #3
HV IN FROM POWER MODULE
BUS BAR
GND STUD
B REVISED PER ECO # 1072
A INITIAL RELEASE - REF ECN. #257
SUPERCEDES 040-3834
DLC 8/28/96
GD 2/14/96
BOC COATING TECHNOLOGY
G. DOMINGUEZ
2-14-96
J. JALUFKA
SCHEMATIC, GUN I/F
DO NOT SCALE DRAWING
040-703 4
B
SHEET 1 OF 1





FRONT VIEW



REAR VIEW

NOTES:

1. CONNECTORS BACKPLANE POWER, GUN DRIVER 1-3 ARE MOUNTED ON REAR (SILKSCREEN) SIDE, SOLDER TO FRONT SIDE.
2. CONNECTORS GUN CONTROL 1-3 ARE LONG LEAD PRESSFIT CONNECTORS. INSERT FROM FRONT, SPECIAL TOOL SET 0040-3912-0/0040-3923-0 MUST BE USED, <u>DO NOT SOLDER</u> PRESS FIT CONNECTORS. OBSERVE CORRECT ORIENTATION AND POLARITY.
3. CONNECTORS POS PCB 1-3 ARE SHORT LEAD PRESSFIT CONNECTORS. INSERT FROM FRONT, OBSERVE CORRECT ORIENTATION AND POLARITY.
4. AFTER CLEANING PCB, PLACE CONNECTOR SHELL OVER GUN CONTROL 1-3 OBSERVE ORIENTATION.

A	CHG ORIENTATION OF CONN PER RA 2401	MB	3-3-90

UNLESS OTHERWISE SPECIFIED

DRAWN A. JACQUES 10/3/90

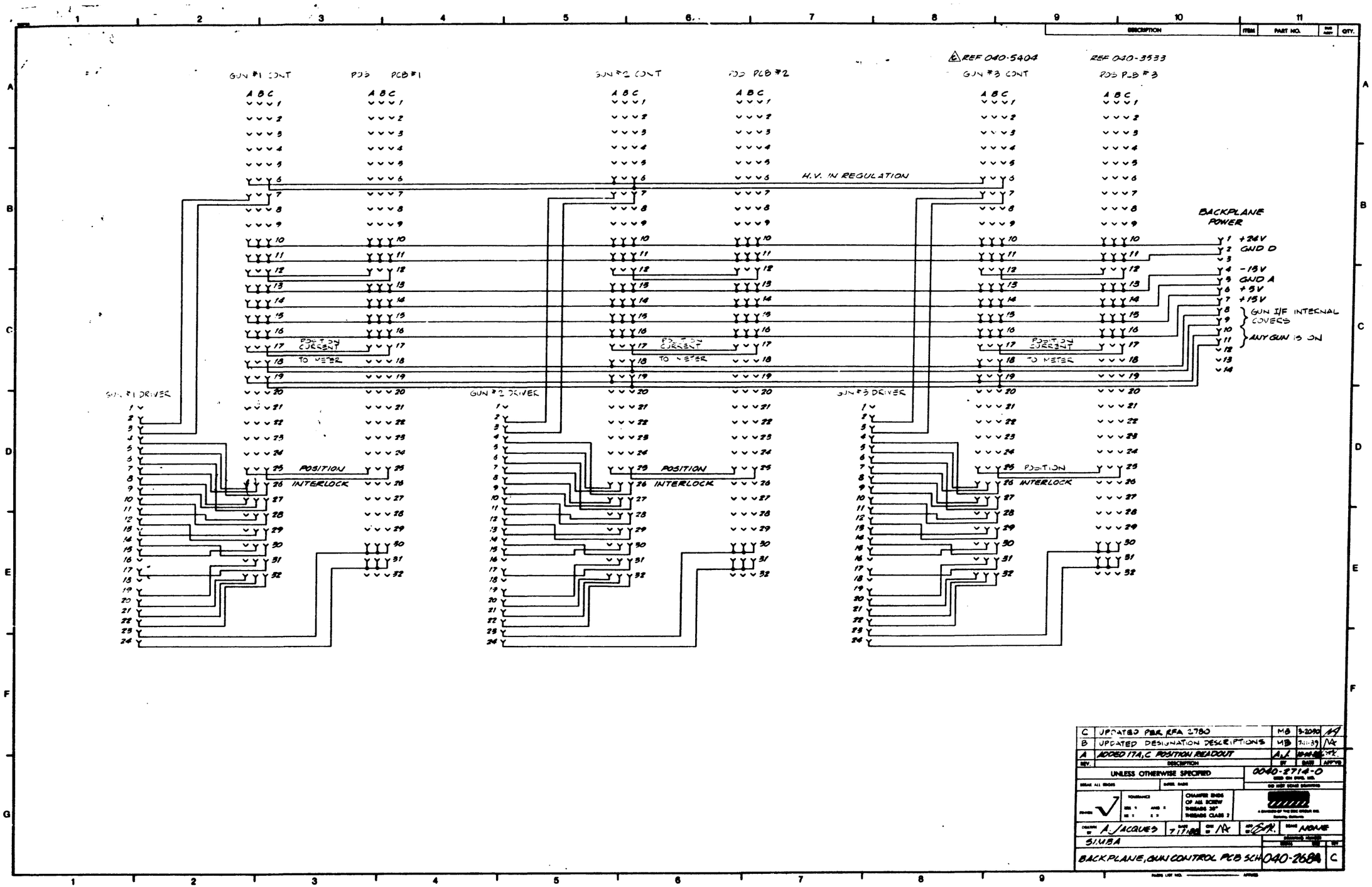
SCALE FULL

SIMBA

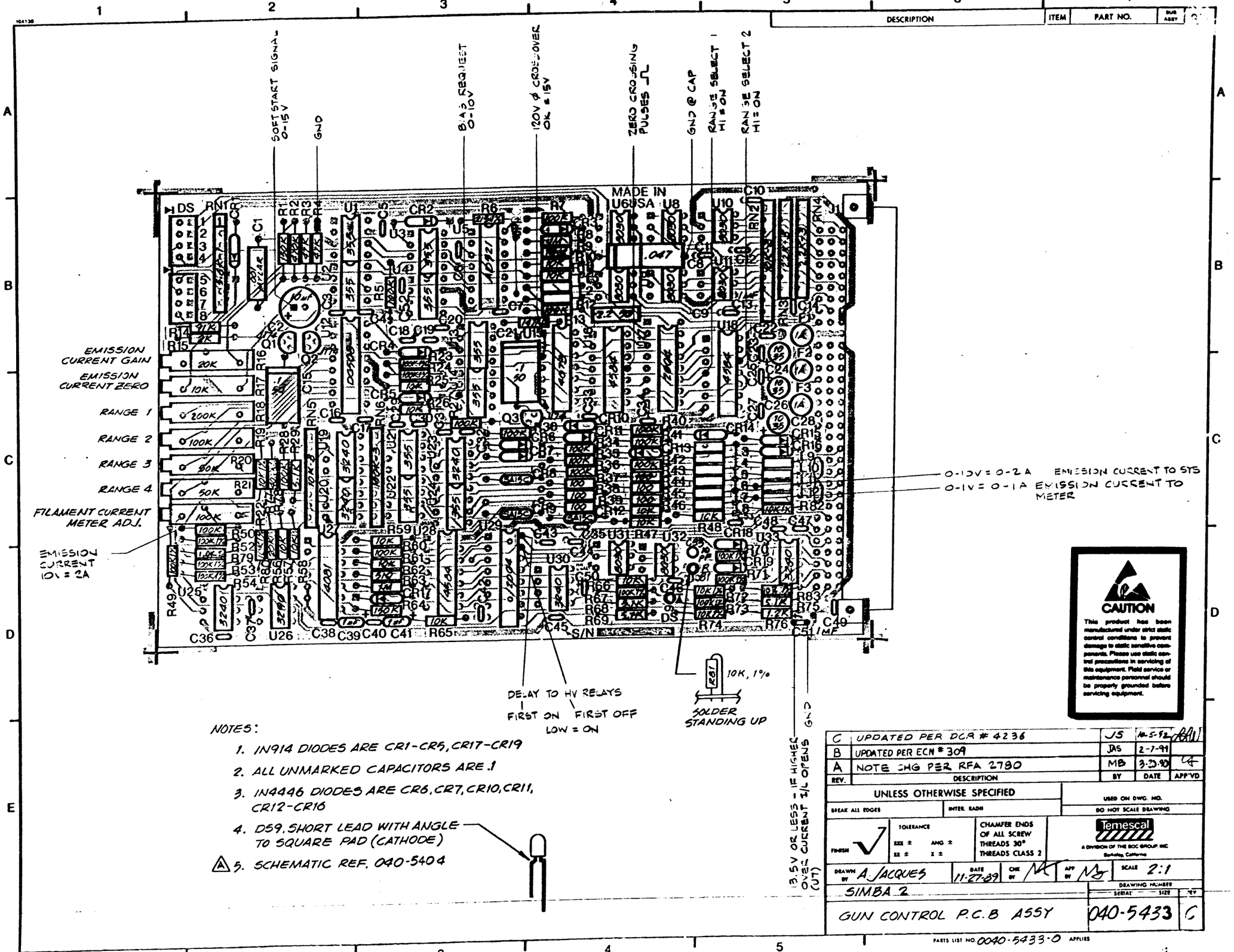
PCB, BACKPLANE ASSY

040-2714

0040-2714-0


GUN #1 CONT
PDB PCB #1
GUN #2 CONT
PDB PCB #2
GUN #3 CONT
PDB PCB #3
REF 040-5404
REF 040-3533
H.V. IN REGULATION
BACKPLANE POWER
+24V
GND D
-15V
GND A
+5V
+15V
GUN I/F INTERNAL COVERS
ANY GUN IS ON
POSITION CURRENT TO METER
GUN #1 DRIVER
GUN #2 DRIVER
GUN #3 DRIVER
POSITION INTERLOCK
DESCRIPTION
ITEM
PART NO.
SUB ASSY
QTY.
C UPDATED PER ECA 2780 MB 9-20-90
B UPDATED DESIGNATION DESCRIPTIONS MB 7-11-89
A ADDED 17A,C POSITION READOUT
UNLESS OTHERWISE SPECIFIED
0040-2714-0
A. JACQUES
SLUBA
BACKPLANE, GUN CONTROL PCB SCH
040-2684
C

DESCRIPTION	ITEM	PART NO.	SUB ASSY



CAUTION

This product has been manufactured under strict static control conditions to prevent damage to static sensitive components. Please use static control precautions in servicing of this equipment. Field service or maintenance personnel should be properly grounded before servicing equipment.

NOTES:

1. IN914 DIODES ARE CR1-CR5, CR17-CR19
2. ALL UNMARKED CAPACITORS ARE .1
3. IN4446 DIODES ARE CR6, CR7, CR10, CR11, CR12-CR16
4. D59, SHORT LEAD WITH ANGLE TO SQUARE PAD (CATHODE)
5. SCHEMATIC REF. 040-5404

REV.	DESCRIPTION	BY	DATE	APP'VD
C	UPDATED PER DCR # 4236	JS	10-5-92	
B	UPDATED PER ECN # 309	JAS	2-7-91	
A	NOTE CHG PER RFA 2780	MB	3.20.90	

UNLESS OTHERWISE SPECIFIED — USED ON DWG. NO.
BREAK ALL EDGES — INTER. RADII — DO NOT SCALE DRAWING
FINISH — TOLERANCE XXX ± ANG ± XX ± X ± — CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

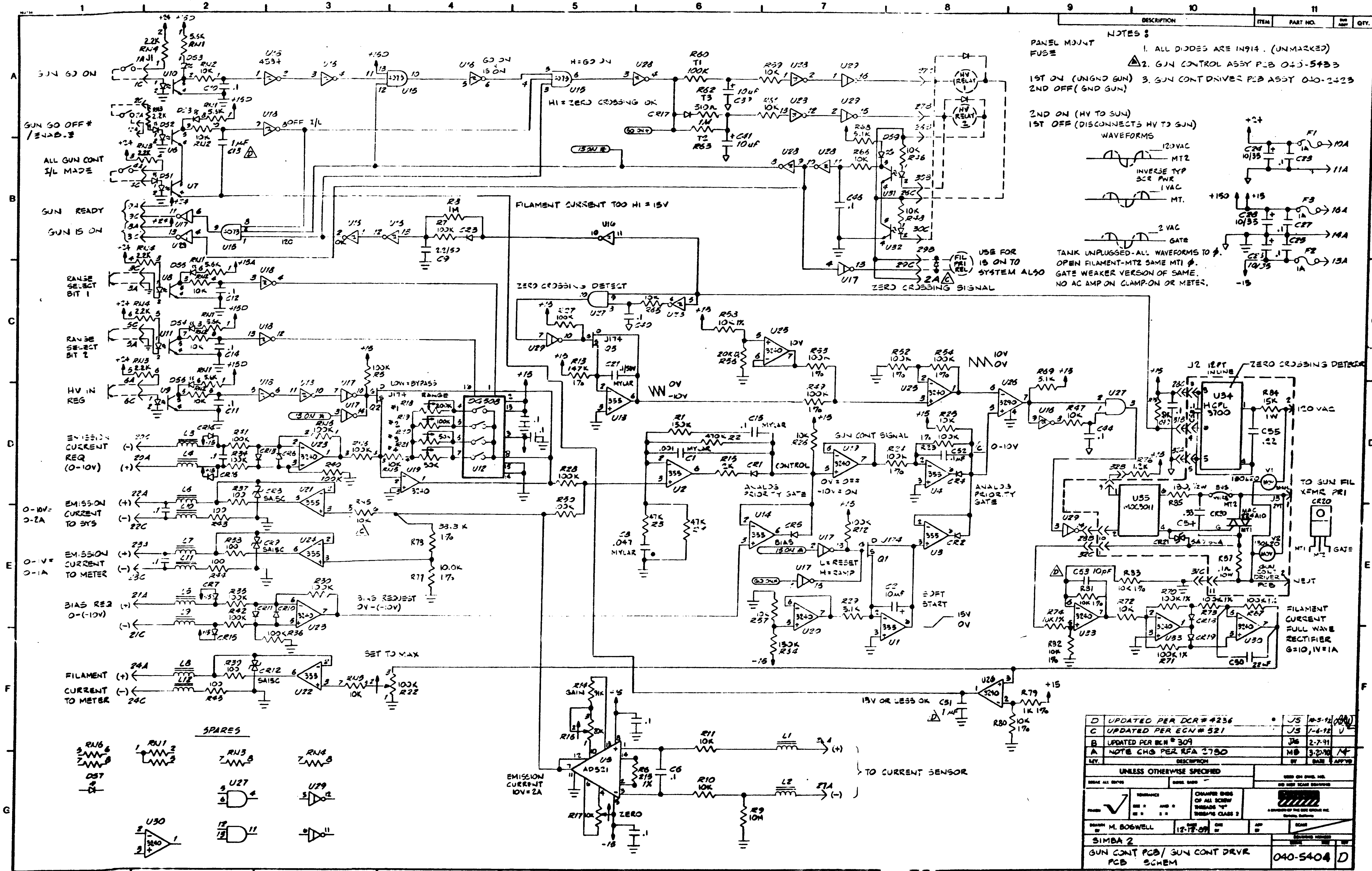
Temescal
A DIVISION OF THE BOC GROUP, INC
Berkeley, California

DRAWN BY A. JACQUES — DATE 11-27-89 — CHK BY — APP BY — SCALE 2:1

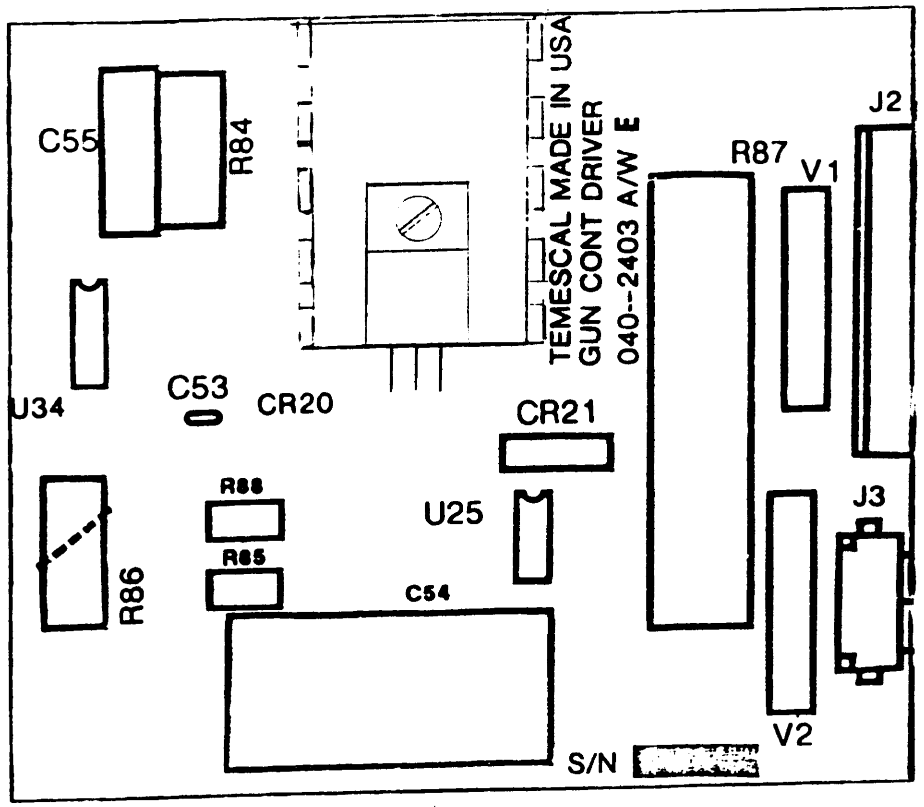
SIMBA 2

GUN CONTROL P.C.B ASSY — DRAWING NUMBER 040-5433 — SERIAL — SIZE C — REV

PARTS LIST NO. 0040-5433-0 APPLIES


NOTES:
1. ALL DIODES ARE IN914. (UNMARKED)
2. GUN CONTROL ASSY PCB 040-5433
3. GUN CONT DRIVER PCB ASSY 040-5423
PANEL MOUNT FUSE
1ST ON (UNGND GUN)
2ND OFF (GND GUN)
2ND ON (HV TO GUN)
1ST OFF (DISCONNECTS HV TO GUN)
WAVEFORMS
TANK UNPLUGGED - ALL WAVEFORMS TO ⏚.
OPEN FILAMENT - MT2 SAME MT1 ⏚.
GATE WEAKER VERSION OF SAME.
NO AC AMP ON CLAMP-ON OR METER.
GUN GO ON
GUN GO OFF# /ENAB.3
ALL GUN CONT I/L MADE
GUN READY
GUN IS ON
RANGE SELECT BIT 1
RANGE SELECT BIT 2
HV IN REG
EMISSION CURRENT REQ (0-10V)
EMISSION CURRENT TO SYS
EMISSION CURRENT TO METER
BIAS REQ 0-(-10V)
FILAMENT CURRENT TO METER
FILAMENT CURRENT TOO HI = 15V
HI = ZERO CROSSING OK
ZERO CROSSING DETECT
ZERO CROSSING SIGNAL
USE FOR IS ON TO SYSTEM ALSO
GUN CONT SIGNAL
ANALOG PRIORITY GATE
BIAS REQUEST 0V-(-10V)
SET TO MAX
SOFT START
L=RESET H=RAMP
15V OR LESS OK
TO CURRENT SENSOR
EMISSION CURRENT 10V=2A
TO GUN FIL XFMR PRI
FILAMENT CURRENT FULL WAVE RECTIFIER G=10, 1V=1A
SPARES
D UPDATED PER DCR# 4236
C UPDATED PER ECN# 521
B UPDATED PER ECN# 309
A NOTE CHG PER RFA 2790
UNLESS OTHERWISE SPECIFIED
M. BOGWELL
SIMBA 2
GUN CONT PCB/ GUN CONT DRVR PCB SCHEM
040-5404 D

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.



NOTES:

1. DO NOT INSTALL R86 UNLESS OTHERWISE SPECIFIED.
2. SCHEMATIC: 040-9363
   BOM: 0040-2423-0
   FAE: 040-2413
3. APPLY HEAT SINK COMPOUND BETWEEN TRIAC AND HEAT SINK.
4. FOR FAB REV. D PERFORM THE FOLLOWING:
   A) CUT TRACE AT J2-3
   B) REMOVE U34 SIDE OF C53.
   C) FROM SOLDER SIDE INSTALL ONE LEAD R88 IN PAD VACATED BY ONE SIDE OF C53.
   D) SOLDER OPEN SIDE C53 TO R88.
   E) ATTACH #20 GA WIRE WRAP WIRE FROM OPEN SIDE R88 TO J2-3.

REV.	DESCRIPTION	BY	DATE	APP'VD
F	UPDATE & REVIEW PER DCR# 7099	JP	9-8-94	A0H
E	WAS MAC223AB	MB	1.31.90	JAS
D	ADDED V1, V2 - CR21 WAS IN4006 REDRAWN	A.J.	12.12.89	JAS

UNLESS OTHERWISE SPECIFIED

BREAK ALL EDGES | INTER. RADII

USED ON DWG. NO.

DO NOT SCALE DRAWING

FINISH √ | TOLERANCE .XXX ± ANG ± .XX ± .X ±

CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

Temescal — A DIVISION OF THE BOC GROUP, INC. Berkeley, California

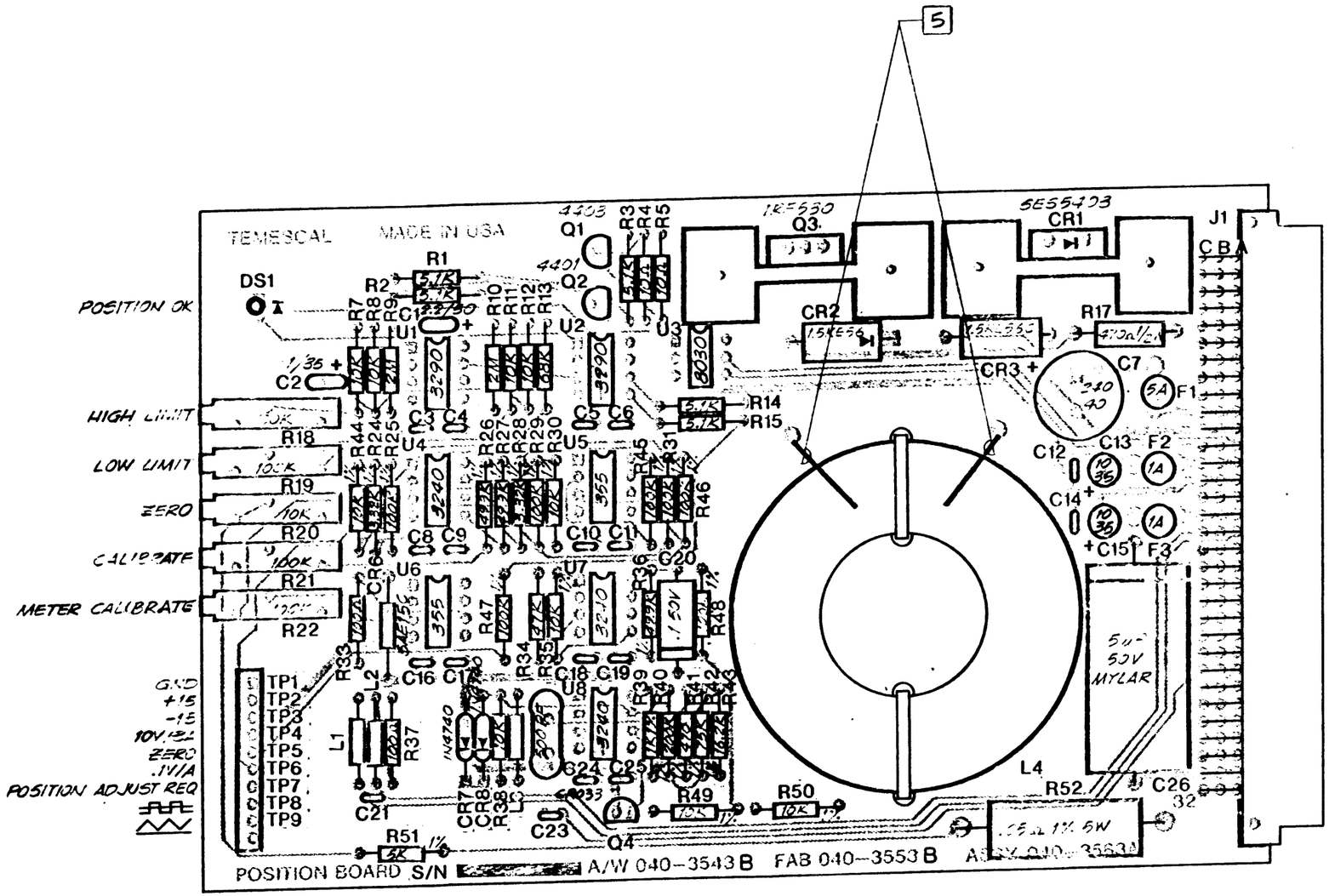
DRAWN BY A. JACQUES | DATE 12-12-89 | CHK BY | APP BY | SCALE 2:1

SIMBA

ASSY, PCB, GUN DRIVER. | DRAWING NUMBER 040-2423 | REV F

PARTS LIST NO. | APPLIES

ITEM	PART NO.	SUB ASSY	QTY.	DESCRIPTION



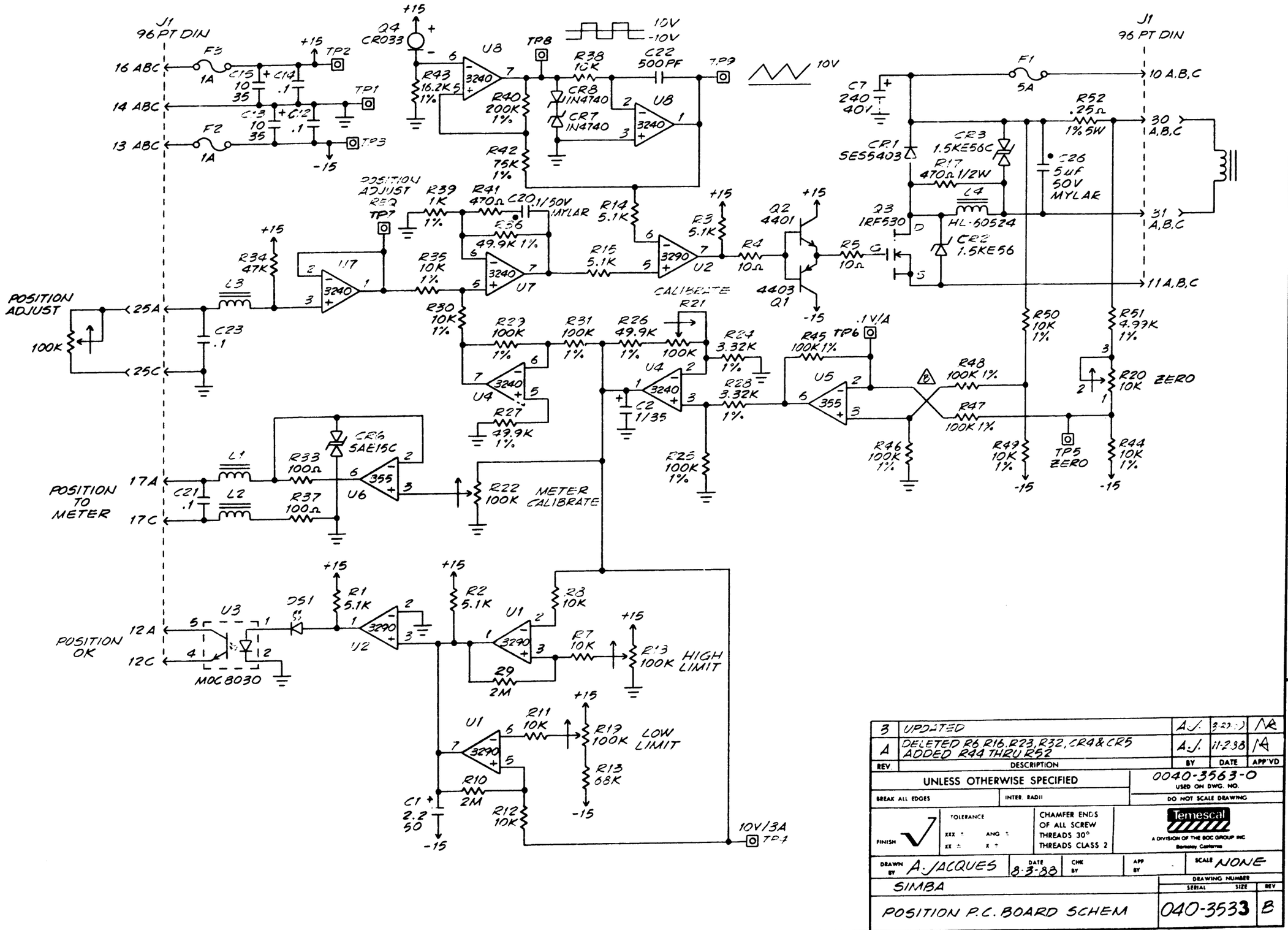
NOTES:

1. ALL UNMARKED CAPACITORS ARE .1
2. INDUCTORS ARE DD-47UH
3. DS1, SHORT LEAD WITH ANGLE (CATHODE) TO SQUARE PAD
4. SCHEMATIC REF. 040-3533-B
5. REMOVE 1/4" VARNISH FROM WIRE BEFORE SOLDERING.

