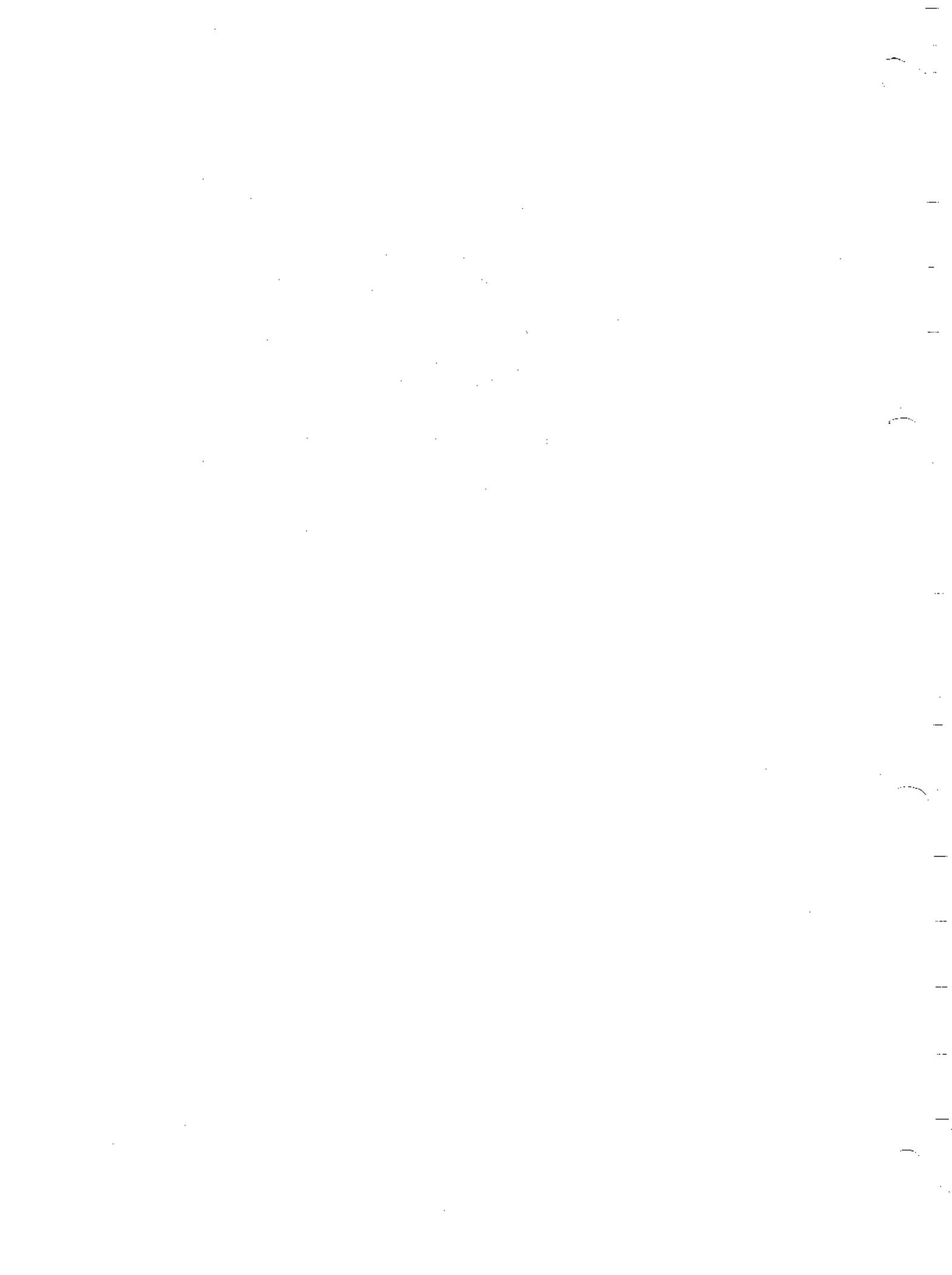


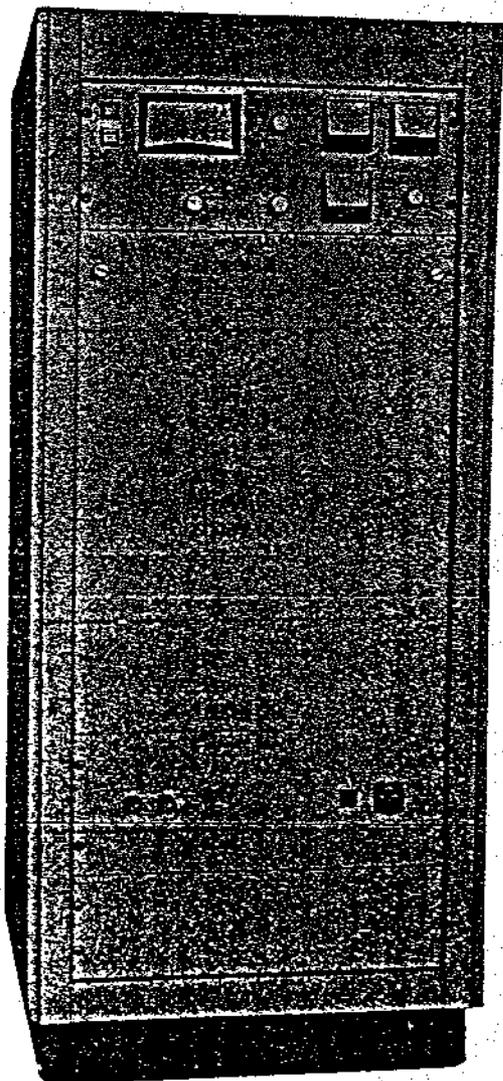
**Henry Electronics
RF Power Generator
Model 2000D**

Operating and Maintenance Manual



OPERATING AND MAINTENANCE MANUAL

HENRY ELECTRONICS RADIO FREQUENCY POWER GENERATORS



MODELS: 1500D

2000D

2500D

3000D

MODEL 2500D SHOWN ABOVE

HENRY ELECTRONICS, INC.

2050 SOUTH BUNDY DRIVE

LOS ANGELES, CA 90025 USA

213-820-1234

SPECIFICATIONS-----

NOTE: Henry Electronics manufactures many different OEM versions of these basic RF power generator models. The specifications listed below are the standard specifications. Individual items may vary on special order power generators.

OUTPUT POWER: 1500D - 0 TO 1500 WATTS 2000D - 0 TO 2000 WATTS