REV.	DESCRIPTION	BY	DATE	APP'VD
C	REVISED OUTLINE OF Q4	JS	11-9-93	
B	ADDED NOTE 5	MB	3.7.90	
A	REVISED & REDRAWN	A.J.	11-3-88	

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII | USED ON DWG. NO. | DO NOT SCALE DRAWING
FINISH | TOLERANCE XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2
Temescal — A DIVISION OF THE BOC GROUP, INC. Berkeley, Calif.
DRAWN BY A. JACQUES | DATE 11-3-88 | CHK BY - | APP BY | SCALE 2:1
SIMBA
POSITION PC BOARD ASSY
DRAWING NUMBER SERIAL 040-3563 REV C
PARTS LIST NO. 040-3563-0 APPLIES

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY



REV.	DESCRIPTION	BY	DATE	APP'VD
3	UPDATED	A.J.	3-27-)	
A	DELETED R6 R16 R23, R32, CR4 & CR5 ADDED R44 THRU R52	A.J.	11-2-88	

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII
TOLERANCE: XXX ± ANG ± ; XX ± X ±
FINISH
CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2
DO NOT SCALE DRAWING

0040-3563-0
USED ON DWG. NO.

Temescal
A DIVISION OF THE BOC GROUP INC
Berkeley, California

DRAWN BY	DATE	CHK BY	APP BY	SCALE
A. JACQUES	8-3-88			NONE

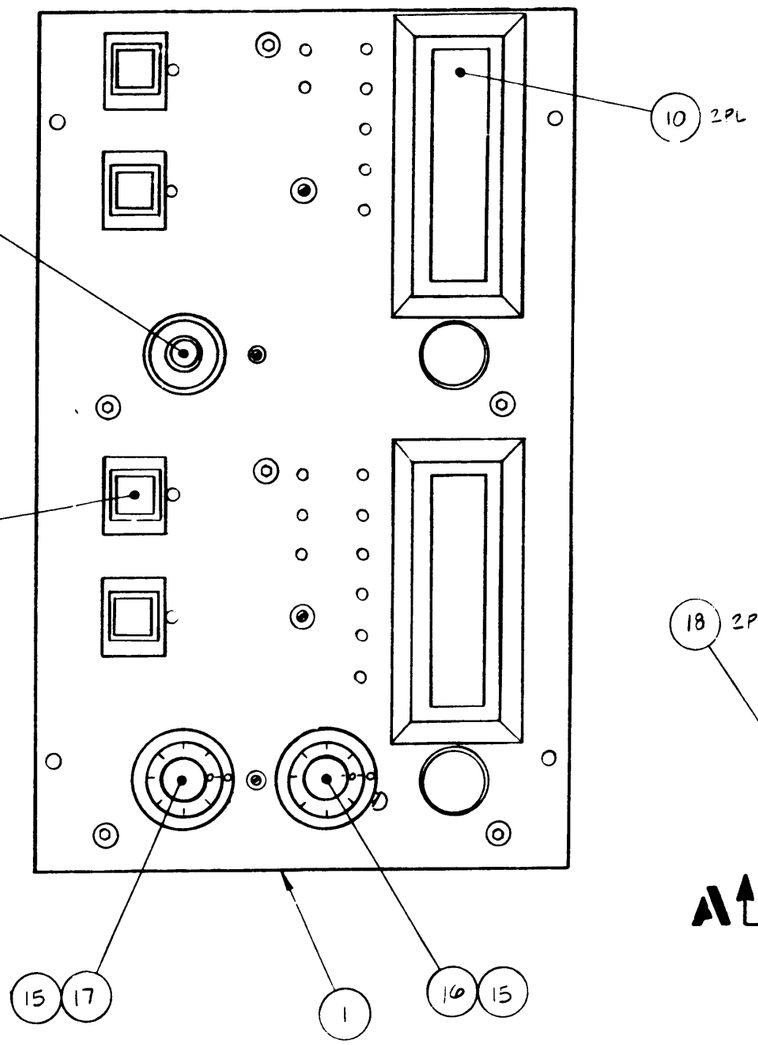
SIMBA

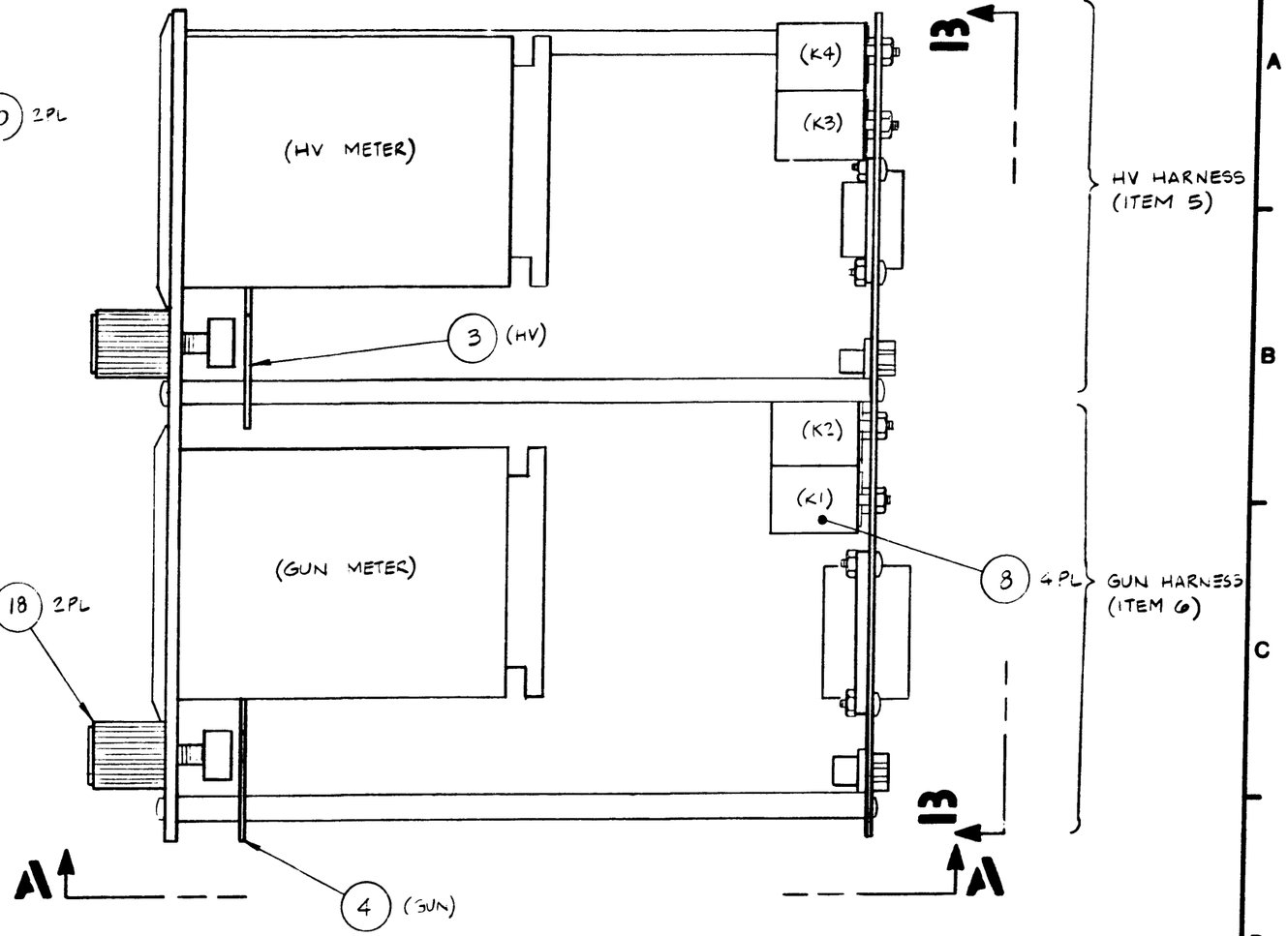
POSITION P.C. BOARD SCHEM

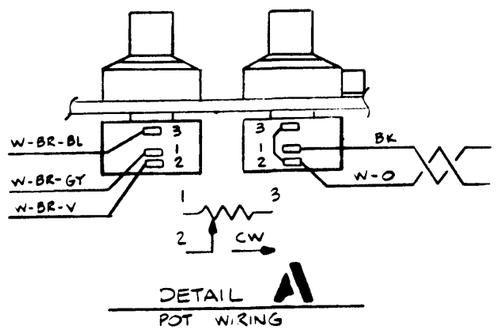
DRAWING NUMBER: 040-3533 B

PARTS LIST NO. ——— APPLIES

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.







DETAIL A
POT WIRING

NOTE: 040-3814 SCHEM

REV.	DESCRIPTION	BY	DATE	APP'VD
D	UPDATE PER ECN # 207	SH	9/19/91	
C	NAS 10K (GUN) & 60.2K (GUN) SH 2	MB	4.3.89	
B	ADDED (J1, J3) MTG JACK SOCKET KIT	MB	12.7.88	
A	RELAY HOLES MODIFIED R. PNL SH 2	MB	10.19.88	

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII | USED ON DWG. NO. | DO NOT SCALE DRAWING

FINISH √ | TOLERANCE XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

A DIVISION OF THE EDO CORP. INC. Salt Lake City, Utah

DRAWN BY M. BOSWELL | DATE 8-22-88 | CHK BY | APP BY | SCALE FULL

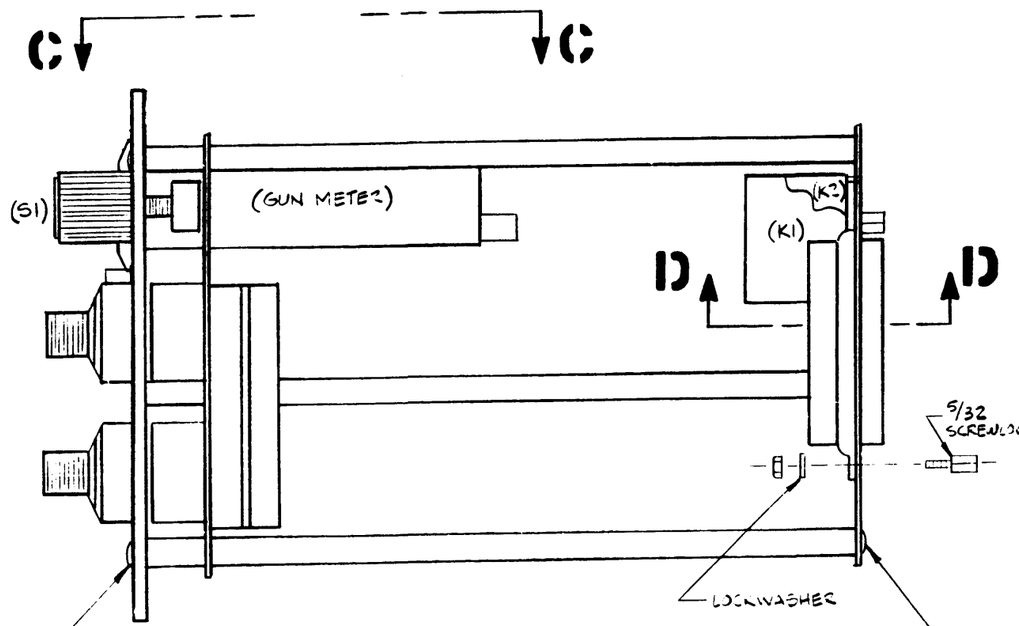
SIMBA

ASSY, HV/GUN CONT REMOTE

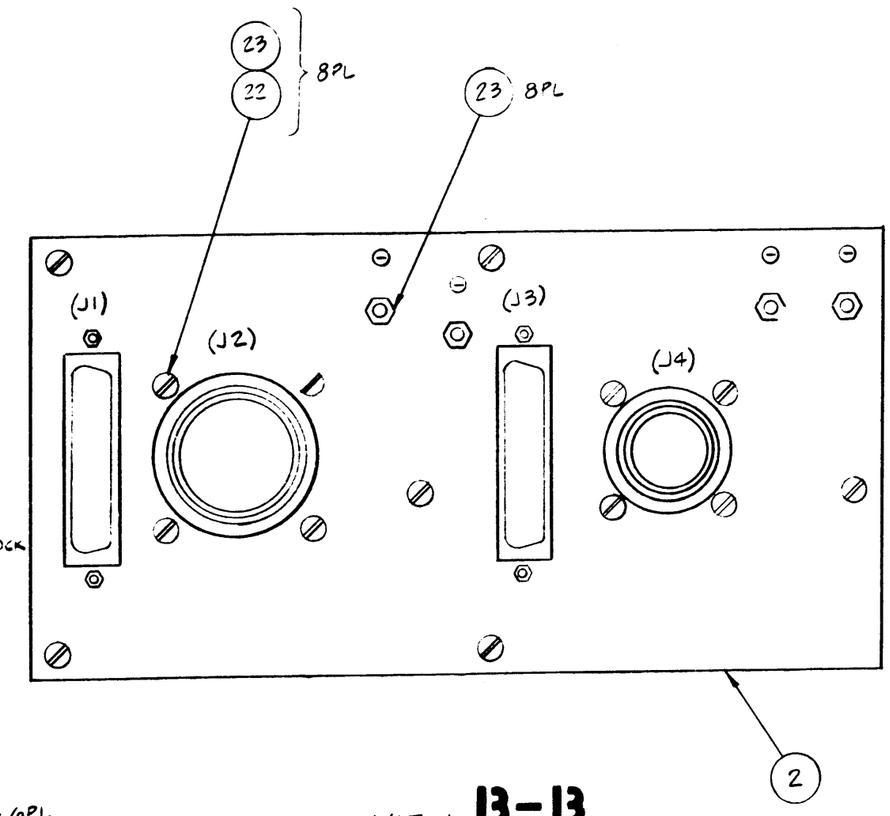
DRAWING NUMBER: SIZE 040-3583 | REV D

PARTS LIST NO. 040-3583-0 APPLIES SH 1 OF 2

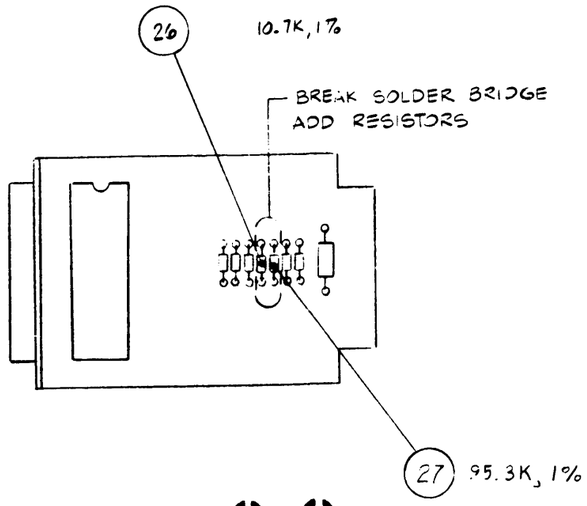
DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.



VIEW **A-A**

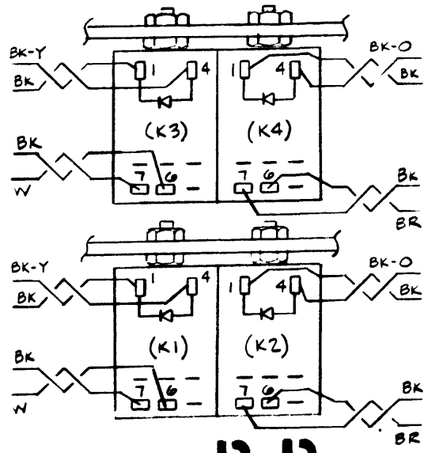


VIEW **B-B**



VIEW **C-C**

COVER REMOVED FOR CLARITY
INSTALL RESISTORS BEFORE
INSTALLING METER W/ PNL



VIEW **D-D**

SCALE: NONE
SOLDER WIRES TO RELAYS
WITH HEATSHRINK

14
22
6PL

REV.	DESCRIPTION	BY	DATE	APP'VD
	SEE SHEET 1			

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTERP. RADII
USED ON SYST. NO.
DO NOT SCALE DRAWING

FINISH √ | TOLERANCE XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

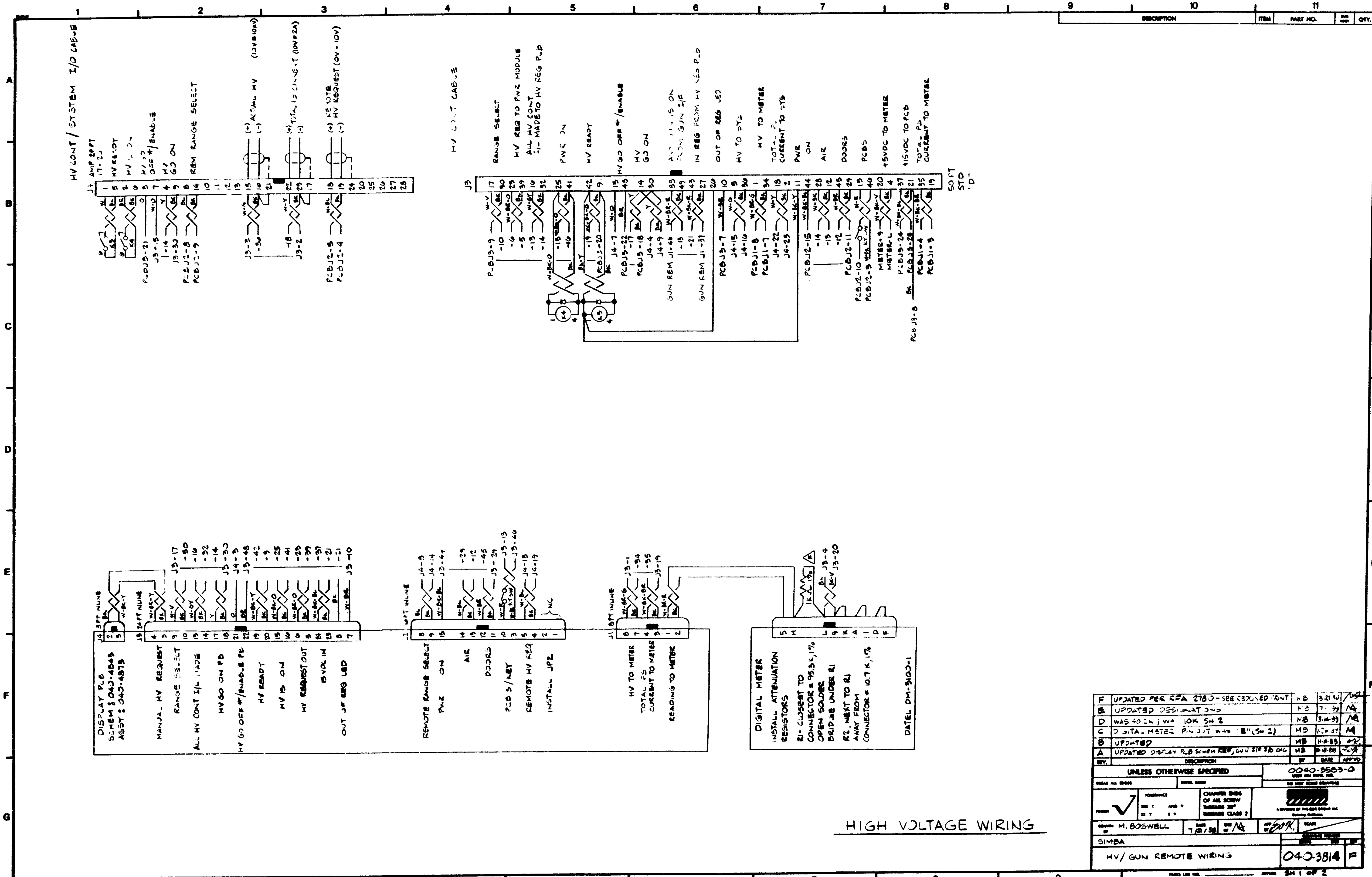
A DIVISION OF THE EEG GROUP, INC.

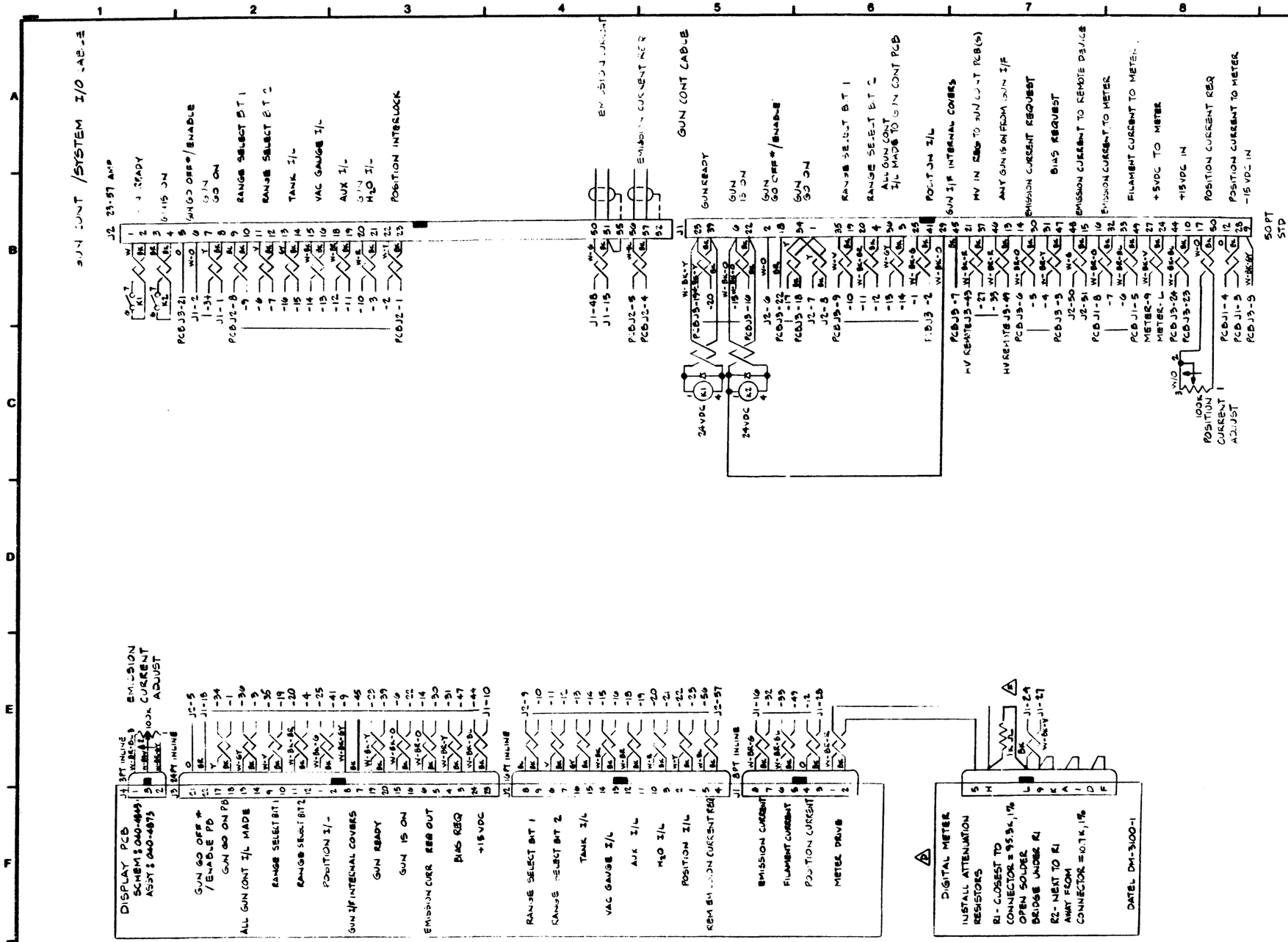
DRAWN BY M. BOSWELL | DATE 8-22-88 | CHK BY | APP BY | SCALE FULL

SIMBA

ASSY, HV/ GUN CONT REMOTE

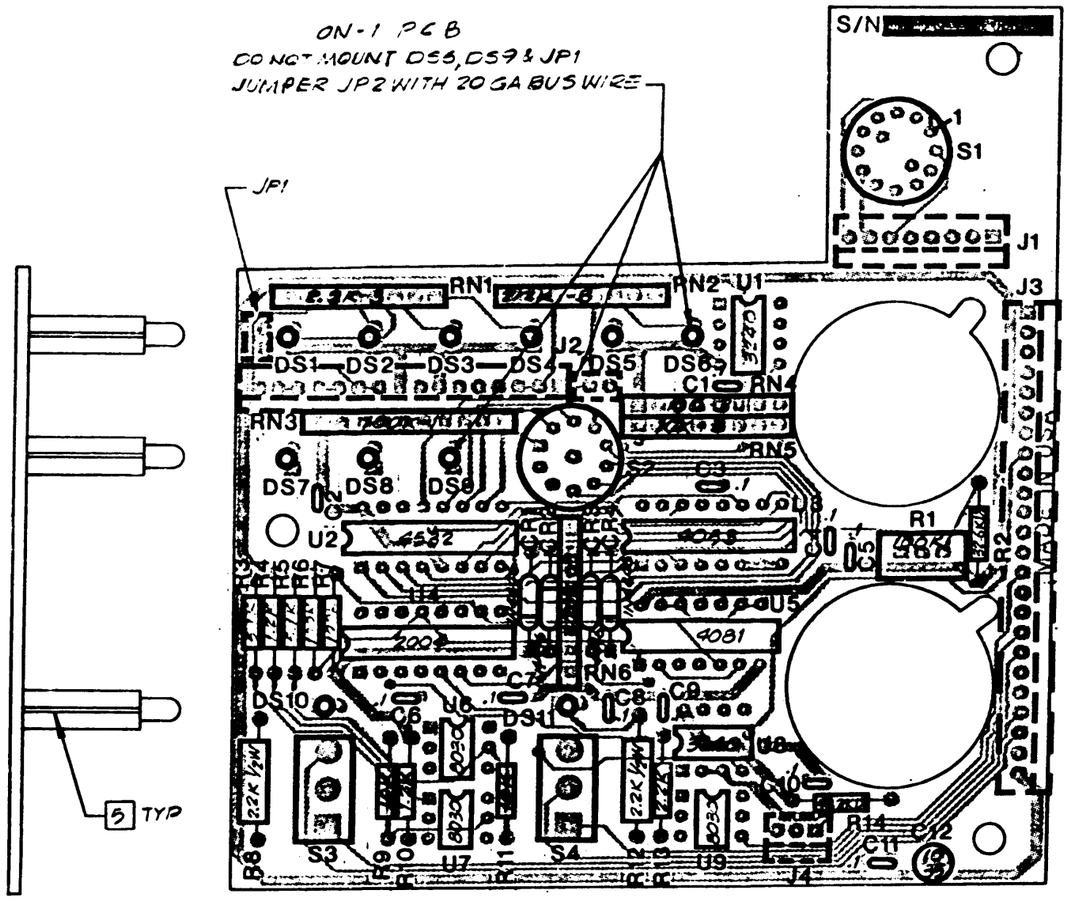
DRAWING NUMBER 040-3583 D


HV CONT / SYSTEM I/O CABLE
HV CONT CABLE
SOFT STD "D"
DISPLAY PCB
SCHEM # 040-4843
ASSY # 040-4873
DIGITAL METER
INSTALL ATTENUATION RESISTORS
DATEL DM-3100-1
HIGH VOLTAGE WIRING
F UPDATED PER RFA 2780 - SEE REDLINED PRINT
E UPDATED DESIGNATIONS
D WAS 40.2K ; WAS 10K SH 2
C DIGITAL METER PINOUT WAS "B" (SH 2)
B UPDATED
A UPDATED DISPLAY PCB SCHEM REF, GUN I/F BD DWG
UNLESS OTHERWISE SPECIFIED
0040-3583-0
M. BOSWELL
SIMBA
HV/ GUN REMOTE WIRING
040-3814
F
SH 1 OF 2



GUN REMOTE WIRING

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.



NOTES:

1. DS1-DS11 SHORT LEAD WITH ANGLE TO SQUARE PAD (CATHODE) SPACER ACCOMPANY LED AS SHOWN.
2. S3 & S4 ROTATION NOT RELEVANT.
3. COMPONENTS SHOWN IN DASH ARE MOUNTED ON FARSIDE.
4. SCHEMATIC REF 040-4343

[5] ONE LEG OUTSIDE OF STANDOFF.

REV.	DESCRIPTION	BY	DATE	APP'VD
A	ITEM 8 WAS 6400-7321-00	GH	10/24/93	

UNLESS OTHERWISE SPECIFIED

BREAK ALL EDGES | INTER. RADII | USED ON ENG. NO. | DO NOT SCALE DRAWING

FINISH | TOLERANCE: XXX ± ANG ± XX ± X ± | CHAMFER ENDS OF ALL SCREW THREADS 30° THREAD CLASS 2

Tennecal — A DIVISION OF THE BDC GROUP, INC. Burnaby, California

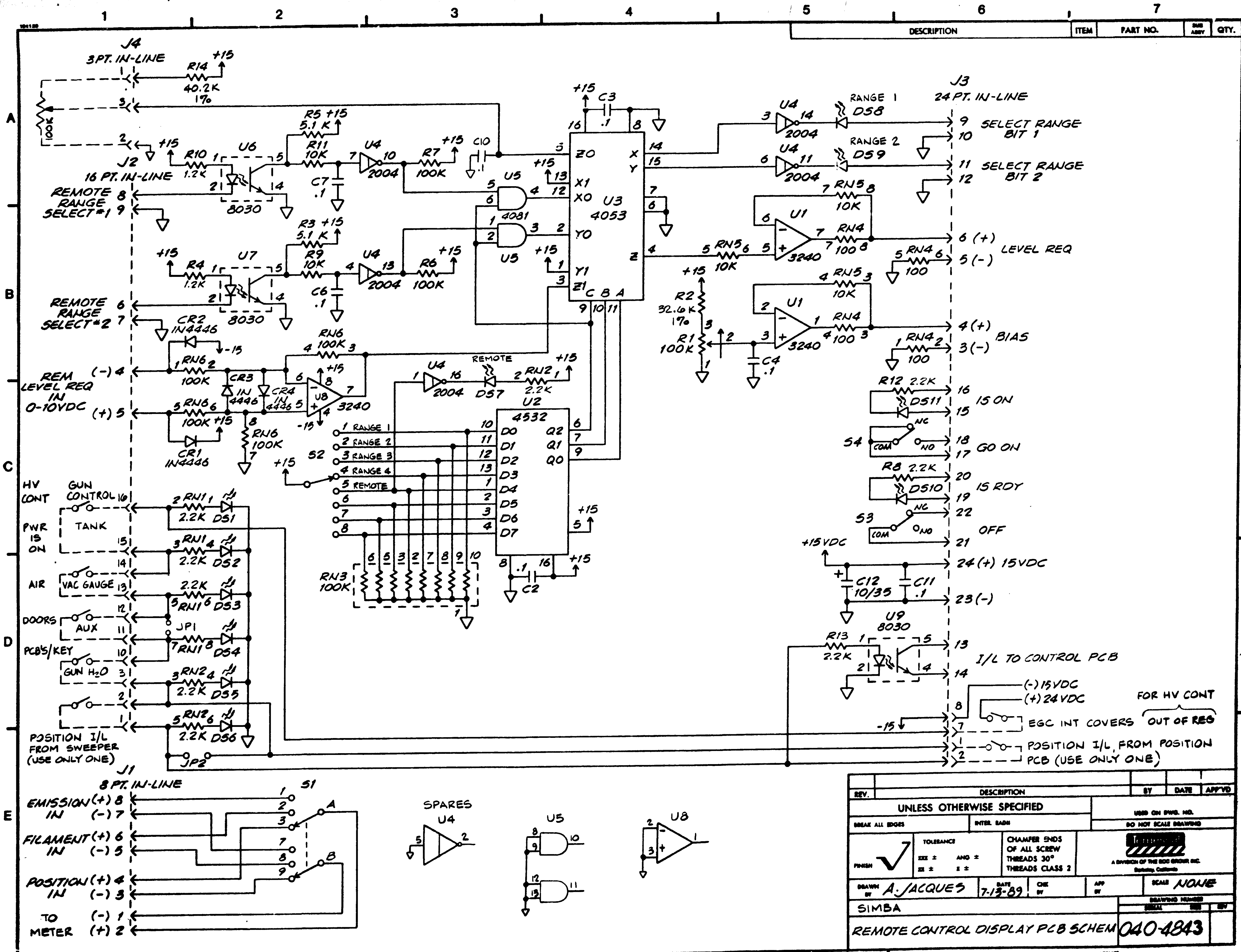
DRAWN BY A. JACQUES | DATE 8-2-93 | CHK | APP | SCALE 2:1

SIMBA

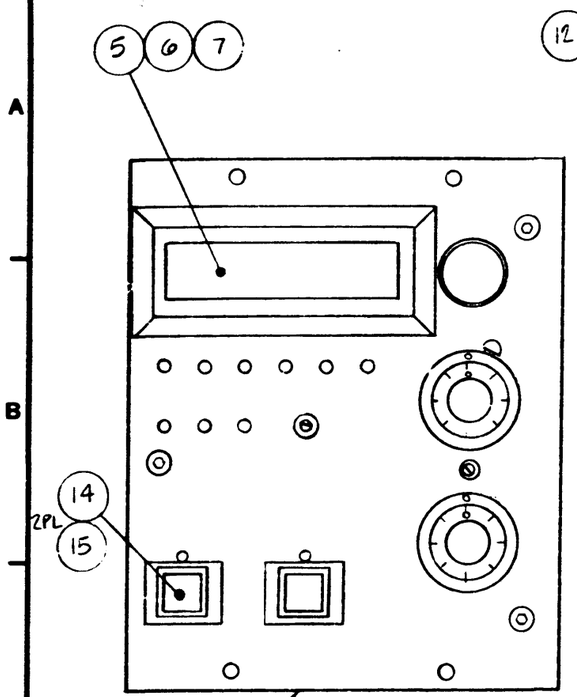
GUN CONTROL DISPLAY PCB ASSY | DRAWING NUMBER: 040-4873 | REV: A

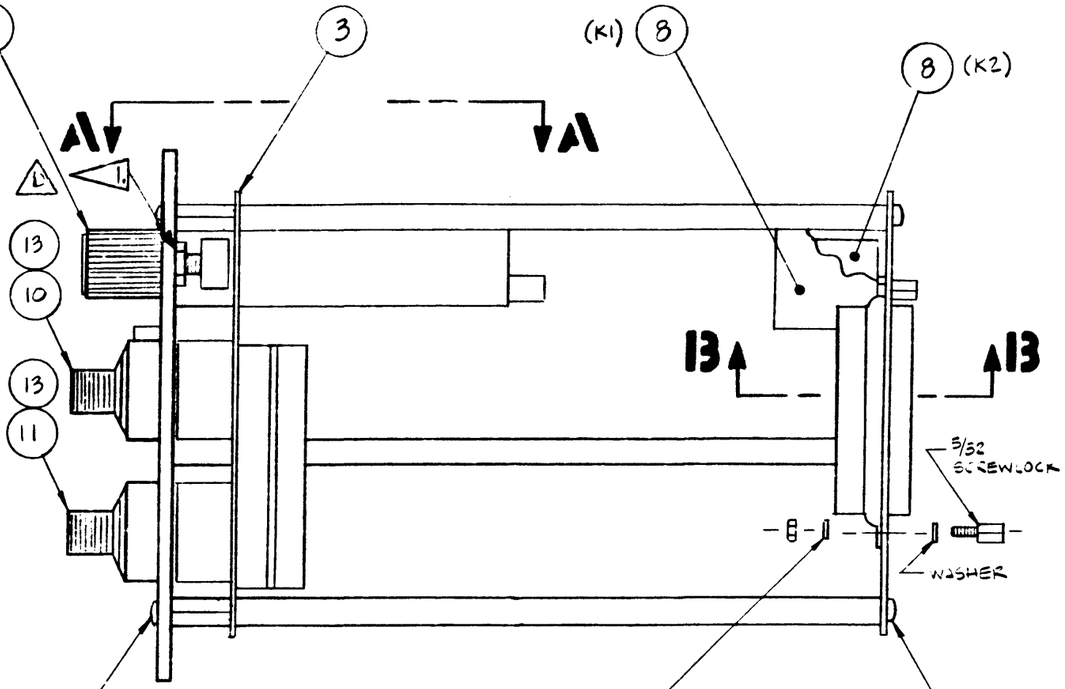
PARTS LIST NO. | APPLIES

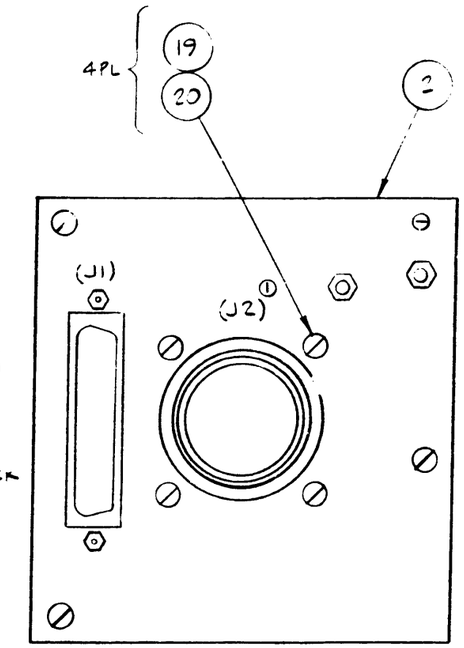
ORIGINAL

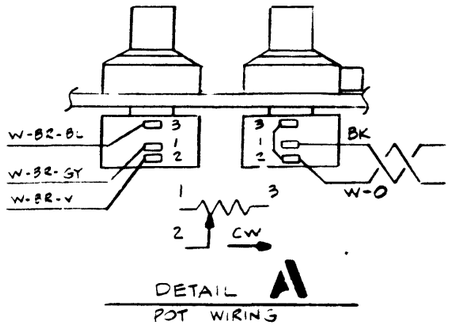

DESCRIPTION
ITEM
PART NO.
QTY.
J4
3PT. IN-LINE
R14
40.2K
1%
+15
J2
16 PT. IN-LINE
REMOTE RANGE SELECT #1
REMOTE RANGE SELECT #2
REM LEVEL REQ IN 0-10VDC
U6
8030
U7
8030
R10 1.2K
R4 1.2K
R5 5.1 K
R11 10K
R3 5.1 K
R9 10K
C7 .1
C6 .1
U4 2004
R7 100K
R6 100K
C10 .1
C3 .1
U5 4081
U3 4053
J3
24 PT. IN-LINE
RANGE 1 DS8
RANGE 2 DS9
SELECT RANGE BIT 1
SELECT RANGE BIT 2
LEVEL REQ
BIAS
U1 3240
RN5 10K
RN4 100
R2 32.6 K 1%
R1 100K
C4 .1
CR2 1N4446
CR1 1N4446
CR3 1N4446
CR4 1N4446
RN6 100K
U8 3240
REMOTE DS7
RN2 2.2K
U2 4532
S2
1 RANGE 1
2 RANGE 2
3 RANGE 3
4 RANGE 4
5 REMOTE
RN3 100K
C2 .1
R12 2.2K DS11
15 ON
S4 COM NC NO
GO ON
R8 2.2K DS10
15 RDY
S3 COM NC NO
OFF
+15VDC
24 (+) 15VDC
23 (-)
C12 10/35
C11 .1
U9 8030
R13 2.2K
I/L TO CONTROL PCB
(-) 15VDC
(+) 24VDC
FOR HV CONT
EGC INT COVERS
OUT OF REG
POSITION I/L FROM POSITION PCB (USE ONLY ONE)
HV CONT
GUN CONTROL
TANK
PWR IS ON
AIR
VAC GAUGE
DOORS
AUX
PCB'S/KEY
GUN H2O
POSITION I/L FROM SWEEPER (USE ONLY ONE)
RN1 2.2K DS1
DS2
DS3
JP1
DS4
DS5
DS6
JP2
J1
8 PT. IN-LINE
EMISSION IN
FILAMENT IN
POSITION IN
TO METER
S1
SPARES
U4
U5
U8
REV.
DESCRIPTION
BY
DATE
APP'VD
UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES
TOLERANCE
CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2
FINISH
DRAWN BY A. JACQUES
DATE 7-13-89
CHK BY
APP BY
SCALE NONE
DO NOT SCALE DRAWING
SIMBA
REMOTE CONTROL DISPLAY PCB SCHEM
040-4843

ITEM	PART NO.	SUB ASSY	QTY.	DESCRIPTION

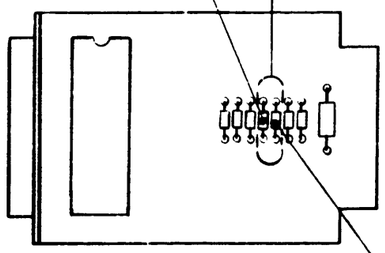




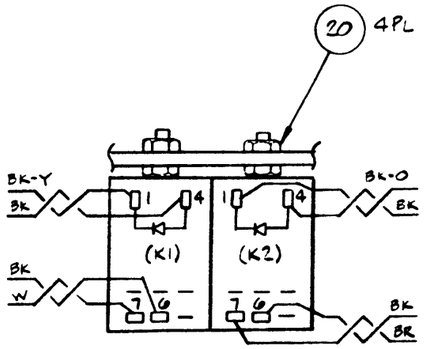




DETAIL A
POT WIRING



VIEW A-A
COVER REMOVED FOR CLARITY



VIEW B-B
SCALE: NONE

D 1. TIGHTEN RETAINER NUT SNUG TO FRONT PANEL, SECURE SWITCH IN PLACE.

NOTE: 040-3814 SCHEM

REV.	DESCRIPTION	BY	DATE	APP'VD
D	ADDED 1 NOTE 1.	JP	8.11.94	
C	WAS 10K & 40.2K	VB	3.3.93	
B	ADDED J1 MTG JACK SCREW KIT	MB	3.7.89	
A	RELAY HOLES MODIFIED R. PILL	MB	10.19.88	

UNLESS OTHERWISE SPECIFIED
BREAK ALL EDGES | INTER. RADII
FINISH | TOLERANCE XXX ± ANG ± XX ± X ±
CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

0040-3630-0 USED ON DWG. NO.
DO NOT SCALE DRAWING

A DIVISION OF THE EDO GROUP, INC. Salisbury, California

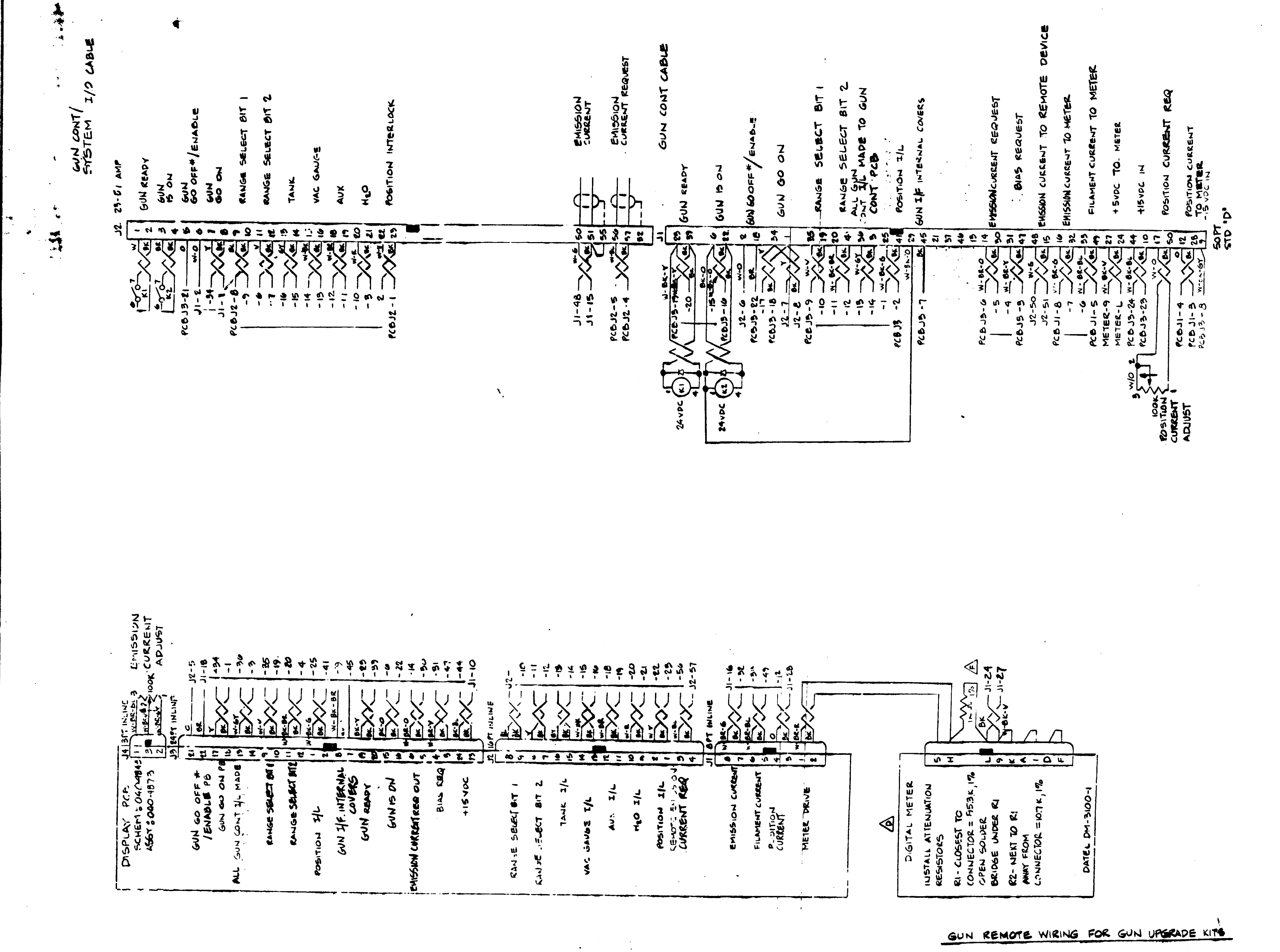
DRAWN BY M BOSWELL | DATE 8-19-88 | CHK BY | APP BY | SCALE FULL

SIMBA

ASSY, GUN CONT REMOTE

DRAWING NUMBER 040-3593 | SERIAL | SIZE D | REV D

PARTS LIST NO. 0040-3593-0 APPLIES



GUN CONT/ SYSTEM I/O CABLE
J2 25-51 AMP
GUN READY
GUN IS ON
GUN GO OFF*/ENABLE
GUN GO ON
RANGE SELECT BIT 1
RANGE SELECT BIT 2
TANK
VAC GAUGE
AUX
H2O
POSITION INTERLOCK
EMISSION CURRENT
EMISSION CURRENT REQUEST
GUN CONT CABLE
J1
GUN READY
GUN IS ON
GUN GO OFF*/ENABLE
GUN GO ON
RANGE SELECT BIT 1
RANGE SELECT BIT 2
ALL GUN I/L MADE TO GUN CONT PCB
POSITION I/L
GUN I/F INTERNAL COVERS
EMISSION CURRENT REQUEST
BIAS REQUEST
EMISSION CURRENT TO REMOTE DEVICE
EMISSION CURRENT TO METER
FILAMENT CURRENT TO METER
+5VDC TO METER
+15VDC IN
POSITION CURRENT REQ
POSITION CURRENT TO METER -15 VDC IN
50PT STD 'D'
24VDC
24VDC
100K POSITION CURRENT ADJUST
EMISSION CURRENT ADJUST
100K
DISPLAY PCB SCHEM 040-4814 ASSY 000-4873
GUN GO OFF */ENABLE PB
GUN GO ON PB
ALL GUN CONT I/L MADE
RANGE SELECT BIT 1
RANGE SELECT BIT 2
POSITION I/L
GUN I/F INTERNAL COVERS
GUN READY
GUN IS ON
EMISSION CURRENT OUT
BIAS REQ
+15VDC
RANGE SELECT BIT 1
RANGE SELECT BIT 2
TANK I/L
VAC GAUGE I/L
AUX I/L
H2O I/L
POSITION I/L
REMOTE EMISSION CURRENT REQ
EMISSION CURRENT
FILAMENT CURRENT
POSITION CURRENT
METER DRIVE
DIGITAL METER
INSTALL ATTENUATION RESISTORS
R1 - CLOSEST TO CONNECTOR = 953K, 1%
OPEN SOLDER BRIDGE UNDER R1
R2 - NEXT TO R1 AWAY FROM CONNECTOR = 10.7K, 1%
DATEL DM-3100-1

GUN REMOTE WIRING FOR GUN UPGRADE KITS

REV.	DESCRIPTION	BY	DATE	APPV'D
F	UPDATED PER RFA 2780 - SEE REDLINED PRINT	MB	9-23-93	
E	UPDATED DESIGNATIONS	MB	7-1-89	
D	WAS 40.2K; WAS 10K	MB	3-14-89	
C	DIGITAL METER PIN OUT WAS "E"	MB	1-23-89	
B	UPDATED	MB	11-11-88	
A	UPDATED DISPLAY PCB SCHEM REF WAS 040-2183	MB		

UNLESS OTHERWISE SPECIFIED

DRAWN M. BOSWELL

SIMBA

GUN REM CONT WIRING

SECTION 8
PARTS LISTS

POWER MODULE

GUN INTERFACE

HV/GUN CONTROL UNIT

SPARE PARTS KITS

* Lists parts in factory reworked PCB designated 0040-5433-0

EFFECTIVITY DATE: ALL

S I N G L E L E V E L B I L L S O F M A T E R I A L

PARENT PART: 0040-6740-1 POWER MODULE ASSY 208-240V SIMBAXX
ERC: 3 DATE: 00-XXX-00

ITEM NO	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER	OPR SEQ
0001	0040-6733-0	DWG,SCHEMATIC,PWR MOD-SIMBA 2A	EA	0	50
0002	0040-6743-0	DWG,POWER MODULE-SIMBA 2A	EA	0	50
0003	6921-4251-0	TUBE,TETRODE EIMAC 8171-4CX10,000D	EA	1	50
0004	0040-6650-0	PCB ASSY,H.V. REGULATOR SIMBA 2	EA	1	50
0005	0040-3443-0	PCB ASSY,CONTROL GRID-SIMBA 2	EA	1	50
0006	0610-1653-0	PCB ASSY,SCRN BIAS CV-20	EA	1	50
0007	0040-7130-0	ENCLOSURE,POWER MODULE SIMBA 2A	EA	1	50
0008	0040-6770-0	CONTROL PANEL ASSY,PWR MOD-SIMBA 2A	EA	1	50
0009	0040-6780-0	HV RECT/RES PNL ASSY PWR MOD	EA	1	50
0010	0040-6750-1	BRKR PNL ASSY,PM 208-240V SIMBAXX	EA	1	50
0011	0040-6760-0	REG/RELAY PNL ASSY,PWR MOD-SIMBA 2A	EA	1	50
0012	0040-6790-1	BASE/TETRODE PL,PM 208-415V SIMBAXX	EA	1	50
0014	0040-6900-0	FAB,EXHAUST CHIMNEY PWR MOD	EA	1	50
0015	9034-2064-0	FILTER, .5 X 9.375 X 16.5 AL	EA	1	50
0016	6260-1201-0	FAN THIN 115 VAC 50/60 CYCLE	EA	3	50
0017	6620-9310-0	KEYLATCH 200SERIES STHCO #931020110	EA	1	50
0018	6156-3450-0	SWITCH TEMP 200F ELMWOOD #345022141	EA	1	50
0019	6014-3911-0	CONN,TWO SCREW 1 1/2 T&B 3306	EA	1	50
0021	1123-1765-0	SCREW C FLAT 10-32 X 1.5 BLK OX	EA	18	50
0022	1123-1755-0	SCREW C FLAT 10-32X.50 BLK OX	EA	16	50
0023	1924-1754-0	SCREW C BUTT S 10-32X.375 BLK	EA	20	50
0024	1073-1025-0	WASHER,#10 FINISHING-BLACK NYLON	EA	38	50
0025	1923-1756-0	SCREW FLAT 10-32 X .625 BLK	EA	4	50

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6740-2 POWER MODULE ASSY 380-415V SIMBA XX

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-6733-0	DWG,SCHEMATIC,PWR MOD-SIMBA 2A	EA	0.0000
002	0040-6743-0	DWG,POWER MODULE, SIMBA 2A	EA	0.0000
003F	6921-4251-1	TUBE,TETRODE NATIONAL 8171-4CX10,000D	EA	1.0000
004	0040-6650-0	PCB, ASSY, H.V. REG-SIMBA 2 *ESD	EA	1.0000
005	0040-3443-0	PCB, ASSY, CONTROL GRID-SIMBA 2 *ESD	EA	1.0000
006	0610-1653-0	PCB, ASSY, SCREEN BIAS CV-20 *ESD	EA	1.0000
007	0040-7130-0	ENCLOSURE,POWER MODULE SIMBA 2A	EA	1.0000
008	0040-6770-2	CONTROL PNL ASY,PWR MOD,380-415V SIMBA2A	EA	1.0000
009	0040-6780-0	HV RECT/RES PNL ASSY PWR MOD	EA	1.0000
010	0040-6750-2	BRKR PNL ASSY,PM 380-415V SIMBA XX	EA	1.0000
011	0040-6760-0	REG/RELAY PNL ASSY,PWR MOD-SIMBA 2A	EA	1.0000
012	0040-6790-1	BASE/TETRODE PL,PM 208-415V SIMBA XX	EA	1.0000
014	0040-6900-0	FAB,EXHAUST CHIMNEY PWR MOD	EA	1.0000
015	9034-2064-0	FILTER, AIR, .5"X 9.38"X 16.5" EXP ALUM	EA	1.0000
016	6260-1201-0	FAN THIN 115 VAC 50/60 CYCLE	EA	3.0000
017	6620-9310-0	KEYLATCH 200SERIES STHCO #931020110	EA	1.0000
018	6156-3450-1	SWITCH TEMP 180 F ELMWOOD #345022110	EA	1.0000
019	6014-3911-0	CONN,TWO SCREW 1 1/2 T&B 3306	EA	1.0000
021	1123-1765-0	SCREW CAP FLAT 10-32 X 1.5 BLK OX	EA	18.0000
022	1123-1755-0	SCREW CAP FLATHEAD 10-32 X.50 BLK OX	EA	16.0000
023	1924-1754-0	SCREW C BUTT 5 10-32X.375 BLK	EA	20.0000
024	1073-1025-0T	WASHER,#10 FINISHING-BLACK NYLON	EA	38.0000
025	1923-1756-0	SCREW FLAT SOC HD 10-32 X .625 BLK OXIDE	EA	4.0000
026	1923-1456-0	SCREW, CAP FLT 8-32 X .625 BLACK OXIDE	EA	11.0000
027	1924-1757-0	SCREW C BUTT 5 10-32X1.00 BLK	EA	3.0000
028	1924-1455-0	SCREW C BUTT 5 8-32X.500 BLK	EA	16.0000
029	1924-1254-0	SCREW C BUTT 6-32 X .375 BLACK	EA	12.0000
030	1377-1600-0	WASHER, FLAT SAE #10 SST	EA	13.0000
031	1258-1751-0	NUT, KEP 10-32 ZC	EA	7.0000
032	1258-1401-0	NUT, KEP 8-32 ZC	EA	16.0000
033	1258-1201-0	NUT, HEX, KEP, 6-32 ZC	EA	8.0000
034	1975-0010-0	WASHER EXT LOCK #10 ZC	EA	11.0000
035	0833-8731-1	HIGH VOLTAGE LABEL (ENGLISH)	EA	5.0000
036	6641-9064-0	LABEL WARNING HI VOLTAGE INT. LARGE	EA	4.0000
037	0040-6880-0	COVER,SAFETY PANEL PWR MOD SIMBAXX	EA	1.0000
038	6348-0025-0	PANDUIT TIE WRAP W/MNTG HOLE	EA	3.0000
039	6048-9503-0	CONNECTOR, PLUG, 2-PIN,.093", 1545P	EA	1.0000
040	6048-9523-0	CONN PLUG WO/EARS 03-06-2043	EA	1.0000
041	6261-5504-0	FINGER GUARD , METAL	EA	1.0000
042	6156-9322-0	SWITCH, LIMIT	EA	3.0000
043	6156-9231-2	SWITCH ENCLOSURE TERMINAL	EA	3.0000
044	0413-7981-2	MICRO SWITCH BRKT	EA	1.0000
045	0040-7480-0	BRACKET, DOOR SW, SIMBA 2A	EA	2.0000
046E	6047-4331-0	CONN 8PT FEM RECEP AMP #206433-1	EA	1.0000
047E	6047-4341-0	CONN,8PT MALE PLUG AMP 206434-1	EA	1.0000
048F	6047-0021-0	CONTACT, PIN, SIZE 20 DF, 20-24 AWG	EA	6.0000
049F	6047-0032-0	CONN SOC, 24-20 GA,AMP#66504-9 CPC SER 2	EA	6.0000
050	0040-6080-0	PANEL, FRONT FAB W/ TEMESCAL SILKSCREEN	EA	1.0000
051	6960-0100-0	REGULATOR, AC MODULE W/RAMP *ESD	EA	1.0000
052	6149-3006-0	TERMINAL BLOCK 4AWG PHOENIX TYPE UK16N	EA	1.0000
053	6149-3002-0	TERMINAL BLOCK END COVER PHOENIX	EA	1.0000
054	6305-0004-6L	WIRE 4AWG LT BLUE STRANDED PLATED COPPER	FT	4.5000
057	6641-6010-0	LABEL, GROUND, IEC.417 NO.5017-1IN. DIA.	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6740-3 POWER MODULE ASSY 480V SIMBA XX

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-6733-0	DWG,SCHEMATIC,PWR MOD-SIMBA 2A	EA	0.0000
002	0040-6743-0	DWG,POWER MODULE, SIMBA 2A	EA	0.0000
003F	6921-4251-1	TUBE,TETRODE NATIONAL 8171-4CX10,000D	EA	1.0000
004	0040-6650-0	PCB, ASSY, H.V. REG-SIMBA 2 *ESD	EA	1.0000
005	0040-3443-0	PCB, ASSY, CONTROL GRID-SIMBA 2 *ESD	EA	1.0000
006	0610-1653-0	PCB, ASSY, SCREEN BIAS CV-20 *ESD	EA	1.0000
007	0040-7130-0	ENCLOSURE,POWER MODULE SIMBA 2A	EA	1.0000
008	0040-6770-3	CONTROL PANEL ASSY,PWR MOD,480V SIMBA2A	EA	1.0000
009	0040-6780-0	HV RECT/RES PNL ASSY PWR MOD	EA	1.0000
010	0040-6750-3	BRKR PNL ASSY,PM 480V SIMBA XX	EA	1.0000
011	0040-6760-0	REG/RELAY PNL ASSY,PWR MOD-SIMBA 2A	EA	1.0000
012	0040-6790-3	BASE/TETRODE PL/PM 480V SIMBA XX	EA	1.0000
014	0040-6900-0	FAB,EXHAUST CHIMNEY PWR MOD	EA	1.0000
015	9034-2064-0	FILTER, AIR, .5"X 9.38"X 16.5" EXP ALUM	EA	1.0000
016	6260-1201-0	FAN THIN 115 VAC 50/60 CYCLE	EA	3.0000
017	6620-9310-0	KEYLATCH 200SERIES STHCO #931020110	EA	1.0000
018	6156-3450-1	SWITCH TEMP 180 F ELMWOOD #345022110	EA	1.0000
019	6014-3911-0	CONN,TWO SCREW 1 1/2 T&B 3306	EA	1.0000
021	1123-1765-0	SCREW CAP FLAT 10-32 X 1.5 BLK OX	EA	18.0000
022	1123-1755-0	SCREW CAP FLATHEAD 10-32 X.50 BLK OX	EA	16.0000
023	1924-1754-0	SCREW C BUTT 5 10-32X.375 BLK	EA	20.0000
024	1073-1025-0T	WASHER,#10 FINISHING-BLACK NYLON	EA	38.0000
025	1923-1756-0	SCREW FLAT SOC HD 10-32 X .625 BLK OXIDE	EA	4.0000
026	1923-1456-0	SCREW, CAP FLT 8-32 X .625 BLACK OXIDE	EA	11.0000
027	1924-1757-0	SCREW C BUTT 5 10-32X1.00 BLK	EA	3.0000
028	1924-1455-0	SCREW C BUTT 5 8-32X.500 BLK	EA	16.0000
029	1924-1254-0	SCREW C BUTT 6-32 X .375 BLACK	EA	12.0000
030	1377-1600-0	WASHER, FLAT SAE #10 SST	EA	13.0000
031	1258-1751-0	NUT, KEP 10-32 ZC	EA	7.0000
032	1258-1401-0	NUT, KEP 8-32 ZC	EA	16.0000
033	1258-1201-0	NUT, HEX, KEP, 6-32 ZC	EA	8.0000
034	1975-0010-0	WASHER EXT LOCK #10 ZC	EA	11.0000
035	0833-8731-1	HIGH VOLTAGE LABEL (ENGLISH)	EA	5.0000
036	6641-9064-0	LABEL WARNING HI VOLTAGE INT. LARGE	EA	4.0000
037	0040-6880-0	COVER,SAFETY PANEL PWR MOD SIMBAXX	EA	1.0000
038	6348-0025-0	PANDUIT TIE WRAP W/MNTG HOLE	EA	3.0000
039	6048-9503-0	CONNECTOR, PLUG, 2-PIN,.093", 1545P	EA	1.0000
040	6048-9523-0	CONN PLUG WO/EARS 03-06-2043	EA	1.0000
041	6261-5504-0	FINGER GUARD , METAL	EA	1.0000
042	6156-9322-0	SWITCH, LIMIT	EA	3.0000
043	6156-9231-2	SWITCH ENCLOSURE TERMINAL	EA	3.0000
044	0413-7981-2	MICRO SWITCH BRKT	EA	1.0000
045	0040-7480-0	BRACKET, DOOR SW, SIMBA 2A	EA	2.0000
046E	6047-4331-0	CONN 8PT FEM RECEP AMP #206433-1	EA	1.0000
047E	6047-4341-0	CONN,8PT MALE PLUG AMP 206434-1	EA	1.0000
048F	6047-0021-0	CONTACT, PIN, SIZE 20 DF, 20-24 AWG	EA	6.0000
049F	6047-0032-0	CONN SOC, 24-20 GA,AMP#66504-9 CPC SER 2	EA	6.0000
050	0040-6080-0	PANEL, FRONT FAB W/ TEMESCAL SILKSCREEN	EA	1.0000
053	6641-6010-0	LABEL, GROUND, IEC.417 NO.5017-1IN. DIA.	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6770-0 OBSOLETE USE 0040-6770-1,-2,-3

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-6773-0	DWG,CONTROL PANEL,PWR MOD-SIMBA 2A	EA	0.0000
002	0040-6840-0	FAB,CONTROL PANEL PWR MOD	EA	1.0000
003	6054-1813-0	XFMER,100VA 208-480/24	EA	1.0000
004	6054-1812-2	XFMR 2K VA	EA	1.0000
005	6054-2300-0	XFMR EWC RPT 230-0.25	EA	2.0000
006	6024-4224-0	PWR SUP 24VDC .5A LAMBDA LVS-42E-24B	EA	1.0000
007	6024-4014-0	PWR SUPPLY 5V 2A +-15V .2A	EA	1.0000
008	6470-4560-0	270 5 OHMS 100W RESISTOR	EA	3.0000
009	6261-0034-0T	FILTER,LINE	EA	1.0000
010	6056-0208-0	FUSE BLOCK,FOR ACME TA-2-81323 XFMR PRI.	EA	1.0000
011	6056-0208-1	FUSE BLOCK,FOR ACME TA-2-81323 XFMR SEC.	EA	1.0000
012	6149-0461-0	TERMINAL STRIP 115/N/G PHX#0461018	EA	10.0000
013	6149-0201-0	BRIDGE, INSERT EB10-6(3)	EA	2.0000
014	6149-2772-0	END CLAMP TYPE E/UK	EA	2.0000
015	6149-2770-1	END COVER D-UKK3/5 PHX#2770024	EA	1.0000
016	6149-2215-0	BLANK MARKER STRIP 10SECT ZB5	EA	2.0000
017	6950-3575-0	RAIL MOUNTING FLAT DIN EN	FT	1.0000
018	6407-4561-0	RESISTOR, WW, 10 OHM, 2W, 5%	EA	1.0000
019	6047-4326-0	TERMINAL STRIP, SOLDER, 2 LUG	EA	1.0000
020	6950-1564-0	BRACKET .062TH X 1-9/16H X 31/64	EA	4.0000
021	0040-6890-0	FAB,FILTER MTG BRACKET PWR MOD	EA	1.0000
023	1258-1401-0	NUT, KEP 8-32 ZC	EA	8.0000
024A	1975-0008-0	WASHER EXT LOCK # 8 ZINC PL	EA	8.0000
026	1258-1201-0	NUT, HEX, KEP, 6-32 ZC	EA	8.0000
027A	1975-0006-0	WASHER EXT LOCK # 6 ZINC PL	EA	8.0000
028	1240-1757-0	SCREW, BIND HD 10-32 X .750 ZC	EA	5.0000
029	1258-1751-0	NUT, KEP 10-32 ZC	EA	6.0000
030	1975-0010-0	WASHER EXT LOCK #10 ZC	EA	12.0000
032	6475-5712-0	RES BRACKET OHMITE 12B	EA	6.0000
033	8353-0270-0	ADHESIVE,"THREADLOCKER 270", 10ML BOTTLE	EA	0.0000
034	1721-1760-0	SCREW, CAP SOC #10-32 X 1.25 BRASS	EA	1.0000
035	1760-1700-0T	NUT MACHINE 10-32 BRS	EA	1.0000
036	1778-1700-0	WASHER FLAT #10L BRS	EA	2.0000
037	1222-2260-0	SCREW, CAP HEX 3/8-16 X 1.25 ZC	EA	4.0000
038	1263-2200-0	NUT, HEX 3/8-16 ZC	EA	4.0000
039	1377-2200-0	WASHER, FLAT SAE 3/8 SST	EA	8.0000
040	1373-2200-0	WASHER, SPRING LOCK 3/8 SST	EA	4.0000
042	0040-6810-0	HARNESS,PWR MOD-SIMBA 2A	EA	1.0000
043	1042-1759-0	SCREW M RD 2 10-32X1.0 BLK NYL	EA	6.0000
044	1060-1032-0	NUT, MACHINE 10-32 NYLON	EA	12.0000
045	1240-1455-0	SCREW, BIND HD 8-32 X .500 ZC	EA	4.0000
046	1240-1255-0	SCREW, BIND HD SLOTTED 6-32 X .500 ZC	EA	4.0000
047	1240-1756-0	SCREW M BIND 2 10-32X.625 ZC	EA	6.0000
048	1240-1456-0	SCREW, BINDING HEAD 8-32 X .625	EA	2.0000
049	1240-1252-0	SCREW, BIND HD 6-32 X .250 ZC	EA	4.0000
050	6014-1506-0	CABLE LUG, CONE SCREW 14/4 AWG	EA	1.0000
051	1377-1600-0	WASHER, FLAT SAE #10 SST	EA	11.0000
052	6056-0204-62	FUSE,6.25AMP,250VAC DUAL ELE. TIME-DELAY	EA	1.0000
053	6641-6053-0	LABEL, FUSE, (6.25A,T), 1" X 1/2"	EA	1.0000
054	6641-6020-0	LABEL, GROUND, IEC.417 NO.5019-.5IN DIA.	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6780-0 HV RECT/RES PNL ASSY PWR MOD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-6783-0	DWG,HV RECT/RES PNL P M SIMBA 2A	EA	0.0000
002	0040-6850-0	FAB, HAYSITE, RECT/RES PNL PWR MOD	EA	1.0000
003	6505-9381-0	CAPACITOR 4800 pF, 20 kV	EA	6.0000
004	6473-2004-0	RESISTOR, 50 OHM, 50 WATT, 5%	EA	3.0000
005	0307-8882-0	BUS BAR COOPER HV CAPACITOR	EA	2.0000
006	6448-6000-0	RESISTOR 6M 60W	EA	1.0000
007	6041-2630-0	RELAY HV SPDT 26.5VDC COIL KILOVAC H8	EA	1.0000
008	6838-9410-0	DIODE, RECTIFIER, 800V, 1A *ESD	EA	1.0000
009	6484-0453-0	RESISTOR 45.3 OHMS 1/4W DALE RN-60D	EA	1.0000
010	6047-4326-0	TERMINAL STRIP, SOLDER, 2 LUG	EA	1.0000
011	6468-4623-0	1K 25W OHMITE 0205	EA	1.0000
012	0040-7790-0	KIT, MIN LOAD RES PANEL, SIMBA 2	EA	3.0000
014	6472-4371-1	25 OHM 225W	EA	2.0000
015	0307-7293-0	H.V. RECTIFIER HV COMPONENTS JH234	EA	6.0000
016	6039-2165-1	STANDOFF SMITH 2165-1A GLASTIC	EA	5.0000
017	6040-8705-0	STANDOFF 8-32 X 1-1/2 LG PHENOLIC	EA	3.0000
018	0040-6830-0	FAB,CLAMP TUBE PWR MOD	EA	1.0000
019	6056-0313-1	FUSE CLIP ILSCO C-13	EA	3.0000
020	6475-5718-0	RESISTOR BRACKET BRS	EA	4.0000
022	6950-1564-0	BRACKET .062TH X 1-9/16H X 31/64	EA	6.0000
023	6300-2016-2	WIRE 16GA RED 20 KV R7902016	FT	8.0000
024	6300-2016-4	WIRE 16GA YEL 20 KV ROWE R790-2016	FT	8.0000
025	6300-3516-0	WIRE 16GA BLK 35KV	FT	15.0000
026	6300-0002-0	WIRE 16GA GRN/YELLOW 300V INS	FT	1.0000
027	6300-0001-0	WIRE 20 GA GRN/YELLOW 300V INS	FT	1.0000
028	0206-4471-2T	GND STUD	EA	2.0000
030	1760-1800-0	NUT, HEX 1/4-20 BRASS	EA	4.0000
031	1258-1800-0	NUT, KEP 1/4-20 ZC	EA	1.0000
032	1778-1800-0	WASHER, FLAT 1/4 BRASS	EA	4.0000
033	1975-0025-0	WASHER EXT LOCK 1/4 ZINC PL	EA	9.0000
034	1042-1759-0	SCREW M RD 2 10-32X1.0 BLK NYL	EA	12.0000
035	1240-1756-0	SCREW M BIND 2 10-32X.625 ZC	EA	4.0000
036	1060-1032-0	NUT, MACHINE 10-32 NYLON	EA	24.0000
037	1258-1751-0	NUT, KEP 10-32 ZC	EA	4.0000
038	1975-0010-0	WASHER EXT LOCK #10 ZC	EA	4.0000
039	1098-1600-0	ROD THREADED 8-32 (2FT LG) NYLON	EA	1.0000
040	1240-1456-0	SCREW, BINDING HEAD 8-32 X .625	EA	6.0000
043	1060-1401-0	NUT 8-32 BLACK NYLON	EA	2.0000
044	1258-1401-0	NUT, KEP 8-32 ZC	EA	8.0000
045	1083-0250-0	WASHER,SHOULDER #8 .250 OD NYLON	EA	2.0000
046	1975-0008-0	WASHER EXT LOCK # 8 ZINC PL	EA	30.0000
052	6044-0657-1	LUG RING 1/4 #16 GA ETC BB-225-14XT	EA	11.0000
053	6044-0820-1	LUG RING 10 #16 GA	EA	4.0000
054	6044-0817-1	LUG #8 RING BLUE ON TAPE ETC BB-239-08X	EA	15.0000
055	6641-3713-0	LABEL,VINYL 3/8,D,PANDUIT PCL-037-D	CD	1.0000
056	6641-3716-0	LABEL,VINYL 3/8,G,PANDUIT PCL-037-G	CD	1.0000
057	6641-3717-0	LABEL, VINYL 3/8,H,PANDUIT PCL-037-H	CD	1.0000
058	6641-3723-0	LABEL,VINYL 3/8,N,PANDUIT PCL-037-N	CD	1.0000
059	6641-3724-0	LABEL,VINYL 3/8,O,PANDUIT PCL-037-O	CD	1.0000
060	6641-3729-0	LABEL,VINYL 3/8,T,PANDUIT PCL-037-T	CD	1.0000
061	6641-3730-0	LABEL,VINYL 3/8,U,PANDUIT PCL-037-U	CD	1.0000
062	6641-3731-0	LABEL,VINYL 3/8,V,PANDUIT PCL-037-V	CD	1.0000
063	6044-0701-1	LUG RING INSULATED #10 X 16-14 AWG	EA	15.0000
064	1222-1855-0	SCREW, CAP HEX 1/4-20 X .500 ZC	EA	7.0000
065	1222-1854-0	SCREW, CAP HEX 1/4-20 X .375 ZC	EA	3.0000
066	6044-0715-2	TERMINAL RING LUG 12-10AWG WIRE STUD	EA	2.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6790-1 BASE/TETRODE PL,PM 208-415V SIMBA XX

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-6793-0	DWG,BASE/TETRODE PNL,P/M-SIMBA 2A	EA	0.0000
002	0040-6040-0	BASEPLATE,POWER MODULE SIMBA 2A	EA	1.0000
003	0040-6860-0	FAB,TETRODE PNL PWR MOD	EA	1.0000
004	0040-7160-0	BRACKET,CAP/AIR SW P.M. SIMBA 2A	EA	1.0000
005	6921-4252-0	CHIMNEY,TETRODE EIMAC SK-1306	EA	1.0000
006	6921-4253-0	TUBE SOCKET	EA	1.0000
007	0040-6920-0	FAB,CHIMNEY MODIF. PWR MOD	EA	1.0000
008	6054-1650-0	XFMR 115/16VCT 50A EWC RPT 16-50	EA	1.0000
009	0040-4253-0	XFMR 18.8KVA HI VOLT	EA	1.0000
010	6271-1604-0	BLOWER,EBM, 110V, EBM #G2E160AD05-25	EA	1.0000
011	6511-2169-0	CAPACITOR, 20 UF, EBM BLOWER	EA	1.0000
012	6511-0150-0	CAPACITOR HV 1UF 15K VDC LK-150-105	EA	1.0000
013B	6505-9415-0	CAPACITOR, .25uF, 2KVDC, 20%	EA	1.0000
014	6516-1953-0	CAPACITOR 10MFD, 200V, 10%	EA	1.0000
015	6473-2203-0	RESISTOR 25 OHM 100W NI	EA	2.0000
016	6473-2005-0	RESISTOR 270N 100 OHM 50W	EA	1.0000
017	6470-4673-0	RESISTOR 270 50K OHM 100W	EA	1.0000
018	6470-1100-0	RESISTOR 5K 100W OHMITE L100J5K0	EA	1.0000
019	6448-0010-0	RESISTOR 1 OHM 25W 1% NON INDUCTIVE	EA	1.0000
020	6014-8014-0	6 PT (5-40) STRIP,TERMINAL KULKA 670-6	EA	1.0000
021	6014-8640-0	CINCH JONES #140J-1 JUMPER FOR 5-40 SIZE	EA	1.0000
022	6156-4311-0	PSF100A 0.5 AIR FLOW SW	EA	5.0000
023	9018-3056-0	CASTER SWIVEL W/BRAKE	EA	1.0000
024	9018-3008-0	CASTER RIGID COLSON 2-3008-53 (FIXED)	EA	2.0000
025	6300-2016-2	WIRE 16GA RED 20 KV R7902016	EA	2.0000
026	6300-2016-4	WIRE 16GA YEL 20 KV ROWE R790-2016	FT	1.0000
027	6300-2016-0	WIRE 16GA BLK 20 KV ROWE R790-2016-0	FT	1.0000
028	6341-0010-0	WIRE GROUNDING 6 GA FLEX CLEAR	FT	1.0000
029	6338-5000-1	WIRE HOOK-UP TYPE B 16 AWG 19STR 600V	FT	5.0000
030	6338-5020-1	WIRE HOOK-UP TYPE B 20AWG 7 STR 600V PVC	FT	1.0000
031	0040-3872-0	STANDOFF, 1"DIA X 11"LG,TAP #3/8-16	FT	1.0000
032	6040-8697-1	STANDOFF 8-32 X 1.00 LG PHENOLIC	EA	4.0000
033	6040-8361-1	STANDOFF 3-1/2" AL 6-32	EA	2.0000
034	6475-5712-0	RES BRACKET OHMITE 12B	EA	4.0000
035	6475-5709-0	RESISTOR BRACKET BRS	EA	6.0000
036B	6040-0010-0	STANDOFF 5/16 HEX MALE/FEMALE 8-32 X 1/2	EA	2.0000
037	6048-9502-0	CONNECTOR, RECEPTACLE,3-PIN,.093",1396R	EA	2.0000
038	6044-3601-4	LUG 1/4 RING RT ANGLE ETC E36014R90	EA	1.0000
039	6014-1706-0	CONNECTOR COMP LUG BLUE	EA	4.0000
040	6044-0657-1	LUG RING 1/4 #16 GA ETC BB-225-14XT	EA	4.0000
041	6044-0817-1	LUG #8 RING BLUE ON TAPE ETC BB-239-08X	EA	6.0000
042	6044-0629-1	RING LUG, (#16 BLUE) #6 SCREW	EA	2.0000
043	6044-0723-0	LUG RING #6 RED	EA	5.0000
044	6305-0010-0	WIRE 10GA G-Y AWM 133STR 600V	EA	1.0000
045	6044-0403-0	RING 112 10-12GA ETC C-201-12X	FT	6.0000
046	6044-0701-1	LUG RING INSULATED #10 X 16-14 AWG	EA	1.0000
047	1222-2260-0	SCREW, CAP HEX 3/8-16 X 1.25 ZC	EA	1.0000
048	1222-2660-0	SCREW, CAP HEX 1/2-13 X 1.25 ZC	EA	4.0000
049	1222-2256-0	SCREW, CAP HEX 3/8-16 X .625 ZC	EA	4.0000
050	1263-2600-0	NUT, HEX 1/2-13 UNC CAD OR = PLATED STL	EA	6.0000
051	1377-2200-0	WASHER, FLAT SAE 3/8 SST	EA	4.0000
052	1373-2200-0	WASHER, SPRING LOCK 3/8 SST	EA	14.0000
			EA	14.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6790-1 BASE/TETRODE PL,PM 208-415V SIMBA XX

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
053	1240-1759-0T	SCREW M BIND 2 10-32X1.00	ZC	EA	4.0000
054	1240-1756-0	SCREW M BIND 2 10-32X.625	ZC	EA	4.0000
055	1240-1757-0	SCREW, BIND HD 10-32 X .750	ZC	EA	4.0000
056	1258-1751-0	NUT, KEP 10-32	ZC	EA	10.0000
057	1377-1600-0	WASHER, FLAT SAE #10	SST	EA	8.0000
058	1975-0010-0	WASHER EXT LOCK #10 ZC		EA	12.0000
059	1240-1456-0	SCREW, BINDING HEAD 8-32 X .625		EA	10.0000
060	1258-1401-0	NUT, KEP 8-32	ZC	EA	8.0000
061	1975-0008-0	WASHER EXT LOCK # 8 ZINC PL		EA	10.0000
062	1240-1257-0	SCREW, BIND HD SLOTTED 6-32 X .750	ZC	EA	10.0000
063	1258-1201-0	NUT, HEX, KEP, 6-32	ZC	EA	6.0000
064	1975-0006-0	WASHER EXT LOCK # 6 ZINC PL		EA	10.0000
065	1240-0458-0	SCREW M BIND 2 2-56X.875	ZC	EA	4.0000
066	1263-0400-0	NUT MACHINE #2-56	ZC	EA	4.0000
067	1222-1857-0	SCREW, CAP HEX 1/4-20 X .750 UNC	ZC	EA	6.0000
068	1258-1800-0	NUT, KEP 1/4-20	ZC	EA	6.0000
069	1975-0025-0	WASHER EXT LOCK 1/4 ZINC PL		EA	6.0000
070	6641-3712-0	LABEL,VINYL 3/8,C,PANDUIT PCL-037-C		CD	1.0000
071	6641-3724-0	LABEL,VINYL 3/8,O,PANDUIT PCL-037-O		CD	1.0000
072	6641-3722-0	LABEL,VINYL 3/8,M,PANDUIT PCL-037-M		CD	1.0000
073	6641-3729-0	LABEL,VINYL 3/8,T,PANDUIT PCL-037-T		CD	1.0000
074	6641-3728-0	LABEL,VINYL 3/8,S,PANDUIT PCL-037-S		CD	1.0000
075	1373-2600-0	WASHER, SPRING LOCK, 1/2 NOM		EA	4.0000
076	1042-1459-0	SCREW MACH RD SLTD 2 8-32X1.00 BLACK NYL		EA	1.0000
078B	6044-7330-0	TERMINAL LUG, SOLDER TIN PLATE #8		EA	2.0000
079B	6114-0018-0	TUBING TEFLON #18 NATURAL		IN	1.0000
080	6056-0207-0	FUSE,100AMP,250VAC DUAL ELEM. TIME-DELAY		EA	1.0000
081	6056-0207-1	FUSE HOLDER,61-100AMP,250VAC		EA	1.0000
082	6641-6054-0	LABEL, FUSE, (100A,T), 1" X 1/2"		EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6790-3 BASE/TETRODE PL/PM 480V SIMBA XX

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-6793-0	DWG,BASE/TETRODE PNL,P/M-SIMBA 2A	EA	0.0000
002	0040-6040-0	BASEPLATE,POWER MODULE SIMBA 2A	EA	1.0000
003	0040-6860-0	FAB,TETRODE PNL PWR MOD	EA	1.0000
004	0040-7160-0	BRACKET,CAP/AIR SW P.M. SIMBA 2A	EA	1.0000
005	6921-4252-0	CHIMNEY,TETRODE EIMAC SK-1306	EA	1.0000
006	6921-4253-0	TUBE SOCKET	EA	1.0000
007	0040-6920-0	FAB,CHIMNEY MODIF. PWR MOD	EA	1.0000
008	6054-1650-0	XFMR 115/16VCT 50A EWC RPT 16-50	EA	1.0000
009	0040-3153-3	TRANSFORMER,MAIN STEP UP,480VAC	EA	1.0000
010	6271-1604-0	BLOWER,EBM, 110V, EBM #G2E160AD05-25	EA	1.0000
011	6511-2169-0	CAPACITOR, 20 UF, EBM BLOWER	EA	1.0000
012	6511-0150-0	CAPACITOR HV 1UF 15K VDC LK-150-105	EA	1.0000
013B	6505-9415-0	CAPACITOR, .25uF, 2KVDC, 20%	EA	1.0000
014	6516-1953-0	CAPACITOR 10MFD, 200V, 10%	EA	2.0000
015	6473-2203-0	RESISTOR 25 OHM 100W NI	EA	1.0000
016	6473-2005-0	RESISTOR 270N 100 OHM 50W	EA	1.0000
017	6470-4673-0	RESISTOR 270 50K OHM 100W	EA	1.0000
018	6470-1100-0	RESISTOR 5K 100W OHMITE L100J5K0	EA	1.0000
019	6448-0010-0	RESISTOR 1 OHM 25W 1% NON INDUCTIVE	EA	1.0000
020	6014-8014-0	6 PT (5-40) STRIP,TERMINAL KULKA 670-6	EA	1.0000
021	6014-8640-0	CINCH JONES #140J-1 JUMPER FOR 5-40 SIZE	EA	5.0000
022	6156-4311-0	PSF100A 0.5 AIR FLOW SW	EA	1.0000
023	9018-3056-0	CASTER SWIVEL W/BRAKE	EA	2.0000
024	9018-3008-0	CASTER RIGID COLSON 2-3008-53 (FIXED)	EA	2.0000
025	6300-2016-2	WIRE 16GA RED 20 KV R7902016	FT	1.0000
026	6300-2016-4	WIRE 16GA YEL 20 KV ROWE R790-2016	FT	1.0000
027	6300-2016-0	WIRE 16GA BLK 20 KV ROWE R790-2016-0	FT	1.0000
028	6341-0010-0	WIRE GROUNDING 6 GA FLEX CLEAR	FT	5.0000
029	6338-5000-1	WIRE HOOK-UP TYPE B 16 AWG 19STR 600V	FT	1.0000
030	6338-5020-1	WIRE HOOK-UP TYPE B 20AWG 7 STR 600V PVC	FT	1.0000
031	0040-3872-0	STANDOFF, 1"DIA X 11"LG,TAP #3/8-16	EA	4.0000
032	6040-8697-1	STANDOFF 8-32 X 1.00 LG PHENOLIC	EA	2.0000
033	6040-8361-1	STANDOFF 3-1/2" AL 6-32	EA	4.0000
034	6475-5712-0	RES BRACKET OHMITE 12B	EA	6.0000
035	6475-5709-0	RESISTOR BRACKET BRS	EA	2.0000
036B	6040-0010-0	STANDOFF 5/16 HEX MALE/FEMALE 8-32 X 1/2	EA	2.0000
037	6048-9502-0	CONNECTOR, RECEPTACLE,3-PIN,.093",1396R	EA	1.0000
038	6044-3601-4	LUG 1/4 RING RT ANGLE ETC E36014R90	EA	4.0000
039	6014-1706-0	CONNECTOR COMP LUG BLUE	EA	4.0000
040	6044-0657-1	LUG RING 1/4 #16 GA ETC BB-225-14XT	EA	6.0000
041	6044-0817-1	LUG #8 RING BLUE ON TAPE ETC BB-239-08X	EA	2.0000
042	6044-0629-1	RING LUG, (#16 BLUE) #6 SCREW	EA	5.0000
043	6044-0723-0	LUG RING #6 RED	EA	1.0000
044	6305-0010-0	WIRE 10GA G-Y AWM 133STR 600V	FT	6.0000
045	6044-0403-0	RING 112 10-12GA ETC C-201-12X	EA	1.0000
046	6044-0701-1	LUG RING INSULATED #10 X 16-14 AWG	EA	1.0000
047	1222-2260-0	SCREW, CAP HEX 3/8-16 X 1.25 ZC	EA	4.0000
048	1222-2660-0	SCREW, CAP HEX 1/2-13 X 1.25 ZC	EA	4.0000
049	1222-2256-0	SCREW, CAP HEX 3/8-16 X .625 ZC	EA	6.0000
050	1263-2600-0	NUT, HEX 1/2-13 UNC CAD OR = PLATED STL	EA	4.0000
051	1377-2200-0	WASHER, FLAT SAE 3/8 SST	EA	14.0000
052	1373-2200-0	WASHER, SPRING LOCK 3/8 SST	EA	14.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6790-3 BASE/TETRODE PL/PM 480V SIMBA XX

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
053	1240-1759-0T	SCREW M BIND 2 10-32X1.00	ZC	EA	4.0000
054	1240-1756-0	SCREW M BIND 2 10-32X.625	ZC	EA	4.0000
055	1240-1757-0	SCREW, BIND HD 10-32 X .750	ZC	EA	4.0000
056	1258-1751-0	NUT, KEP 10-32	ZC	EA	10.0000
057	1377-1600-0	WASHER, FLAT SAE #10	SST	EA	8.0000
058	1975-0010-0	WASHER EXT LOCK #10 ZC		EA	12.0000
059	1240-1456-0	SCREW, BINDING HEAD 8-32 X .625		EA	10.0000
060	1258-1401-0	NUT, KEP 8-32	ZC	EA	8.0000
061	1975-0008-0	WASHER EXT LOCK # 8 ZINC PL		EA	10.0000
062	1240-1257-0	SCREW, BIND HD SLOTTED 6-32 X .750	ZC	EA	10.0000
063	1258-1201-0	NUT, HEX, KEP, 6-32	ZC	EA	6.0000
064	1975-0006-0	WASHER EXT LOCK # 6 ZINC PL		EA	10.0000
065	1240-0458-0	SCREW M BIND 2 2-56X.875	ZC	EA	4.0000
066	1263-0400-0	NUT MACHINE #2-56	ZC	EA	4.0000
067	1222-1857-0	SCREW, CAP HEX 1/4-20 X .750 UNC	ZC	EA	6.0000
068	1258-1800-0	NUT, KEP 1/4-20	ZC	EA	6.0000
069	1975-0025-0	WASHER EXT LOCK 1/4 ZINC PL		EA	6.0000
070	6641-3712-0	LABEL,VINYL 3/8,C,PANDUIT PCL-037-C		CD	1.0000
071	6641-3724-0	LABEL,VINYL 3/8,O,PANDUIT PCL-037-O		CD	1.0000
072	6641-3722-0	LABEL,VINYL 3/8,M,PANDUIT PCL-037-M		CD	1.0000
073	6641-3729-0	LABEL,VINYL 3/8,T,PANDUIT PCL-037-T		CD	1.0000
074	6641-3728-0	LABEL,VINYL 3/8,S,PANDUIT PCL-037-S		CD	1.0000
075	1373-2600-0	WASHER, SPRING LOCK, 1/2 NOM		EA	4.0000
078B	6044-7330-0	TERMINAL LUG, SOLDER TIN PLATE #8		EA	2.0000
079B	6114-0018-0	TUBING TEFLON #18 NATURAL		IN	1.0000
080	6056-0207-0	FUSE,100AMP,250VAC DUAL ELEM. TIME-DELAY		EA	1.0000
081	6056-0207-1	FUSE HOLDER,61-100AMP,250VAC		EA	1.0000
082	6641-6054-0	LABEL, FUSE, (100A,T), 1" X 1/2"		EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6650-0 PCB, ASSY, H.V. REG-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
000	0040-6624-0	SCHEMATIC, H.V.REG/CNTRL GRID-SIMBA 2	EA	0.0000
001	0040-6643-0	FAB, PCB, H.V. REGULATOR-SIMBA 2	EA	1.0000
005	6844-8030-0	IC, OPTICAL ISO DARLINGTON OUTPUT *ESD U1-U4,U7-U9	EA	7.0000
006	6844-0355-0	IC, OP AMP, MONOLITHIC JFET INPUT *ESD U26-U28,U30-U32,U34, U37,U38,U42,U43	EA	11.0000
007	6928-3240-0	IC, DUAL BI-MOS OP AMP *ESD U29,U33,U40	EA	3.0000
008	6928-3290-0	IC,DUAL BIMOS VOLATAGE COMPARATOR *ESD U35,U36	EA	2.0000
009	6928-0003-0	IC, INSTRUMENTATION AMPLIFIER *ESD U24,U25	EA	2.0000
010	6844-1404-0	IC, VOLTAGE REFERENCE, 10VDC *ESD U41	EA	1.0000
012	6844-0555-0	IC, PRECISION TIMER *ESD U13	EA	1.0000
013	6844-9320-0	IC, SOCKET NARROW, 20 CONTACT U10-U12 (SOCKETS)	EA	3.0000
014	6844-0050-0	IC, PROGRAM LOGIC ARRAY 8 IN 10 I/O *ESD U12	EA	1.0000
015	6844-0159-0	IC, PROGRAM LOGIC SEQUENCER *ESD U10,U11	EA	2.0000
016	6824-4010-0	TRANSISTOR, NPN, LOW POWER *ESD Q3-Q10	EA	8.0000
017	6810-9140-0	DIODE, SWITCHING, 100V 75mA *ESD CR1,CR19,CR21-CR26	EA	8.0000
018	6814-4446-0	DIODE, GENERAL PURPOSE,150 mA, 100V *ESD CR5-CR14,CR17,CR18	EA	12.0000
019	6838-0011-1	DIODE, TVS, BIDIRECTIONAL, 15Vwm *ESD CR15,CR16,CR20,CR29	EA	4.0000
020	6838-9410-0	DIODE, RECTIFIER, 800V, 1A *ESD CR28, CR37	EA	2.0000
021	6814-7330-0	DIODE ZENER, 5.1 V, 1 W *ESD CR27	EA	1.0000
022	6838-0015-0	DIODE, TVS, UNIDIRECTIONAL, 13.6Vwm *ESD CR2,CR35,CR36	EA	3.0000
023	6841-1340-0	LED, HIGH EFFICENCY RED DS1-6,DS9	EA	7.0000
024	6960-0028-0	CAPACITOR, .01uF, 100VDC, 20% C14	EA	1.0000
027	6505-0007-0	CAPACITOR, 10uF, 35VDC, 20% C17,C31,C61,C63,C65	EA	5.0000
028D	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C4-7,10-13,16,26-30,32,35,37 C40,44,45,47,49,57,58,62,64 C8,19-25,33,34,38,39 C41-43,46,48,50-56,59,60,66-68	EA	56.0000
029	6528-1035-0	CAPACITOR, TANTALUM, 1MF 35VDC, +/-10% C15,C18	EA	2.0000
030	6054-0047-0	INDUCTOR, .47uH, 10% L1-L10,L13-L16	EA	14.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6650-0 PCB, ASSY, H.V. REG-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
031	6404-4592-0	RESISTOR, CC/CF, 100 OHM, 1/4W, 5% R22-R25,R33,R34,R83, R84	EA	8.0000
032	6404-4610-0	RESISTOR, CF/CC, 470 OHM, 1/4W, 5% R71	EA	1.0000
033	6404-4617-0	RESISTOR, CF/CC, 820 OHM, 1/4W, 5% R4	EA	1.0000
034	6448-1432-0	RESISTOR, MF, 2K, 1/8W, 1% R106	EA	1.0000
035	6404-4641-0	RESISTOR, CF/CC, 4.7K, 1/4W, 5% R65	EA	1.0000
036	6404-4643-0	RESISTOR, CF/CC, 5.1K, 1/4W, 5% R57,R105	EA	2.0000
037	6404-4650-1	RESISTOR, CF/CC, 8.2K, 1/4, 5% R103	EA	1.0000
038	6404-4654-0	RESISTOR, CF/CC, 10K, 1/4W, 5% R14,20,30,32,37 R53,R56,58,73,74, R79,80,82,100,104	EA	15.0000
039	6404-4661-0	RESISTOR, CF/CC, 20K, 1/4W, 5% R38,R86	EA	2.0000
040	6404-4670-0	RESISTOR, CF/CC, 39K, 1/4W, 5% R55	EA	1.0000
041	6404-4675-0	RESISTOR, CF/CC, 47K OHM, 1/4W, 5% R47	EA	1.0000
042	6404-4677-0	RESISTOR, CF/CC, 51K, 1/4W, 5% R43,R63	EA	2.0000
043	6404-4690-0	RESISTOR, CF/CC, 100K, 1/4W, 5% R52,R64,R66,R81	EA	4.0000
044	6404-4712-0	RESISTOR, CF/CC, 470K, 1/4W, 5% R45,R48,R70	EA	3.0000
045	6404-4725-0	RESISTOR, CF/CC, 1MEG, 1/4W, 5% R13,R19,R72,R78	EA	4.0000
046	6403-0033-0	RESISTOR, MF, 10K, 1/8W, 1% R7,17,39,40,49, 50,59,61,102	EA	9.0000
047	6403-0018-0	RESISTOR, MF, 20K, 1/8W, 1% R11	EA	1.0000
048	6448-5301-0	RESISTOR, MF, 30.1K, 1/4W, 1% R77	EA	1.0000
049	6484-0698-0	RESISTOR, MF, 69.8K, 1/8W, 1% R76	EA	1.0000
050	6484-0091-0	RESISTOR, MF, 90.9K, 1/8W, 1% R12,R18	EA	2.0000
051	6403-0020-0	RESISTOR, MF, 100K, 1/8W, 1% R26-29,41,42,60,62, 68	EA	9.0000
052	6484-0147-0	RESISTOR, MF, 147K, 1/8W, 1% R31	EA	1.0000
053	6484-0267-0	RESISTOR, MF, 267K, 1/8W, 1% R36,R101	EA	2.0000
054	6400-0460-0	RESISTOR NETWORK 5 ISO RESISTORS 470 OHM	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-6650-0 PCB, ASSY, H.V. REG-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
055	6400-0239-0	RESISTOR NETWORK, 4 ISO RESISTORS 1K RN5	EA	2.0000
056	6400-0054-0	RESISTOR NETWORK, 4 ISO RESISTORS 3.3K RN7,RN9	EA	2.0000
057	6400-0562-0	RESISTOR NETWORK 4 ISO RESISTORS 5.6K RN8,RN10	EA	1.0000
058	6400-0109-0	RESISTOR NETWORK 5 ISO RESISTORS 6.8K RN4	EA	1.0000
059	6400-0013-0	RESISTOR NETWORK 4 ISO RESISTORS 10K RN6	EA	1.0000
060	6046-7266-0	POTENTIOMETER, TRIMMER, CERMET, 10K RN3	EA	1.0000
061	6046-7940-0	POTENTIOMETER, TRIMMER, 20K R15,R21	EA	2.0000
062	6046-0066-0	POTENTIOMETER, TRIMMER, CERMET, 100K R10,R16	EA	2.0000
063	6046-0067-0	POTENTIOMETER, TRIMMER, CERMET 200K R35,R51,R54,R85	EA	4.0000
064	6056-9068-0	FUSE HOLDER VERTICAL MNT 5A AT 125V R75	EA	1.0000
065	6056-2731-0	FUSE, MICRO, FAST ACTING 1A, 125V F1,F2,F4	EA	3.0000
066	6056-2733-0	FUSE, MICRO, FAST ACTING, 3A, 125V F4	EA	1.0000
067	6047-0012-0	CONN, HEADER, LATCH/EJECT, 50 PIN PC MNT F1,F2	EA	2.0000
068	6047-0018-0	KEY, POLARIZING FOR 3M HEADERS J1	EA	1.0000
069	6047-4544-2	CONN, HEADER, POLARIZED, 24 POSITION HEADER KEY	EA	2.0000
070	6047-7224-1	CONN, HEADER UNSHROUDED 1 PIN PC MNT J2	EA	1.0000
071	6047-7224-3	CONN, HEADER, UNSHROUDED 3 PIN PC MNT TP1,TP6-12	EA	8.0000
072	6047-7224-4	CONN, HEADER, UNSHROUDED, 4 PIN PC MNT (RANGE SELECT)	EA	2.0000
073	6047-2610-0	JUMPER HOUSED, 2 POSITION, .10 CENTERS TP2-TP5	EA	1.0000
074	6404-4631-0	RESISTOR, CF/CC, 2.2K, 1/4W, 5% (RANGE SELECT=JP1,JP2)	EA	2.0000
075	6400-7850-0	RESISTOR NETWORK, 4 ISO RESISTORS 2.2K R3,R8	EA	2.0000
076	6404-4621-0	RESISTOR, CF/CC, 1.2K, 1/4W, 5% RN1,RN2	EA	1.0000
077D	6503-3350-1	CAPACITOR, .33 uF, 50VDC, 20% R5	EA	4.0000
078	6516-1908-0	CAPACITOR, .001uF, 630 VDC, 5% C1,C2,C3,C9	EA	1.0000
079	6404-4665-0	RESISTOR, CF/CC, 27K, 1/4W, 5% C53	EA	1.0000
080	6404-4665-0	RESISTOR, CF/CC, 27K, 1/4W, 5% R67	EA	1.0000
081	SUBCON19	SUBCONTRACTED LABOR-PCB ASSY 0040-6650-0	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-3443-0 PCB, ASSY, CONTROL GRID-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
000	0040-6624-0	SCHEMATIC, H.V.REG/CNTRL GRID-SIMBA 2		EA	0.0000
001	0040-3433-0	FAB, PCB, CONTROL GRID-SIMBA 2		EA	1.0000
002	6060-6169-0	HEATSINK, EXTRUSION, SINGLE DEVICE TO-3		EA	1.0000
003	6827-0285-0	TRANSISTOR, POWER MOSFET, N CHANNEL *ESD Q2		EA	1.0000
004	6922-0918-0	DIODE, RECTIFIER, 3A, 1KVrrm CR31	*ESD	EA	1.0000
005	6840-1922-0	DIODE, ZENER 200V, 400mW CR33	*ESD	EA	1.0000
006	6814-7360-0	DIODE, ZENER, 6.8VDC, 1W CR32	*ESD	EA	1.0000
007	6404-4670-0	RESISTOR, CF/CC, 39K, 1/4W, 5% R91		EA	1.0000
008	6405-4636-0	RESISTOR, CC, 3.3K, 1/2W, 5% R97		EA	1.0000
009	6407-4605-0	RESISTOR, CC, 330 OHM, 2W, 5% R96		EA	1.0000
010	6826-6520-0	TRANSISTOR, PNP, HIGH VOLTAGE 350V *ESD Q1		EA	1.0000
011	6503-6010-2	CAPACITOR, .001uF, 6KVDC, 10% C72		EA	1.0000
012	6405-4735-0	RESISTOR,CC, 2.2M, 1/2W, 5% R99		EA	1.0000
013	6425-2050-0	RESISTOR, WW, 50K, 20W, 5% R98		EA	1.0000
014	6407-4561-0	RESISTOR, WW, 10 OHM, 2W, 5% R95		EA	1.0000
015	6409-4100-0	RESISTOR, WW, 100 OHM, 5W, 5% R94		EA	1.0000
016	6406-4692-0	RESISTOR, CC, 120K, 1W, 5% R93,R92		EA	2.0000
017	6404-4621-0	RESISTOR, CF/CC, 1.2K, 1/4W, 5% R89,90		EA	2.0000
018	6404-4610-0	RESISTOR, CF/CC, 470 OHM, 1/4W, 5% R88		EA	1.0000
019	6406-4592-0	RESISTOR, CC, 100 OHM, 1W, 5% R87		EA	1.0000
020	6503-0339-0	CAPACITOR, .01uF, 1KVDC, +100%/-0% C73		EA	1.0000
021	6505-1963-0	CAPACITOR, 10uF, 600VDC C71		EA	1.0000
022	6505-0007-0	CAPACITOR, 10uF, 35VDC, 20% C70		EA	1.0000
023	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C67,68,69		EA	3.0000
024	6517-0715-0	CAPACITOR, 0.1uF, 800VDC, 5% C66		EA	1.0000
025	6054-0047-0	INDUCTOR, .47uH, 10% L11,L12		EA	2.0000
026	6842-0110-0	RECTIFIER BRIDGE 2A, 600V BR1	*ESD	EA	1.0000
027	6922-0421-0	VARISTOR, METAL OXIDE	*ESD	EA	2.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-3443-0 PCB, ASSY, CONTROL GRID-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
		V1,V2			
028	6841-3700-0	I.C. OPTICAL COUPLER AC/DC TO LOGIC	*ESD	EA	1.0000
		U43			
029	6844-8030-0	IC, OPTICAL ISO DARLINGTON OUTPUT	*ESD	EA	2.0000
		U44,U45			
030	6814-7400-0	DIODE, ZENER, 10VDC, 1W	*ES	EA	1.0000
		CR30			
031	6047-4544-4	CONN, HEADER, POLARIZED, 14 POSITION		EA	1.0000
		J3			
032	6960-1287-0	TERMINAL, PCB QUICK DISCONNECT .250 TAB		EA	2.0000
		TB1,TB2			
033	6056-0016-0	FUSE, PICO, FAST ACTING, 1A, 125V		EA	1.0000
		F3			
035	6841-1340-0	LED, HIGH EFFICENCY RED		EA	2.0000
		DS10,DS11			
036	6047-0073-0	SOCKET, TEST, PC MOUNT		EA	2.0000
037	6039-0002-0	INSULATOR, MICA, TO-3		EA	1.0000
038	1240-1254-0	SCREW, BIND HD SLOTTED 6-32 X .375	ZC	EA	4.0000
039	1240-1255-0	SCREW, BIND HD SLOTTED 6-32 X .500	ZC	EA	2.0000
040	1258-1201-0	NUT, HEX, KEP, 6-32	ZC	EA	6.0000
041	6348-0371-5	CABLE TIE, STA-STRAP 5.3in LONG		EA	1.0000
042	SUBCON15	SUBCONTRACTED LABOR-PCB ASSY 0040-3443-0		EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0610-1653-0 PCB, ASSY, SCREEN BIAS CV-20 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
000	0040-3853-0	SCHEMATIC, SCREEN BIAS CV-20	EA	0.0000
001	0610-1643-0	FAB, PCB, SCREEN BIAS CV-20	EA	1.0000
002	6047-0302-0	CONN, HEADER, DETENT LOCK, 2 PIN PC MNT J2	EA	1.0000
003	6047-0069-0	CONN, HEADER, LOCKING, 10 PIN PC MNT J1	EA	1.0000
004	6960-1287-0	TERMINAL, PCB QUICK DISCONNECT .250 TAB TB1,TB2	EA	2.0000
005	6404-4560-0	RESISTOR, CF/CC, 10 OHM, 1/4W, 5% R4,5	EA	2.0000
006	6407-4568-0	RESISTOR, CC, 20 OHM, 2W, 5% R9,10	EA	2.0000
007	6406-4592-0	RESISTOR, CC, 100 OHM, 1W, 5% R8	EA	1.0000
008	6407-4690-0	RESISTOR, CC, 100K, 2W, 5% R2,3,6,7	EA	4.0000
009	6453-1772-0	RESISTOR, WW, 50K, 12W, 5% R1,11	EA	2.0000
010	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C3	EA	1.0000
011	6517-0715-0	CAPACITOR, 0.1uF, 800VDC, 5% C4	EA	1.0000
012	6505-1963-0	CAPACITOR, 10uF, 600VDC C1,2	EA	2.0000
013	6922-0320-0	VARISTOR, METAL OXIDE, TVS *ESD MOV-2	EA	1.0000
014	6922-1000-0	VARISTOR, METAL OXIDE, TVS *ESD MOV-1	EA	1.0000
015	6814-7400-0	DIODE, ZENER, 10VDC, 1W *ES CR1	EA	1.0000
016	6814-7470-0	DIODE, ZENER, 20VDC, 1W, 5% *ESD CR2,3	EA	2.0000
017	6922-0760-0	DIODE, RECTIFIER, IKV, 6A *ESD CR4,CR5	EA	2.0000
018	6841-3700-0	I.C. OPTICAL COUPLER AC/DC TO LOGIC *ESD U1	EA	1.0000
019	6348-0371-5	CABLE TIE, STA-STRAP 5.3in LONG	EA	2.0000
020	SUBCON24	SUBCONTRACTED LABOR-PCB ASSY 0610-1653-0	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-7040-0 GUN I/F, 1GUN-SIMBA XX, TEMESCAL LOGO

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-7034-0	SCHEMATIC, GUN INTERFACE	EA	0.0000
002	0040-7050-0	HARNESS,GUN INTERFACE-SIMBA 2A	EA	1.0000
003	0040-2823-0	FAB, FT PNL COVER,GUN I/F, SIMBA 2	EA	1.0000
004	0040-6930-0	PANEL, FRONT, GUN I/F TEMESCAL LOGO	EA	1.0000
005	0040-6940-0	FAB,REAR PANEL GUN I/F	EA	1.0000
006	0040-6950-0	FAB,RIGHT SIDE PANEL GUN I/F	EA	1.0000
007	0040-7020-0	FAB,BASEPLATE GUN I/F	EA	1.0000
008	0040-2843-0	FAB, CORNER POST, CARD CAGE GUN I/F	EA	4.0000
009	0040-6960-0	FAB,INTERNAL PNL NO.1 GUN I/F	EA	1.0000
010	0040-6970-0	FAB,INTERNAL PNL NO.2 GUN I/F	EA	1.0000
011	0040-2714-0	PCB, ASSY, GUN CNTRL BKPLANE-SIMBA2*ESD	EA	1.0000
012	6950-0005-0	CARD GUIDE #RAD4125 UNITRACK	EA	12.0000
013	0040-2423-0	PCB, ASSY, GUN DRIVER-SIMBA 2 *ESD	EA	1.0000
014	6054-2412-0	TRANSFORMER DUAL PRI 24/12VDC SECONDARY	EA	1.0000
015	6041-1455-D24	RELAY, FLANGE MOUNT, 3PDT, 24VDC COIL	EA	3.0000
016	6260-8500-0	BLOWER, PAMOTOR #8500N	EA	1.0000
017	6024-4205-0	PWR SUPPLY 5V 2A LAMBDA LVS-42E-5	EA	1.0000
018	6024-4415-0	PWR SPLY +15VDC 1.7A LAMBDA LVS44-15B	EA	2.0000
019	0040-7000-0	FAB,TOP/BOTTOM CARDCAGE GUN I/F	EA	2.0000
020	0040-7010-0	FAB,TOP/SIDE COVER GUN I/F	EA	1.0000
021	0040-7150-0	FAB,PNL,BLANK OFF,GUN I/F 2A	EA	2.0000
023	9034-0012-0	FILTER.25 X 3.14 X 3.14 AL FIL	EA	1.0000
024	6841-0019-1	CURRENT SENSOR 0-100A WITH GND SCH	EA	1.0000
025	6041-2630-0	RELAY HV SPDT 26.5VDC COIL KILOVAC H8	EA	2.0000
026	6468-4623-0	1K 25W OHMITE 0205	EA	3.0000
027	6040-2613-0	STANDOFF, CERAMIC THREADED CANNOT BE TAPPED THRU	EA	4.0000
028	0607-4772-2	BUS BAR FABRICATION	EA	1.0000
029	6040-8172-0	STANDOFF 8-32 X 1-3/4 LG PHENOLIC	EA	2.0000
030	0040-6980-0	FAB,POST CORNER GUN I/F	EA	5.0000
031	6047-0001-0	JACK SOCKET ASSEMBLY	EA	3.0000
032	0040-6990-0	FAB,BAR CARDCAGE SUPPORT GUN I/F	EA	2.0000
033	6831-0200-0	SCBA-2 BRIDGE RECTIFIER, SINGLE PHASE,	EA	1.0000
034	6048-6003-0	CAPACITOR BRACKET MALLORY #VR-3	EA	1.0000
037	6405-4675-0	RESISTOR 47K 1/2W 5%	EA	1.0000
038	0206-4471-2T	GND STUD	EA	1.0000
039	1760-1800-0	NUT, HEX 1/4-20 BRASS	EA	1.0000
040	1778-1800-0	WASHER, FLAT 1/4 BRASS	EA	1.0000
042	1924-1254-0	SCREW C BUTT 6-32 X .375 BLACK	EA	8.0000
043	1924-1454-0	SCREW, SOC HD BUTTON #8-32 X .375 LG	EA	6.0000
044	1222-1855-0	SCREW, CAP HEX 1/4-20 X .500 ZC	EA	4.0000
045	1240-1755-0	SCREW, BIND HD 10-32 X .500 ZC	EA	4.0000
046	1240-1454-0	SCREW, BIND HD 8-32 X .375 ZC	EA	14.0000
047	1098-1600-0	ROD THREADED 8-32 (2FT LG) NYLON	EA	1.0000
048	1240-1252-0T	SCREW M BIND 2 6-32X.250 ZC	EA	12.0000
049	1240-1254-0	SCREW, BIND HD SLOTTED 6-32 X .375 ZC	EA	30.0000
053	1240-0854-0	SCREW, MACHINE, BINDING HEAD 4-40 X .375	EA	25.0000
054	1258-1800-0	NUT, KEP 1/4-20 ZC	EA	4.0000
055	1258-1201-0	NUT, HEX, KEP, 6-32 ZC	EA	24.0000
056	1258-0800-0	NUT, HEX, KEP, 4-40 ZC	EA	25.0000
057	1975-0025-0	WASHER EXT LOCK 1/4 ZINC PL	EA	2.0000
058	1975-0010-0	WASHER EXT LOCK #10 ZC	EA	4.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-7040-0 GUN I/F, 1GUN-SIMBA XX, TEMESCAL LOGO

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
059	1975-0008-0	WASHER EXT LOCK # 8 ZINC PL	EA	15.0000
060	1975-0006-0	WASHER EXT LOCK # 6 ZINC PL	EA	28.0000
061	1975-0004-0	WASHER EXT LOCK # 4 ZINC PL	EA	24.0000
062	6056-3440-2	FUSEHOLDER 24V INDICATING	EA	1.0000
063	6056-3098-0	FUSE 3AG-5A 240V SLO-BLO	EA	1.0000
064	1258-1401-0	NUT, KEP 8-32 ZC	EA	2.0000
065	1083-0250-0	WASHER,SHOULDER #8 .250 OD NYLON	EA	6.0000
066	6156-0121-0	SWITCH,SPDT ROCKER C&K121/J12S205QA	EA	1.0000
067	6040-5004-0	STANDOFF PCB SNAP-IN 1/4" SPCS-4	EA	12.0000
069	1242-3000-0	SEAL, KNOCKOUT, 1/2"	EA	2.0000
070	6838-9410-0	SCREW M ROND TAMPERPROOF 6-32 X.375	EA	2.0000
071	6300-1522-0	DIODE, RECTIFIER, 800V, 1A *ESD	EA	2.0000
073	0040-5433-0	WIRE 22GA HV 15KV WHT ROWE R7901522	FT	25.0000
074	6505-7500-0	PCB, ASSY, GUN CONTROL-SIMBA 2 *ESD	EA	1.0000
075	0040-3803-1	CAPACITOR, 7500uF 50VDC -10/+75%	EA	1.0000
076	0040-3803-2	CABLE ASSY,50PT D 11"	EA	1.0000
077	0040-3803-3	CABLE ASSY,50PT D 14"	EA	1.0000
080	1042-1455-0	CABLE ASSY,50PT D 17"	EA	1.0000
081	1060-1401-0	SCREW,BINDING HD,SLTD 8-32 X.500 BLK NYL	EA	8.0000
084	6156-9322-0	NUT 8-32 BLACK NYLON	EA	10.0000
085	6149-0461-0	SWITCH, LIMIT	EA	1.0000
086	6149-2770-1	TERMINAL STRIP 115/N/G PHX#0461018	EA	5.0000
087	6149-2215-0	END COVER D-UKK3/5 PHX#2770024	EA	1.0000
088	6149-2772-0	BLANK MARKER STRIP 10SECT ZB5	EA	2.0000
089	6149-0201-0	END CLAMP TYPE E/UK	EA	2.0000
090	6950-3575-0	BRIDGE, INSERT EB10-6(3)	EA	1.0000
092	1252-0837-0	RAIL MOUNTING FLAT DIN EN	FT	1.0000
093	0833-8731-1	SCREW ROUND HEAD PHILLIPS 8-32 3/8 LG	EA	9.0000
094	6641-7236-4	HIGH VOLTAGE LABEL (ENGLISH)	EA	1.0000
095	6641-6000-0	LABEL-DANGER HV-72364	EA	3.0000
096	6040-8184-0	LABEL, GROUND, IEC417 NO.5017-.5IN DIA.	EA	1.0000
098	1377-1200-0	STANDOFF 1/4OD 4.00LG X 6-32 ALUM	EA	1.0000
099	6641-9063-0	WASHER, FLAT SAE #6 SST	EA	4.0000
100	6641-9064-0	LABEL WARNING HI VOLT INT'L SMALL	EA	2.0000
101	1241-1256-0	LABEL WARNING HI VOLTAGE INT. LARGE	EA	2.0000
103	1240-1752-0	SCREW M FLAT 2 6-32X.625 ZC	EA	4.0000
104	1222-1858-0	SCREW, BIND HD 10-32 X .250 ZC	EA	4.0000
105	1222-1859-0	SCREW, CAP HEX 1/4-20 X .875 ZC	EA	1.0000
106	1378-1800-0	SCREW, CAP HEX 1/4-20 X 1.00 ZC	EA	1.0000
107	1240-1259-0	WASHER, FLAT 1/4 SST	EA	8.0000
108	6261-2020-0	SCREW, BIND HD 6-32 X 1.00 ZC	EA	2.0000
109	6056-3025-0	FILTER RFI 20AMP	EA	1.0000
110	6056-8102-0	FUSE, SLO BLO, 3AG 2.5A, 250VAC	EA	1.0000
111	6641-6055-0	FUSE BLOCK, 300V FOR 1/4 X 1 1/4 FUSE	EA	1.0000
		LABEL, FUSE, (2.5A,T), 1" X 1/2"	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-2714-0 PCB, ASSY, GUN CNTRL BKPLANE-SIMBA2*ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
000	0040-2684-0	SCHEMATIC, GUN CNTRL BACKPLANE-SIMBA 2	EA	0.0000
001	0040-2704-0	FAB, PCB, GUN CNTRL BACKPLANE-SIMBA 2	EA	1.0000
002	6047-8458-0	CONN, DIN, PRESS FIT, 96 PIN PC MOUNT GUN CTRL 1,2,3	EA	3.0000
003	6047-4544-2	CONN, HEADER, POLARIZED, 24 POSITION GUN DVR 1,2,3	EA	3.0000
004	6047-4544-4	CONN, HEADER, POLARIZED, 14 POSITION BKPLNE PWR	EA	1.0000
005	6047-8458-1	CONNECTOR SHELL 96 PIN GUN CTRL 1,2,3	EA	3.0000
006	6047-8457-0	CONNECTOR, PRESS FIT, 96 PIN PC MOUNT POS PCB 1,2,3	EA	3.0000
007	SUBCON14	SUBCONTRACTED LABOR-PCB ASSY 0040-2714-0	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-5433-0 PCB, ASSY, GUN CONTROL-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
000	0040-5404-0	SCHEMATIC, GUN CONTROL-SIMBA 2		EA	0.0000
001	0040-5423-0	FAB, PCB, GUN CONTROL-SIMBA 2		EA	1.0000
002	6844-0355-0	IC, OP AMP, MONOLITHIC JFET INPUT U1-U4,U13,U14,U21, U22,U24	*ESD	EA	9.0000
003	6928-0003-0	IC, INSTRUMENTATION AMPLIFIER U5	*ESD	EA	1.0000
004	6928-3240-0	IC, DUAL BI-MOS OP AMP U19,U20,U23,U25,U30 U33	*ESD	EA	6.0000
005	6928-3290-0	IC,DUAL BIMOS VOLATAGE COMPARATOR U26	*ESD	EA	1.0000
006	6844-8030-0	IC, OPTICAL ISO DARLINGTON OUTPUT U6-U11,U31,U32	*ESD	EA	8.0000
007	6844-0508-0	IC, CMOS ANALOG MULTIPLEXER, 8 CHAN U12	*ESD	EA	1.0000
008	6844-4073-0	I.C. CMOS TRIPLE 3 INPUT AND GATE U15	*ESD	EA	1.0000
009	6844-4081-0	IC, CMOS QUAD 2 INPUT AND GATE U27	*ESD	EA	1.0000
010	6844-4584-0	IC, MOS HEX SCHIMITT TRIGGER U16,U18,U28	*ESD	EA	3.0000
011	6844-2004-0	IC,MONOLITHIC DARLINGTON TRANS ARRAY U17,U29	*ESD	EA	2.0000
012	6842-0174-0	TRANSISTOR P-CHANNEL JFET Q1-Q3	*ESD	EA	3.0000
013	6810-9140-0	DIODE, SWITCHING, 100V 75mA CR1-CR5,CR17-CR19	*ESD	EA	8.0000
014	6814-4446-0	DIODE, GENERAL PURPOSE,150 mA, 100V CR6,CR7,CR10,CR11, CR13-CR16	*ESD	EA	8.0000
015	6838-0011-1	DIODE, TVS, BIDIRECTIONAL, 15Vwm CR8,CR9,CR12	*ESD	EA	3.0000
016	6841-0051-0	L.E.D. QUAD INDICATOR, RED DS1-DS8		EA	2.0000
017	6841-1340-0	LED, HIGH EFFICENCY RED DS9		EA	1.0000
018	6448-0215-0	RESISTOR, MF, 215 OHM, 1/4W, 1% R6		EA	1.0000
019	6400-0205-0	RESISTOR NETWORK 7 RESISTORS W/COM 5.6K RN1		EA	1.0000
020	6400-0013-0	RESISTOR NETWORK 4 ISO RESISTORS 10K RN5		EA	1.0000
021	6400-1030-0	RESISTOR NETWORK 5 ISO RESISTORS 10K RN2		EA	1.0000
022	6400-0017-0	RESISTOR NETWORK 4 ISO RESISTORS 100K RN6		EA	1.0000
023	6046-8710-1	POTENTIOMETER, TRIMMER, CERMET, 10K R17		EA	1.0000
024	6046-8720-1	POTENTIOMETER, TRIMMER, CERMET, 20K R16		EA	1.0000
025	6046-8750-1	POTENTIOMETER, TRIMMER, CERMET, 50K		EA	2.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-5433-0 PCB, ASSY, GUN CONTROL-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
026	6046-8810-1	POTENTIOMETER, TRIMMER, CERMET, 100K R20,R21	EA	2.0000
027	6403-0020-0	RESISTOR, MF, 100K, 1/8W, 1% R19,R22	EA	10.0000
028	6404-4592-0	RESISTOR, CC/CF, 100 OHM, 1/4W, 5% R23,R24,R49,R52,R53, R54,R67,R70,R71,R73	EA	6.0000
029	6404-4612-0	RESISTOR, CF/CC, 510 OHM, 1/4W, 5% R37-R39,R43-R45	EA	1.0000
030	6404-4621-0	RESISTOR, CF/CC, 1.2K, 1/4W, 5% R62	EA	1.0000
031	6404-4630-0	RESISTOR, CF/CC, 2K, 1/4W, 5% R76	EA	1.0000
032	6404-4643-0	RESISTOR, CF/CC, 5.1K, 1/4W, 5% R15	EA	1.0000
033	6404-4654-0	RESISTOR, CF/CC, 10K, 1/4W, 5% R29,R68,R69,R75	EA	4.0000
034	6046-8825-1	POTENTIOMETER, TRIMMER, CERMET, 250K R10,R11,R25,R26, R46-R48,R57,R59, R61,R65,R66	EA	12.0000
035	6404-4688-0	RESISTOR, CF/CC, 91K, 1/4W, 5% R18	EA	1.0000
036	6404-4690-0	RESISTOR, CF/CC, 100K, 1/4W, 5% R14	EA	1.0000
037	6404-4695-0	RESISTOR, CF/CC, 150K, 1/4W, 5% R7,R5,R12,R27,R28, R30,R34,R35,R36,R41, R42,R50,R40,R60	EA	14.0000
038	6404-4712-0	RESISTOR, CF/CC, 470K, 1/4W, 5% R1,R64	EA	2.0000
039	6404-1000-0	RESISTOR, CF/CC, 10M, 1/4W, 5% R2	EA	1.0000
040	6400-7850-0	RESISTOR NETWORK, 4 ISO RESISTORS 2.2K R9	EA	1.0000
041	6516-1908-0	CAPACITOR, .001uF, 630 VDC, 5% RN3,RN4	EA	2.0000
042	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C1	EA	1.0000
043	6516-0002-0	CAPACITOR, .1uF, 63VDC, 5% C3-C7,C10-C12,C14, C16-C20,C22,C23,C25, C27,C29-C38,C40, C42-C49,C52,C54	EA	39.0000
044	6528-1035-0	CAPACITOR, TANTALUM, 1MF 35VDC, +/-10% C15,C21	EA	2.0000
046	6552-2200-2	CAPACITOR, 2.2uF, 50VDC, 20% C39,C41	EA	2.0000
047	6528-0002-0	CAPACITOR, 10uF, 20VDC, 10% C9	EA	1.0000
048	6505-0007-0	CAPACITOR, 10uF, 35VDC, 20% C2	EA	1.0000
			EA	3.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-5433-0 PCB, ASSY, GUN CONTROL-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
049	6517-1932-0	CAPACITOR, .047uF, 200VDC, 5% C24,C26,C28	EA	1.0000
050	6404-4675-0	RESISTOR, CF/CC, 47K OHM, 1/4W, 5% C8	EA	2.0000
051	6404-4725-0	RESISTOR, CF/CC, 1MEG, 1/4W, 5% R3,R4	EA	2.0000
055	6049-1643-0	CONN, DIN, SHROUDED RIGHT ANGLE 96 PIN R8,R63	EA	1.0000
056	6056-9068-0	FUSE HOLDER VERTICAL MNT 5A AT 125V J1	EA	3.0000
057	6056-2731-0	FUSE, MICRO, FAST ACTING 1A, 125V F1-F3	EA	3.0000
058	6054-0047-0	INDUCTOR, .47uH, 10% F1-F3	EA	12.0000
060	6403-0033-0	RESISTOR, MF, 10K, 1/8W, 1% L1-L12	EA	8.0000
061	6403-0037-0	RESISTOR, MF, 38.3K, 1/8W, 1% R58,R72,R74,R77, R80-R83	EA	1.0000
062	6403-0031-0	RESISTOR, MF, 1K, 1/8W, 1% R78	EA	1.0000
063	6505-0035-0	CAPACITATOR, 22UF, 25V, 20% R79	EA	1.0000
065	6403-0018-0	RESISTOR, MF, 20K, 1/8W, 1% C50	EA	1.0000
066	6403-0147-0	RESISTOR, MF, 147K, 1/8W, 1% R56	EA	1.0000
067	6503-0004-0	CAPACITOR, 10pF, 1KVDC, 10% R13	EA	1.0000
068	6960-0031-0	CAPACITOR, 1uF, 50VDC, 20% C53	EA	2.0000
069	SUBCON13	SUBCONTRACTED LABOR-PCB ASSY 0040-5433-0 C13,C51	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-2553-0 PCB, ASSY, GUN CONTROL-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-2543-0	FAB PCB, GUN CONTROL-SIMBA 2	EA	1.0000
002	6844-0355-0	IC, OP AMP, MONOLITHIC JFET INPUT *ESD U1-U4,U13,U14,U21,U22,U24	EA	9.0000
003	6928-0003-0	IC, INSTRUMENTATION AMPLIFIER *ESD U5	EA	1.0000
004	6928-3240-0	IC, DUAL BI-MOS OP AMP *ESD U19,U20,U23,U25,U30,U33	EA	6.0000
005	6928-3290-0	IC,DUAL BIMOS VOLATAGE COMPARATOR *ESD U26	EA	1.0000
006	6844-8030-0	IC, OPTICAL ISO DARLINGTON OUTPUT *ESD U6-U11,U31,U32	EA	8.0000
007	6844-0508-0	IC, CMOS ANALOG MULTIPLEXER, 8 CHAN *ESD U12	EA	1.0000
008	6844-4073-0	I.C. CMOS TRIPLE 3 INPUT AND GATE *ESD U15	EA	1.0000
009	6844-4081-0	IC, CMOS QUAD 2 INPUT AND GATE *ESD U27	EA	1.0000
010	6844-4584-0	IC, MOS HEX SCHIMITT TRIGGER *ESD U16,U18,U28	EA	3.0000
011	6844-2004-0	IC,MONOLITHIC DARLINGTON TRANS ARRAY*ESD U17,U29	EA	2.0000
012	6842-0174-0	TRANSISTOR P-CHANNEL JFET *ESD Q1-Q3	EA	3.0000
013	6810-9140-0	DIODE, SWITCHING, 100V 75mA *ESD CR1-CR5,CR17-CR19	EA	8.0000
014	6814-4446-0	DIODE, GENERAL PURPOSE,150 mA, 100V *ESD CR6,CR7,CR10,CR11,CR13-CR16	EA	8.0000
015	6838-0011-1	DIODE, TVS, BIDIRECTIONAL, 15Vwm *ESD CR8,CR9,CR12	EA	3.0000
016	6841-0051-0	L.E.D. QUAD INDICATOR, RED DS1-DS8	EA	2.0000
017	6841-1340-0	LED, HIGH EFFICENCY RED DS9	EA	1.0000
018	6448-0215-0	RESISTOR, MF, 215 OHM, 1/4W, 1% R6	EA	1.0000
019	6400-0205-0	RESISTOR NETWORK 7 RESISTORS W/COM 5.6K RN1	EA	1.0000
020	6400-0013-0	RESISTOR NETWORK 4 ISO RESISTORS 10K RN3,RN4,RN5	EA	3.0000
021	6400-1030-0	RESISTOR NETWORK 5 ISO RESISTORS 10K RN2	EA	1.0000
022	6400-0017-0	RESISTOR NETWORK 4 ISO RESISTORS 100K RN6	EA	1.0000
023	6046-8710-1	POTENTIOMETER, TRIMMER, CERMET, 10K R17	EA	1.0000
024	6046-8720-1	POTENTIOMETER, TRIMMER, CERMET, 20K R16	EA	1.0000
025	6046-8750-1	POTENTIOMETER, TRIMMER, CERMET, 50K R20,R21	EA	2.0000
026	6046-8810-1	POTENTIOMETER, TRIMMER, CERMET, 100K R18,R19,R22	EA	3.0000
027	6403-0020-0	RESISTOR, MF, 100K, 1/8W, 1%	EA	10.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-2553-0 PCB, ASSY, GUN CONTROL-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
028	6404-4592-0	R23,R24,R49,R52,R53, R54,R67,R70,R71,R73 RESISTOR, CC/CF, 100 OHM, 1/4W, 5%	EA	6.0000
029	6404-4612-0	R37-R39,R43-R45 RESISTOR, CF/CC, 510 OHM, 1/4W, 5%	EA	1.0000
030	6404-4621-0	R62 RESISTOR, CF/CC, 1.2K, 1/4W, 5%	EA	1.0000
031	6404-4630-0	R76 RESISTOR, CF/CC, 2K, 1/4W, 5%	EA	1.0000
032	6404-4643-0	R15 RESISTOR, CF/CC, 5.1K, 1/4W, 5%	EA	4.0000
033	6404-4654-0	R29,R68,R69,R75 RESISTOR, CF/CC, 10K, 1/4W, 5%	EA	12.0000
035	6404-4688-0	R10,R11,R25,R26,R46-R48, R57,R59,R61,R65,R66 RESISTOR, CF/CC, 91K, 1/4W, 5%	EA	1.0000
036	6404-4690-0	R14 RESISTOR, CF/CC, 100K, 1/4W, 5%	EA	14.0000
037	6404-4695-0	R5,R7,R12,R27,R28,R30,R34, R35,R36,R40,R41,R42,R50,R60 RESISTOR, CF/CC, 150K, 1/4W, 5%	EA	2.0000
038	6404-4712-0	R1,R64 RESISTOR, CF/CC, 470K, 1/4W, 5%	EA	1.0000
039	6404-1000-0	R2 RESISTOR, CF/CC, 10M, 1/4W, 5%	EA	1.0000
041	6516-1908-0	R9 CAPACITOR, .001uF, 630 VDC, 5%	EA	1.0000
042	6960-0030-0	C1 CAPACITOR, 0.1uF, 50VDC, 20%	EA	40.0000
043	6516-0002-0	C3-C7,C10-C14,C16-C20,C22,C23,C25, C27,C29-C38,C40,C42-C49,C52,C53 CAPACITOR, .1uF, 63VDC, 5%	EA	2.0000
044	6528-1035-0	C21,C15 CAPACITOR, TANTALUM, 1MF 35VDC, +/-10%	EA	2.0000
046	6552-2200-2	C39,C41 CAPACITOR, 2.2uF, 50VDC, 20%	EA	1.0000
047	6528-0002-0	C9 CAPACITOR, 10uF, 20VDC, 10%	EA	1.0000
048	6505-0007-0	C2 CAPACITOR, 10uF, 35VDC, 20%	EA	3.0000
049	6517-1932-0	C24,C28,C26 CAPACITOR, .047uF, 200VDC, 5%	EA	1.0000
050	6404-4675-0	C8 RESISTOR, CF/CC, 47K OHM, 1/4W, 5%	EA	2.0000
051	6404-4725-0	R3,R4 RESISTOR, CF/CC, 1MEG, 1/4W, 5%	EA	2.0000
055	6049-1643-0	R8,R63 CONN, DIN, SHROUDED RIGHT ANGLE 96 PIN	EA	1.0000
056	6056-9068-0	J1 FUSE HOLDER VERTICAL MNT 5A AT 125V	EA	3.0000
057	6056-2731-0	F1-F3 FUSE, MICRO, FAST ACTING 1A, 125V	EA	3.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-2553-0 PCB, ASSY, GUN CONTROL-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
058	6054-0047-0	INDUCTOR, .47uH, 10% F1-F3	EA	12.0000
060	6403-0033-0	RESISTOR, MF, 10K, 1/8W, 1% L1-L12	EA	8.0000
061	6403-0037-0	RESISTOR, MF, 38.3K, 1/8W, 1% R58,R72,R74,R77,R80-R83	EA	1.0000
062	6403-0031-0	RESISTOR, MF, 1K, 1/8W, 1% R78	EA	1.0000
063	6505-0035-0	CAPACITATOR, 22UF, 25V, 20% R79	EA	1.0000
064	6503-3350-1	CAPACITOR, .33 uF, 50VDC, 20% C50	EA	1.0000
065	6403-0018-0	RESISTOR, MF, 20K, 1/8W, 1% C51	EA	1.0000
066	6403-0147-0	RESISTOR, MF, 147K, 1/8W, 1% R56	EA	1.0000
067	SUBCON11	SUBCONTRACTED LABOR-PCB ASSY 0040-2553-0 R13	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-2423-0 PCB, ASSY, GUN DRIVER-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
000	0040-9363-0	SCHEMATIC, GUN DRIVER-SIMBA 2	EA	0.0000
001	0040-2413-0	FAB, PCB, GUN DRIVER-SIMBA 2	EA	1.0000
002	6841-3700-0	I.C. OPTICAL COUPLER AC/DC TO LOGIC *ESD U34	EA	1.0000
003	6844-3011-0	IC, OPTICAL TRIAC DRIVER *ESD U25	EA	1.0000
004	6842-2240-0	TRIAC, 40 AMP, 200V *ESD CR20	EA	1.0000
005	6838-0075-0	DIODE, TVS, BIDIRECTIONAL 7.5VDC *ESD CR21	EA	1.0000
006	6505-2200-0	CAPACITOR, .22uF, 400VDC, 5% C54	EA	1.0000
007	6406-4658-0	RESISTOR, CC, 15K, 1W, 5% R84	EA	1.0000
008	6405-4625-0	RESISTOR, CF/CC, 1.2K OHM, 1/2W, 5% R88	EA	1.0000
009	6405-4598-0	RESISTOR, CC, 180 OHMS, 1/2W, 5% R85	EA	1.0000
010	6423-4010-0	RESISTOR, WW, .1 OHMS, 10 W, 5% R87	EA	1.0000
011	6047-4542-2	CONNECTOR, HEADER POLARIZED 12 POSITION J2	EA	1.0000
012	6060-6109-0	HEATSINK, SINGLE DEVICE TO-220	EA	1.0000
013	1240-0854-0	SCREW, MACHINE, BINDING HEAD 4-40 X .375	EA	1.0000
014	1258-0800-0	NUT, HEX, KEP, 4-40 ZC	EA	1.0000
015	6047-0302-0	CONN, HEADER, DETENT LOCK, 2 PIN PC MNT J3	EA	1.0000
016	6517-1934-0	CAPACITOR .22uF, 200VDC, 10% C55	EA	1.0000
017	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C53	EA	1.0000
018	6922-1562-0	VARISTOR, METAL OXIDE, TVS, 130VRMS *ESD V1,V2	EA	2.0000
019	6405-4592-0	RESISTOR, CF/CC, 100 OHM, 1/2W, 5% R86	EA	1.0000
020	SUBCON10	SUBCONTRACTED LABOR-PCB ASSY 0040-2423	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-3563-0 PCB, ASSY, POSITION-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
000	0040-3533-0	SCHEMATIC, POSITION-SIMBA 2		EA	0.0000
001	0040-3553-0	FAB, PCB, POSITION-SIMBA 2		EA	1.0000
002	6824-4030-0	TRANSISTOR, PNP, LOW POWER Q1	*ESD	EA	1.0000
003	6824-4010-0	TRANSISTOR, NPN, LOW POWER Q2	*ESD	EA	1.0000
004	6960-0530-0	TRANSISTOR, N CHANNEL POWER MOSFET Q3	*ESD	EA	1.0000
005	6960-0008-0T	DIODE, CURRENT REGULATOR Q4		EA	1.0000
006	6928-3290-0	IC,DUAL BIMOS VOLATAGE COMPARATOR U1,U2	*ESD	EA	2.0000
007	6844-8030-0	IC, OPTICAL ISO DARLINGTON OUTPUT U3	*ESD	EA	1.0000
008	6928-3240-0	IC, DUAL BI-MOS OP AMP U4,U7,U8	*ESD	EA	3.0000
009	6844-0355-0	IC, OP AMP, MONOLITHIC JFET INPUT U5,U6	*ESD	EA	2.0000
010	6841-1340-0	LED, HIGH EFFICENCY RED DS1		EA	1.0000
011	6840-0001-0	DIODE, RECTIFIER, ULTRAFAST RECOVERY CR1		EA	1.0000
012	6838-0004-0	DIODE, TVS, UNIDIRECTIONAL 45.4Vwm CR2	*ESD	EA	1.0000
013	6838-0005-0	DIODE, TVS, BIDIRECTIONAL, 45.4Vwm CR3	*ESD	EA	1.0000
014	6046-8710-1	POTENTIOMETER, TRIMMER, CERMET, 10K R20		EA	1.0000
015	6838-0150-0	DIODE, TVS BIDIRECTIONAL, 15Vwm CR6	*ESD	EA	1.0000
016	6814-7400-0	DIODE, ZENER, 10VDC, 1W CR7,CR8	*ES	EA	2.0000
017	6054-0047-0	INDUCTOR, .47uH, 10% L1-L3		EA	3.0000
018	6054-6025-4	INDUCTOR, TOROIDAL, 250mH, 24V, 6A L4		EA	1.0000
019	6049-1643-0	CONN, DIN, SHROUDED RIGHT ANGLE 96 PIN J1		EA	1.0000
020	6047-7225-0	CONN, HEADER, UNSHROUDED, 10 PIN PC MNT TP1-TP9		EA	1.0000
021	6960-6013-0	HEATSINK, SINGLE DEVICE, TO-220 CR1,Q3		EA	2.0000
022	6348-0371-5	CABLE TIE, STA-STRAP 5.3in LONG L4		EA	2.0000
023	6056-2735-0	FUSE, MICRO, FAST ACTING 5A, 125V F1		EA	1.0000
024	6056-2731-0	FUSE, MICRO, FAST ACTING 1A, 125V F2,F3		EA	2.0000
025	6056-9068-0	FUSE HOLDER VERTICAL MNT 5A AT 125V F1-F3		EA	3.0000
026	6442-3971-0	RESISTOR, WW, .25 OHM, 5W, 1% R52		EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-3563-0 PCB, ASSY, POSITION-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
027	6405-4610-0	RESISTOR, CC, 470 OHM, 1/2W, 5% R17	EA	1.0000
028	6046-8810-1	POTENTIOMETER, TRIMMER, CERMET, 100K R18,19,21,22	EA	4.0000
029	6448-5001-0	RES. 1% RN55D 1K OR RN60D R39	EA	1.0000
030	6484-0033-0	RESISTOR, MF, 3.32K, 1/8W, 1% R24,R28	EA	2.0000
032	6484-0001-0	RESISTOR, MF, 16.2K, 1/8W, 1% R43	EA	1.0000
033	6484-0049-9	RESISTOR, MF, 49.9K, 1/8W, 1% R26,R27,R36	EA	3.0000
034	6484-0751-0	RESISTOR, MF, 75K, 1/8W, 1% R42	EA	1.0000
035	6403-0020-0	RESISTOR, MF, 100K, 1/8W, 1% R25,R29,R31,R45-48	EA	7.0000
036	6484-0201-0	RESISTOR, MF, 200K, 1/8W, 1% R40	EA	1.0000
037	6404-4560-0	RESISTOR, CF/CC, 10 OHM, 1/4W, 5% R4,R5	EA	2.0000
038	6404-4592-0	RESISTOR, CC/CF, 100 OHM, 1/4W, 5% R33,R37	EA	2.0000
039	6404-4610-0	RESISTOR, CF/CC, 470 OHM, 1/4W, 5% R41	EA	1.0000
040	6404-4643-0	RESISTOR, CF/CC, 5.1K, 1/4W, 5% R1,2,3,14,15	EA	5.0000
041	6404-4654-0	RESISTOR, CF/CC, 10K, 1/4W, 5% R7,8,11,12,38	EA	5.0000
042	6404-4675-0	RESISTOR, CF/CC, 47K OHM, 1/4W, 5% R34	EA	1.0000
043	6404-4682-0	RESISTOR, CF/CC, 68K, 1/4W, 5% R13	EA	1.0000
044	6403-0033-0	RESISTOR, MF, 10K, 1/8W, 1% R30,R35,R44,R49,R50	EA	5.0000
045	6404-4731-0	RESISTOR, CF/CC, 2MEG, 1/4W, 5% R9,R10	EA	2.0000
046	6505-0003-0	CAPACITOR, 240uF, 40VDC, -10%/+75% C7	EA	1.0000
047	6505-0007-0	CAPACITOR, 10uF, 35VDC, 20% C13,C15	EA	2.0000
048	6516-0686-0	CAPACITOR, 6.8uF, 100VDC, 10% C26	EA	1.0000
049	6528-2250-0	CAPACITOR, 2.2uF, 50V, 10% C1	EA	1.0000
050	6528-1035-0	CAPACITOR, TANTALUM, 1MF 35VDC, +/-10% C2	EA	1.0000
051	6516-0002-0	CAPACITOR, .1uF, 63VDC, 5% C20	EA	1.0000
052	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C3-C6,C8-C12,C16-C19 C21,C23-25,C14	EA	18.0000
053	6503-0501-3	CAPACITOR, 500pF, 100VDC, 5% C22	EA	1.0000
054	6403-0049-0	RESISTOR, MF, 4.99K, 1/8W, 1% R51	EA	1.0000
055	1258-0800-0	NUT, HEX, KEP, 4-40 ZC	EA	2.0000
056	1240-0852-0	SCREW, MACHINE, BINDING HEAD 4-40X.250	EA	2.0000
057	SUBCON16	SUBCONTRACTED LABOR-PCB ASSY 0040-3563-0	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-3583-0 CONTROL, HV/GUN REMOTE, SIMBA 2 S/N

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
001	0040-2560-0	FRONT PNL, HV/GUN CONT,SIMBA 2		EA	1.0000
002	0040-2603-0	FAB, REAR PNL, HV/GUN,CONT SIMBA 2		EA	1.0000
003	0040-4873-1	PCB ASSY,H.V. DISPLAY-SIMBA 2	*ESD	EA	1.0000
004	0040-4873-0	PCB, ASSY, GUN DISPLAY-SIMBA 2	*ESD	EA	1.0000
005	0040-3602-0	HARNESS,H.V. CONT		EA	1.0000
006	0040-3612-0	HARNESS,GUN CONT		EA	1.0000
007	6156-1504-0	4073-1 ACE SWITCH LOCK **KEYED ALIKE**		EA	1.0000
008	6041-1062-0	RELAY 24VDC STUD P&B R10-E6-X2-V700		EA	4.0000
010	6700-0002-0	METER DIGITAL 3-1/2 DIGIT		EA	2.0000
013	6040-9797-0	STDOFF 6-32 X 5/8 AMATOM 9797-A0632		EA	6.0000
014	6040-8189-0	STANDOFF 1/4ROUND 5-1/4 6-32		EA	6.0000
015	6046-3590-1	POT 10 TURN 100K 2W BOURNS 3590S		EA	2.0000
016	6707-0585-0	KNOB COUNTING BLACK W/BRAKE		EA	1.0000
017	6047-7104-0	411 CLARODIAL COUNTING DIAL		EA	1.0000
018	6150-5001-0	KNOB, 1/8 DIA SHAFT		EA	2.0000
019	6156-4328-0	SWITCH FRAME,SNAP-IN BLK		EA	4.0000
020	6156-4846-0	SWITCH CAP,BLACK C&K 484602000		EA	4.0000
021	1924-1254-0	SCREW C BUTT 6-32 X .375 BLACK		EA	6.0000
022	1240-1254-0	SCREW, BIND HD SLOTTED 6-32 X .375	ZC	EA	14.0000
023	1258-1201-0	NUT, HEX, KEP, 6-32	ZC	EA	16.0000
024	1975-0006-0	WASHER EXT LOCK # 6 ZINC PL		EA	6.0000
025	6047-0001-0	JACK SOCKET ASSEMBLY		EA	2.0000
026	6448-0107-0	RESISTOR, MF, 10.7K, 1/4W, 1%		EA	2.0000
027	6484-0095-3	RESISTOR MF 95.3K OHM 1/8W 1%		EA	2.0000
028	6403-0031-0	RESISTOR, MF, 1K, 1/8W, 1%		EA	2.0000
029	6838-9410-0	DIODE, RECTIFIER, 800V, 1A	*ESD	EA	4.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-4873-0 PCB, ASSY, GUN DISPLAY-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
000	0040-4843-0	SCHEMATIC, GUN DISPLAY-SIMBA 2	EA	0.0000
001	0040-4863-0	FAB, PCB, GUN DISPLAY-SIMBA 2	EA	1.0000
002	6928-3240-0	IC, DUAL BI-MOS OP AMP *ESD U1,U8	EA	2.0000
003	6844-4532-0	I.C., CMOS, 8 BIT PRIORITY ENCODER *ESD U2	EA	1.0000
004	6844-4053-0	IC, CMOS, ANALOG MULTIPLEXER 3 CHAN *ESD U3	EA	1.0000
005	6844-2004-0	IC,MONOLITHIC DARLINGTON TRANS ARRAY*ESD U4	EA	1.0000
006	6844-4081-0	IC, CMOS QUAD 2 INPUT AND GATE *ESD U5	EA	1.0000
007	6844-8030-0	IC, OPTICAL ISO DARLINGTON OUTPUT *ESD U6,U7,U9	EA	3.0000
008A	6400-7850-0	RESISTOR NETWORK, 4 ISO RESISTORS 2.2K RN1,RN2	EA	2.0000
009	6400-0257-0	RESISTOR NETWORK, 9 RESISTOR W/COM 100K RN3	EA	1.0000
010	6400-0003-0	RESISTOR NETWORK 4 ISO RESISTORS 100 OHM RN4	EA	1.0000
011	6400-0013-0	RESISTOR NETWORK 4 ISO RESISTORS 10K RN5	EA	1.0000
012	6814-4446-0	DIODE, GENERAL PURPOSE,150 mA, 100V *ESD CR1-CR4	EA	4.0000
013	6841-1340-0	LED, HIGH EFFICENCY RED DS1-DS11	EA	11.0000
014	6046-0066-0	POTENTIOMETER, TRIMMER, CERMET, 100K R1	EA	1.0000
015	6405-4181-0	RESISTOR, MF, 40.2K, 1/4W, 1% R14	EA	1.0000
016	6404-4643-0	RESISTOR, CF/CC, 5.1K, 1/4W, 5% R3,R5	EA	2.0000
017	6405-0004-0	RESISTOR, MF, 32.4K, 1/4W, 1% R2	EA	1.0000
018	6404-4690-0	RESISTOR, CF/CC, 100K, 1/4W, 5% R6,R7	EA	2.0000
019	6156-8121-0T	SWITCH, PUSHBUTTON, MOMENTARY SPDT S3,S4	EA	2.0000
020	6404-4654-0	RESISTOR, CF/CC, 10K, 1/4W, 5% R9,R11	EA	2.0000
021	6400-0017-0	RESISTOR NETWORK 4 ISO RESISTORS 100K RN6	EA	1.0000
022	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C1-C11	EA	11.0000
023	6505-0007-0	CAPACITOR, 10uF, 35VDC, 20% C12	EA	1.0000
024	6047-4548-0	CONN, HEADER, POLARIZED, 8 POSITION J1	EA	1.0000
025	6047-4546-0	CONN, HEADER, POLARIZED, 16 POSITION J2	EA	1.0000
026	6047-4544-2	CONN, HEADER, POLARIZED, 24 POSITION J3	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-4873-0 PCB, ASSY, GUN DISPLAY-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
027	6047-4543-0	CONN, HEADER, POLARIZED, 3 POSITION J4	EA	1.0000
028	6047-7224-2	CONN, HEADER, UNSHROUDED 2 PIN PC MNT JP1,JP2	EA	2.0000
029	6156-0520-0	SWITCH, ROTARY, SINGLE POLE 5 POSITION S2	EA	1.0000
030	6156-0521-0	SWITCH, ROTARY, DOUBLE POLE 3 POSITION S1	EA	1.0000
031	6040-0560-0	SPACER, NYLON, TUBULAR .148 OD, .085 ID DS1-DS11	EA	11.0000
032	6405-4631-0	RESISTOR, CC, 2.2K, 1/2W, 5% R8,R12	EA	2.0000
033	6404-4621-0	RESISTOR, CF/CC, 1.2K, 1/4W, 5% R4,R10	EA	2.0000
034	6404-4631-0	RESISTOR, CF/CC, 2.2K, 1/4W, 5% R13	EA	1.0000
035	SUBCON17	SUBCONTRACTED LABOR-PCB ASSY 0040-4873-0	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-4873-1 PCB ASSY,H.V. DISPLAY-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	0040-4863-0	FAB, PCB, GUN DISPLAY-SIMBA 2	EA	1.0000
002	6928-3240-0	IC, DUAL BI-MOS OP AMP *ESD U1,U8	EA	2.0000
003	6844-4532-0	I.C., CMOS, 8 BIT PRIORITY ENCODER *ESD U2	EA	1.0000
004	6844-4053-0	IC, CMOS, ANALOG MULTIPLEXER 3 CHAN *ESD U3	EA	1.0000
005	6844-2004-0	IC,MONOLITHIC DARLINGTON TRANS ARRAY*ESD U4	EA	1.0000
006	6844-4081-0	IC, CMOS QUAD 2 INPUT AND GATE *ESD U5	EA	1.0000
007	6844-8030-0	IC, OPTICAL ISO DARLINGTON OUTPUT *ESD U6,U7,U9	EA	3.0000
008	6400-7850-0	RESISTOR NETWORK, 4 ISO RESISTORS 2.2K RN1,RN2	EA	2.0000
009	6400-0257-0	RESISTOR NETWORK, 9 RESISTOR W/COM 100K RN3	EA	1.0000
010	6400-0003-0	RESISTOR NETWORK 4 ISO RESISTORS 100 OHM RN4	EA	1.0000
011	6400-0013-0	RESISTOR NETWORK 4 ISO RESISTORS 10K RN5	EA	1.0000
012	6814-4446-0	DIODE, GENERAL PURPOSE,150 mA, 100V *ESD CR1-4	EA	4.0000
013	6841-1340-0	LED, HIGH EFFICENCY RED DS1-5,7,8,10,11	EA	9.0000
014	6046-0066-0	POTENTIOMETER, TRIMMER, CERMET, 100K R1	EA	1.0000
015	6405-4181-0	RESISTOR, MF, 40.2K, 1/4W, 1% R14	EA	1.0000
016	6404-4643-0	RESISTOR, CF/CC, 5.1K, 1/4W, 5% R3,R5	EA	2.0000
017	6405-0004-0	RESISTOR, MF, 32.4K, 1/4W, 1% R2	EA	1.0000
018	6404-4690-0	RESISTOR, CF/CC, 100K, 1/4W, 5% R6,R7	EA	2.0000
019	6156-8121-0T	SWITCH, PUSHBUTTON, MOMENTARY SPDT S3,S4	EA	2.0000
020	6404-4654-0	RESISTOR, CF/CC, 10K, 1/4W, 5% R9,R11	EA	2.0000
021	6400-0017-0	RESISTOR NETWORK 4 ISO RESISTORS 100K RN6	EA	1.0000
022	6960-0030-0	CAPACITOR, 0.1uF, 50VDC, 20% C1-11	EA	11.0000
023	6505-0007-0	CAPACITOR, 10uF, 35VDC, 20% C12	EA	1.0000
024	6047-4548-0	CONN, HEADER, POLARIZED, 8 POSITION J1	EA	1.0000
025	6047-4546-0	CONN, HEADER, POLARIZED, 16 POSITION J2	EA	1.0000
026	6047-4544-2	CONN, HEADER, POLARIZED, 24 POSITION J3	EA	1.0000
027	6047-4543-0	CONN, HEADER, POLARIZED, 3 POSITION	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-4873-1 PCB ASSY,H.V. DISPLAY-SIMBA 2 *ESD

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
		J4		
029	6156-0520-0	SWITCH, ROTARY, SINGLE POLE 5 POSITION	EA	1.0000
		S2		
030	6156-0521-0	SWITCH, ROTARY, DOUBLE POLE 3 POSITION	EA	1.0000
		S1		
031	6040-0560-0	SPACER, NYLON, TUBULAR .148 OD, .085 ID	EA	9.0000
		DS1-5,7,8,10,11		
032	6405-4631-0	RESISTOR, CC, 2.2K, 1/2W, 5%	EA	2.0000
		R8,R12		
033	6404-4621-0	RESISTOR, CF/CC, 1.2K, 1/4W, 5%	EA	2.0000
		R4,R10		
034	6404-4631-0	RESISTOR, CF/CC, 2.2K, 1/4W, 5%	EA	1.0000
		R13		
035	SUBCON18	SUBCONTRACTED LABOR-PCB ASSY 0040-4873-1	EA	1.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-3593-0 CONTROL, GUN REMOTE, SIMBA 2 S/N

ITEM #	COMPONENT PART NUMBER	DESCRIPTION		UM	EXTENDED QTY PER
001	0040-2583-0	FAB, FRONT PANEL, GUN CONT, SIMBA 2		EA	1.0000
002	0040-2612-0	FAB, REAR, PANEL, GUN CONT, SIMBA 2		EA	1.0000
003	0040-4873-0	PCB, ASSY, GUN DISPLAY-SIMBA 2	*ESD	EA	1.0000
004	0040-3612-0	HARNESS,GUN CONT		EA	1.0000
005	6700-0002-0	METER DIGITAL 3-1/2 DIGIT		EA	1.0000
006	6448-0107-0	RESISTOR, MF, 10.7K, 1/4W, 1%		EA	1.0000
007	6484-0095-3	RESISTOR MF 95.3K OHM 1/8W 1%		EA	1.0000
008	6041-1062-0	RELAY 24VDC STUD P&B R10-E6-X2-V700		EA	2.0000
010	6707-0585-0	KNOB COUNTING BLACK W/BRAKE		EA	1.0000
011	6047-7104-0	411 CLARODIAL COUNTING DIAL		EA	1.0000
012	6150-5001-0	KNOB, 1/8 DIA SHAFT		EA	1.0000
013	6046-3590-1	POT 10 TURN 100K 2W BOURNS 3590S		EA	2.0000
014	6156-4328-0	SWITCH FRAME,SNAP-IN BLK		EA	2.0000
015	6156-4846-0	SWITCH CAP,BLACK C&K 484602000		EA	2.0000
016	6040-9797-0	STDOFF 6-32 X 5/8 AMATOM 9797-A0632		EA	3.0000
017	6040-8189-0	STANDOFF 1/4ROUND 5-1/4 6-32		EA	3.0000
018	1924-1254-0	SCREW C BUTT 6-32 X .375 BLACK		EA	3.0000
019	1240-1454-0	SCREW, BIND HD 8-32 X .375	ZC	EA	7.0000
020	1258-1201-0	NUT, HEX, KEP, 6-32	ZC	EA	8.0000
021	1975-0006-0	WASHER EXT LOCK # 6 ZINC PL		EA	3.0000
022	6047-0001-0	JACK SOCKET ASSEMBLY		EA	1.0000
023	6403-0031-0	RESISTOR, MF, 1K, 1/8W, 1%		EA	1.0000
024	6838-9410-0	DIODE, RECTIFIER, 800V, 1A	*ESD	EA	2.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-7490-0 SPARE PARTS KIT, SIMBA 2

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	6041-1062-0	RELAY 24VDC STUD P&B R10-E6-X2-V700	EA	1.0000
002	6041-1455-D24	RELAY, FLANGE MOUNT, 3PDT, 24VDC COIL	EA	1.0000
003	6041-1455-A120	RELAY, FLANGE MOUNT, 3PDT, 120VAC COIL	EA	1.0000
005	6046-3590-1	POT 10 TURN 100K 2W BOURNS 3590S	EA	1.0000
006	6056-2731-0	FUSE, MICRO, FAST ACTING 1A, 125V	EA	10.0000
007	6056-2733-0	FUSE, MICRO, FAST ACTING, 3A, 125V	EA	10.0000
008	6056-2735-0	FUSE, MICRO, FAST ACTING 5A, 125V	EA	10.0000
009	6056-3098-0	FUSE 3AG-5A 240V SLO-BLO	EA	5.0000
010	6156-4311-0	PSF100A 0.5 AIR FLOW SW	EA	1.0000
011	6827-0285-0	TRANSISTOR, POWER MOSFET, N CHANNEL *ESD	EA	1.0000
015	6844-2004-0	IC,MONOLITHIC DARLINGTON TRANS ARRAY*ESD	EA	4.0000
020	6056-0204-8	FUSE, 0.8AMP,600VAC TIME-DELAY	EA	10.0000
021	6056-0204-62	FUSE,6.25AMP,250VAC DUAL ELE. TIME-DELAY	EA	5.0000
022	6056-0204-15	FUSE, 1.5AMP,600VAC TIME-DELAY	EA	5.0000
023	6056-0207-0	FUSE,100AMP,250VAC DUAL ELEM. TIME-DELAY	EA	2.0000
024	6056-3025-0	FUSE, SLO BLO, 3AG 2.5A, 250VAC	EA	5.0000
025	6056-0204-6	FUSE, 0.6AMP,600VAC TIME-DELAY	EA	5.0000

SINGLE LEVEL BILLS OF MATERIAL

PARENT PART: 0040-7490-1 SPARE PARTS KIT DELUXE, SIMBA 2

ITEM #	COMPONENT PART NUMBER	DESCRIPTION	UM	EXTENDED QTY PER
001	6041-1062-0	RELAY 24VDC STUD P&B R10-E6-X2-V700	EA	1.0000
002	6041-1455-D24	RELAY, FLANGE MOUNT, 3PDT, 24VDC COIL	EA	1.0000
003	6041-1455-A120	RELAY, FLANGE MOUNT, 3PDT, 120VAC COIL	EA	1.0000
004	6041-2630-0	RELAY HV SPDT 26.5VDC COIL KILOVAC H8	EA	2.0000
005	6046-3590-1	POT 10 TURN 100K 2W BOURNS 3590S	EA	1.0000
006	6056-2731-0	FUSE, MICRO, FAST ACTING 1A, 125V	EA	10.0000
007	6056-2733-0	FUSE, MICRO, FAST ACTING, 3A, 125V	EA	10.0000
008	6056-2735-0	FUSE, MICRO, FAST ACTING 5A, 125V	EA	10.0000
009	6056-3098-0	FUSE 3AG-5A 240V SLO-BLO	EA	5.0000
010	6156-4311-0	PSF100A 0.5 AIR FLOW SW	EA	1.0000
011	6827-0285-0	TRANSISTOR, POWER MOSFET, N CHANNEL *ESD	EA	1.0000
012	6841-0019-1	CURRENT SENSOR 0-100A WITH GND SCH	EA	1.0000
013	6841-3700-0	I.C. OPTICAL COUPLER AC/DC TO LOGIC *ESD	EA	1.0000
014	6842-2240-0	TRIAC, 40 AMP, 200V *ESD	EA	1.0000
015	6844-2004-0	IC,MONOLITHIC DARLINGTON TRANS ARRAY*ESD	EA	4.0000
016	6844-3011-0	IC, OPTICAL TRIAC DRIVER *ESD	EA	1.0000
017	6056-0199-0	FUSE 2A 600V BUSSMAN #KTK-2	EA	2.0000
020	6056-0204-8	FUSE, 0.8AMP,600VAC TIME-DELAY	EA	10.0000
021	6056-0204-62	FUSE,6.25AMP,250VAC DUAL ELE. TIME-DELAY	EA	5.0000
022	6056-0204-15	FUSE, 1.5AMP,600VAC TIME-DELAY	EA	5.0000
023	6056-0207-0	FUSE,100AMP,250VAC DUAL ELEM. TIME-DELAY	EA	2.0000
024	6056-3025-0	FUSE, SLO BLO, 3AG 2.5A, 250VAC	EA	5.0000
025	6056-0204-6	FUSE, 0.6AMP,600VAC TIME-DELAY	EA	5.0000

ADDENDUM
(001)

Date: December 26, 1997
Publication Affected: Simba® Power Supply Instruction Manual
Publication Number: 0101-8240-2A
Serial Number: **447** and above

IMPORTANT NOTE

The following changed pages reflect manual changes due to a design modification to the resistor board. (This modification affects serial number **447** and above).

Please take the time now to substitute the new pages attached for the present pages in this manual.

Changed pages are: 7-5
7-10
7-10a (new page added)
8-6

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL WIRES ARE 20 AWG.
2. NOMINAL VOLTAGES AT TUBE GRIDS:- SCREEN BIAS (+50V HV OFF; +700V HV ON)
   - CONTROL (-75 TO -350V).

[3] IF SYSTEM EPO IS NOT CONNECTED TO SIMBA EPO, THEN EPO EXT-3 AND EPO EXT-4 SHOULD BE JUMPED.

[4] MAIN BREAKERS AND FUSES TO BE RATED AS FOLLOWS:
FOR 208VAC USE 80A FOR F1, F2 USE 15A
FOR 380VAC USE 50A FOR F1, F2 USE 0.8A
FOR 480VAC USE 40A FOR F1, F2 USE 0.6A

[5] WIRING SHOWN IS WITH FVR. IF FVR IS NOT INSTALLED THEN WIRE FROM TSL3 TO K4-7.

[6] WHEN ROUTING WIRES TO TRANSFORMER T6, ENSURE WIRES DO NOT COME IN CONTACT WITH BODY OF TRANSFORMER.

[7] FOR 380 V SYSTEMS: ATTACH WIRE TO NEUTRAL TERMINAL BLOCK AND WIRE TRANSFORMER T6 PER FIGURE 1.

[8] JUMPER PINS EXT 5 AND EXT 6 ON 0040-6740-4 ONLY

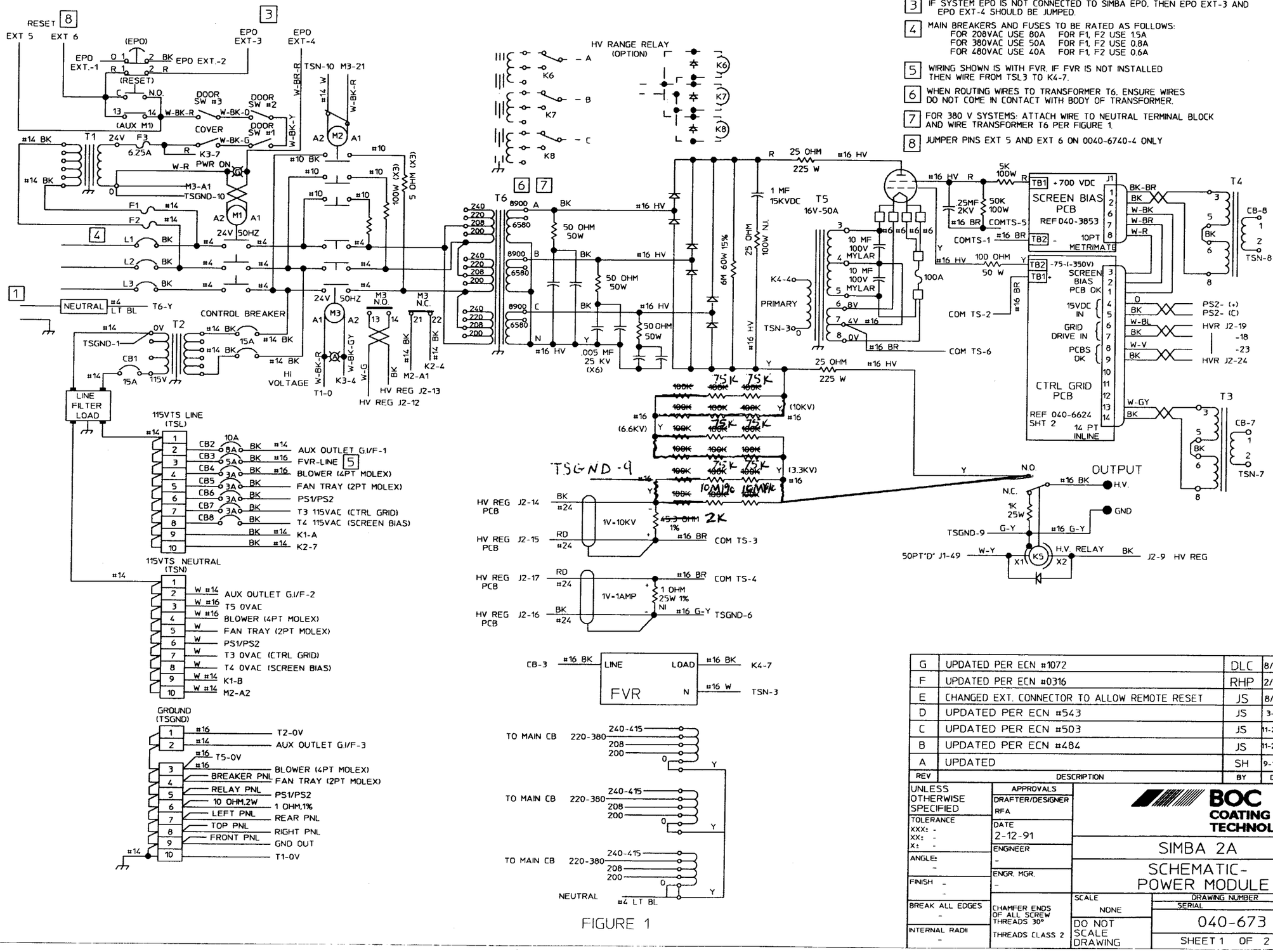


FIGURE 1

REV	DESCRIPTION	BY	DATE	APP'VD
G	UPDATED PER ECN #1072	DLC	8/28/96	-
F	UPDATED PER ECN #0316	RHP	2/28/96	JJ
E	CHANGED EXT. CONNECTOR TO ALLOW REMOTE RESET	JS	8/10/95	MJ
D	UPDATED PER ECN #543	JS	3-4-92	
C	UPDATED PER ECN #503	JS	11-27-91	V²
B	UPDATED PER ECN #484	JS	11-27-91	V²
A	UPDATED	SH	9-11-91	V²

UNLESS OTHERWISE SPECIFIED	APPROVALS
TOLERANCE XXX± - XX± - X± -	DRAFTER/DESIGNER RFA
ANGLE± -	DATE 2-12-91
FINISH -	ENGINEER -
BREAK ALL EDGES -	ENGR. MGR. -
INTERNAL RADII -	CHAMFER ENDS OF ALL SCREW THREADS 30° THREADS CLASS 2

BOC COATING TECHNOLOGY

SIMBA 2A

SCHEMATIC- POWER MODULE

SCALE	DRAWING NUMBER SERIAL	SIZE	REV
NONE	040-673 3		G
DO NOT SCALE DRAWING	SHEET 1 OF 2		

ADDENDUM
(002)

Date: April 30, 1998
Publication Affected: Simba® Power Supply Instruction Manual
Publication Number: 0101-8240-2A
Serial Number: **453** and above

IMPORTANT NOTE

The following pages reflect manual changes due to a new current sensor and a new single power source in the gun interface. (These modifications affect serial number **453** and above.)

Please take the time now to substitute the new pages attached for the present pages in this manual.

Replacement pages are:

7-1
7-18
7-19
7-20
7-23
7-24

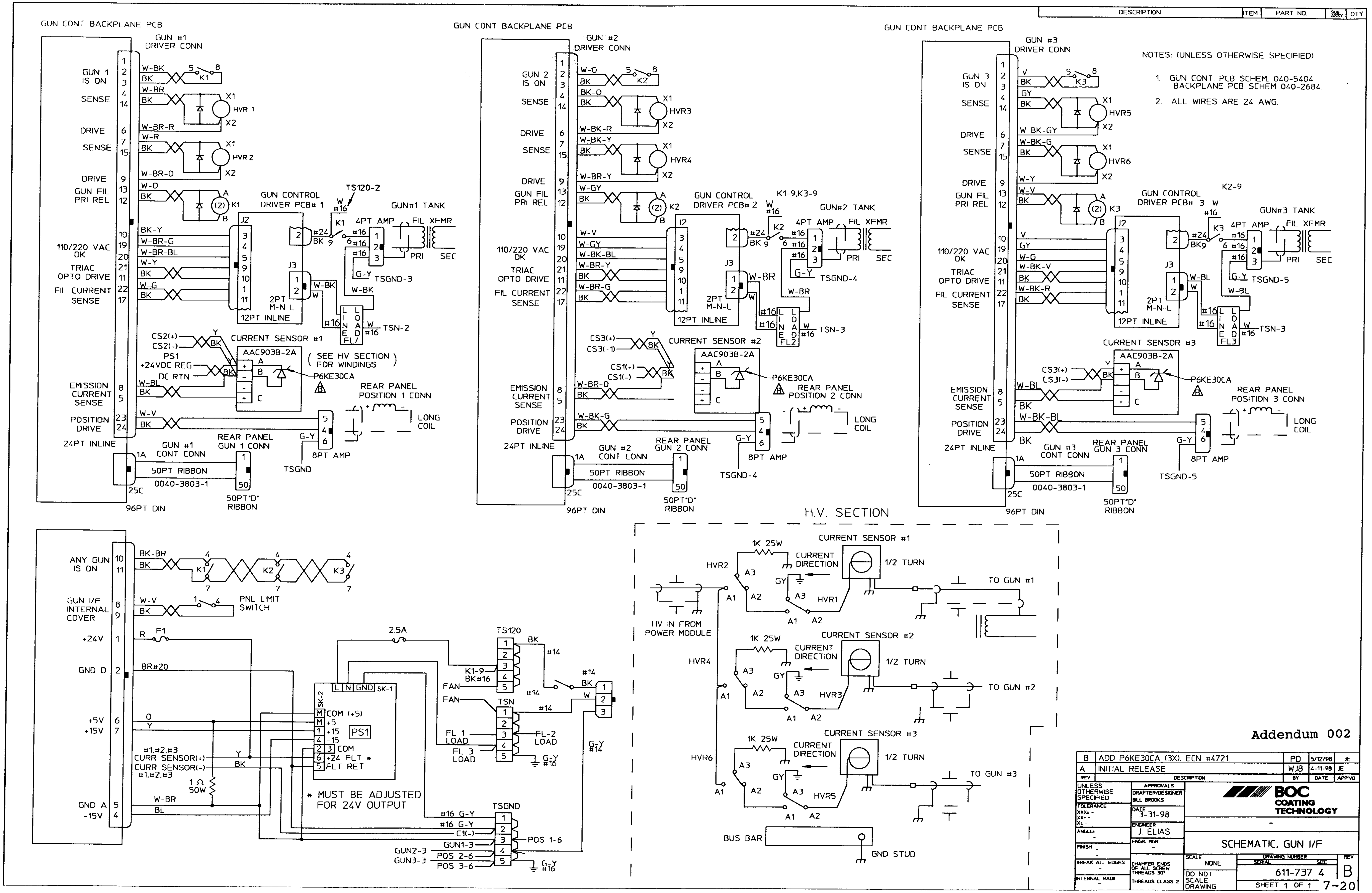
8-1
8-17
8-18
8-20
8-21
8-22

SECTION 7
DRAWINGS

POWER MODULE

GUN INTERFACE

HV/GUN CONTROL UNIT


GUN CONT BACKPLANE PCB
GUN #1 DRIVER CONN
GUN 1 IS ON
SENSE
DRIVE
GUN FIL PRI REL
110/220 VAC OK
TRIAC OPTO DRIVE
FIL CURRENT SENSE
EMISSION CURRENT SENSE
POSITION DRIVE
24PT INLINE
96PT DIN
GUN CONTROL DRIVER PCB# 1
TS120-2
GUN#1 TANK
4PT AMP
FIL XFMR
PRI
SEC
12PT INLINE
2PT M-N-L
TSGND-3
TSN-2
CURRENT SENSOR #1
AAC903B-2A
(SEE HV SECTION FOR WINDINGS)
P6KE30CA
REAR PANEL POSITION 1 CONN
LONG COIL
8PT AMP
TSGND
GUN #1 CONT CONN
REAR PANEL GUN 1 CONN
50PT RIBBON
0040-3803-1
50PT"D" RIBBON
GUN #2 DRIVER CONN
GUN 2 IS ON
GUN CONTROL DRIVER PCB# 2
K1-9,K3-9
GUN#2 TANK
TSGND-4
TSN-3
CURRENT SENSOR #2
REAR PANEL POSITION 2 CONN
GUN #2 CONT CONN
REAR PANEL GUN 2 CONN
GUN #3 DRIVER CONN
GUN 3 IS ON
GUN CONTROL DRIVER PCB# 3
K2-9
GUN#3 TANK
TSGND-5
CURRENT SENSOR #3
REAR PANEL POSITION 3 CONN
GUN #3 CONT CONN
REAR PANEL GUN 3 CONN
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. GUN CONT. PCB SCHEM. 040-5404 BACKPLANE PCB SCHEM 040-2684.
2. ALL WIRES ARE 24 AWG.
ANY GUN IS ON
GUN I/F INTERNAL COVER
PNL LIMIT SWITCH
+24V
GND D
+5V
+15V
GND A
-15V
#1,#2,#3 CURR SENSOR(+)
CURR SENSOR(-) #1,#2,#3
1 Ω 50W
2.5A
PS1
COM (+5)
+24 FLT *
FLT RET
* MUST BE ADJUSTED FOR 24V OUTPUT
TS120
TSN
FL 1 LOAD
FL 3 LOAD
FL-2 LOAD
TSGND
POS 1-6
GUN2-3
GUN3-3
POS 2-6
POS 3-6
H.V. SECTION
HV IN FROM POWER MODULE
1K 25W
CURRENT DIRECTION
1/2 TURN
TO GUN #1
TO GUN #2
TO GUN #3
BUS BAR
GND STUD
Addendum 002
DESCRIPTION
ITEM
PART NO.
QTY
B ADD P6KE30CA (3X). ECN #4721. PD 5/12/98 JE
A INITIAL RELEASE WJB 4-11-98 JE
BOC COATING TECHNOLOGY
DRAFTER/DESIGNER BILL BROOKS
DATE 3-31-98
ENGINEER J. ELIAS
SCHEMATIC, GUN I/F
SCALE NONE
DO NOT SCALE DRAWING
611-737 4
B
SHEET 1 OF 1
7-20

DESCRIPTION	ITEM	PART NO.	SUB ASSY	QTY.

NOTES :

1. ALL DIODES ARE IN914 . (UNMARKED)
2. GUN CONTROL ASSY P.B. 611-7393
3. GUN CONT DRIVER PCB ASSY 040-2423

PANEL MOUNT FUSE

1ST ON (UNGND GUN)
2ND OFF (GND GUN)

2ND ON (HV TO SUN)
1ST OFF (DISCONNECTS HV TO SUN)

WAVEFORMS

120VAC — MT2
INVERSE TYP SCR PWR
1 VAC — MT1
2 VAC — GATE

TANK UNPLUGGED-ALL WAVEFORMS TO ⏚.
OPEN FILAMENT-MT2 SAME MT1 ⏚.
GATE WEAKER VERSON OF SAME.
NO AC AMP ON CLAMP-ON OR METER.

GUN GO ON

GUN GO OFF # /ENABLE

ALL GUN CONT I/L MADE

GUN READY

GUN IS ON

RANGE SELECT BIT 1

RANGE SELECT BIT 2

HV IN REG

EMISSION CURRENT REQ (0-10V)

0-10V= 0-2A EMISSION CURRENT TO SYS

0-1V= 0-1A EMISSION CURRENT TO METER

BIAS REQ 0-(-10V)

FILAMENT CURRENT TO METER

SPARES

GO ON
HI = GO ON
HI = ZERO CROSSING OK

FILAMENT CURRENT TOO HI = 15V

USE FOR 15 ON TO SYSTEM ALSO

ZERO CROSSING SIGNAL

ZERO CROSSING DETECT

BIAS REQUEST 0V-(-10V)

SST TO MAX

GUN CONT SIGNAL

0-10V

ANALOG PRIORITY GATE

CONTROL

0V = OFF -10V = ON

SOFT START

15V 0V

15V OR LESS OK

EMISSION CURRENT 10V = 2A

TO CURRENT SENSOR

J2 REPT INLINE

ZERO CROSSING DETECT

TO SUN FIL XFMR PRI

FILAMENT CURRENT FULL WAVE RECTIFIER G=10, IV=1A

Addendum 002

REV	DESCRIPTION	BY	DATE	APP'VD
A	RELEASED FOR MANUFACTURE	WJB	5-6-98	

UNLESS OTHERWISE SPECIFIED
TOLERANCE
ANGLE
FINISH
BREAK ALL EDGES
INTERNAL RADII

APPROVALS
DRAFTER/DESIGNER: BILL BROOKS
DATE: 5-4-98
ENGINEER: I. ELIAS
ENGR MGR
CHAMFER ENDS OF ALL SCREW THREADS 90°
THREADS CLASS 2
DO NOT SCALE DRAWING

BOC COATING TECHNOLOGY

SIMBA 2

GUN CONT. PCB/GUN CONT. DRVR P. C. B. SCHEMATIC

SCALE 2:1 | DRAWING NUMBER 611-738 4 | SIZE A | SHEET 1 OF 1

ORIGINAL

7-24

Simba 2 Power Supply

ADDENDUM #003

Date: August 20, 1999
Publication Affected: Simba® Power Supply Instruction Manual
Publication Number: 0101-8240-2A
Serial Number Affected: **493 and above**

This addendum covers:
- Arc Detection Delay Settings
- High Voltage Regulator Board

Simba 2 Arc Detection Delay Settings

This addendum reflects changes on the **Simba 2 arc detection delay settings**. Details on the switch settings follow.

Please take the time now to substitute the new pages attached for the present pages in this manual.

Page 7-12: **Dwg. 040-6653-F** replaces Dwg. 040-6653-E.

Additional replacement pages: 8-11, 8-12, and 8-13.

The High Voltage Regulator PCB has an 8-position DIP switch incorporated on it which allows the user to select the delay time that the Simba will maintain constant output during arcing conditions.

The eight positions are all set in the **ON** position at the factory, giving less than a 100 millisecond delay time before the Simba will detect an over-current or out of regulation condition.

The table below shows the delays with respect to the switch settings. Note that this table indicates delay time for the closing of one switch at a time only. If more than one switch is closed, a delay time LESS than the lowest time selected will occur.

DELAY SWITCH	DELAY
'0' (all sw. off)	2.0 sec.
1	1.8 sec.
2	1.6 sec.
3	1.4 sec.
4	1.2 sec.
5	1.0 sec.
6	800mS
7	600mS
8	400mS
6+7+8	200mS
All On	<100mS

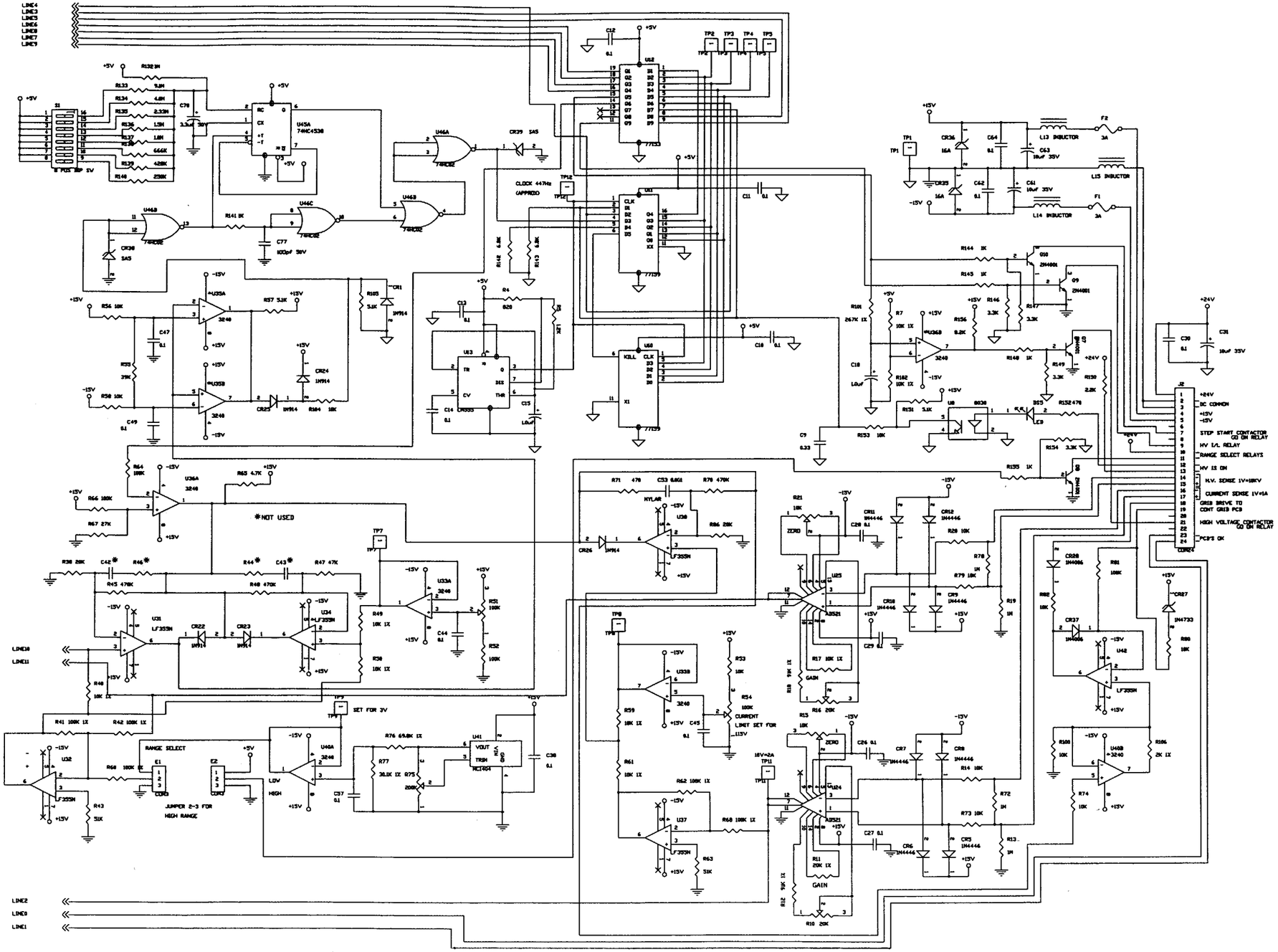
SECTION 7
DRAWINGS

POWER MODULE

GUN INTERFACE

HV/GUN CONTROL UNIT

REV	DRAWING NUMBER	LOC	INSTAL	PROJECT
A	611-7974-0	SWEEP	HV	SIMBA_2



REV	DESCRIPTION	BY	DATE	APP'VD
A	RELEASED FOR MANUFACTURE	MAL	1/27/99	

BOC COATING TECHNOLOGY

DRAWN BY	MARK LODWIG
CHECKED BY	
DATE	01/27/99
APPROVED BY	

PROJECT: SIMBA_2 | INSTAL: HV | LOC: SWEEP

H.V. REGULATOR
PCB SCHEMATIC - SIMBA 2

SCALE: DO NOT SCALE DRAWING

DRAWING NUMBER: 611-7974-0 | SIZE: A | REV: A

SHEET 1 OF 2

PROJECT SIMBA_2 | INSTAL HV | LOC SWEEP | DRAWING NUMBER 0611-7974-HV | REV A

CUTBACK CONTROL

ST'	B	A	Y	X	ACTION	ADVANCE	RESET TO 0,0	KILL	RESET ST'
1	X	X	0	0	NONE	WAITING FOR OUT	———	———	
0	0	0	1	1	CUTBACK BOTH	OF REGULATION TIMEOUT 4538,62	———	8TH TIME HERE	PUSHING OFF BUTTON
0	0	1	1	0	CUTBACK GUN ONLY	IN REGULATION	OUT OF REG	———	
0	1	0	0	0	NONE	IN REGULATION	OUT OF REG	———	
0	1	1	0	0	NONE	———	OUT OF REG	———	IN REG FOR TIME

ANY GUN IS ON
ALL HV I/L MADE
HV GO OFF @ /ENABLE
HV GO ON
IN REG TO GUN I/F
TO OUT OF REG LED
HV READY TO LED
HV IS ON TO LED
H.V. REG 0-10V
H.V. TO SYSTEM
TOTAL PS CURRENT TO METER
TOTAL PS CURRENT TO SYSTEM
H.V. TO METER

CURRENT METER ATENUATOR

NOTES
1. PREVIOUS H.V. REG ASSY 040-5393 & 040-3093.
2. DS7, DS8, R6 HAVE BEEN REMOVED.
3. LAST COMPONENTS
CR39, C77, DS9, E2, F4, J2, L16, Q10, R156, S1, TP12, U46
4. UNLESS OTHERVISE INDICATED ALL RESISTORS 1/4W 5% TOL.
5. UNLESS OTHERVISE INDICATED ALL CAPACITORS EXPRESSED IN MICROFARADS.

7-13a
Addendum 003

REV	DESCRIPTION	BY	DATE	APPVD
–	FOR CURRENT REVISION SEE SHEET 1	–	–	–

BOC COATING TECHNOLOGY

DRAWN BY MARK LODWIG | DATE 01/27/99
CHECKED BY | APPROVED BY

PROJECT SIMBA_2 | INSTAL HV | LOC SWEEP
H.V. REGULATOR
PCB SCHEMATIC – SIMBA 2
SCALE | DRAWING NUMBER 0611-7974-HV | SIZE | REV A
DO NOT SCALE DRAWING | SHEET 2 OF 2

PROJECT SIMBA_2 | INSTAL CONTROL | LOC SWEEP | DRAWING NUMBER 0-611-8014 | REV A

CONTROL GRID DRIVE IN

J3
6
7
Q1
2N6520
R91 39K
CR33
1N992
R97
3.3K
1/2W
CR32
1N4736
Q2
MTM2N85
G
D
S
CR31
MR918
C72
.001 6kV
R96
330
2W
R95 10, 2W
R99
2.2M
1/2W
TB1
TB2
SCREW TERMINALS
TO TETRODE CONTROL GRID

AC POWER IN

13
14
J3
V420LA40B
V1
C66
1uf 800V
POLY
R87
100
1W
MDA110A
BR1
AC
AC
2
4
1
3
R94 100
5W
C71
10uf
800V
R98
50K
20W
V2
V420LA40B
C73
0.01
250V
CR30
1N4740
R92 120K
R93 120K
MCPL-3700
U43
VCC
VD
GND
2
8
6
5
3
R88 470
C67
0.1
+15V
R89 1.2K
DS10
HV REG PS PCB OK
U44
MOC8030
J3 14PT INLINE
8
9
PCB'S OK OUT
+15V
SCREEN BIAS PCB OK
R90 1.2K
DS11
U45
MOC8030

+15V
L12
C68
0.1
L11
1
2
3
TO SCREEN GRID POWER SUPPLY

+15V
F3
1A
C70
10uf
35V
C69
0.1
4
+15V IN
5
DC COMMON

J3 14PT INLINE

7-14
Addendum 003

REV	DESCRIPTION	BY	DATE	APP'VD
A	RELEASED FOR MANUFACTURE	MAL	1/27/99	

BOC COATING TECHNOLOGY

DRAWN BY: MARK LODWIG | DATE: 01/27/99
CHECKED BY | APPROVED BY

PROJECT SIMBA_2 | INSTAL CONTROL | LOC SWEEP

CONTROL GRID PCB SCEMATIC

SCALE: DO NOT SCALE DRAWING

DRAWING NUMBER / SERIAL / SIZE: 0-611-8014 | REV A

SHEET 1 OF 1