 2500D - 0 TO 2500 WATTS 3000D - 0 TO 3000 WATTS

TUBE COMPLEMENT: 1500D - EIMAC 3CX1200A7 2000D - EIMAC 3CX3000A7
 2500D - EIMAC 3CX3000A7 3000D - EIMAC 3CX3000A7

POWER REQUIREMENTS: MANUFACTURED TO CUSTOMER REQUIREMENTS.
STANDARD FORMATS - SINGLE PHASE, 208 VAC, 50/60 HZ.
 1500D - 25 AMPS. 2000D - 30 AMPS.
 2500D - 35 AMPS. 3000D - 40 AMPS.
OR - THREE PHASE, 208 VAC, 50/60 HZ.
 1500D - 10 AMPS. 2000D - 15 AMPS.
 2500D - 15 AMPS. 3000D - 20 AMPS.
SPECIAL VOLTAGES PER CUSTOMER ORDERS.

ENVIRONMENTAL DATA: TEMPERATURE - 0 TO 40 DEGREES C.
 ALTITUDE - 10,000 FEET.

METERING: OPTIONAL PER CUSTOMER'S REQUIREMENTS.
STANDARD FORMAT - PLATE CURRENT, GRID CURRENT, PLATE
 VOLTAGE, FILAMENT VOLTAGE, FORWARD POWER, AND REFLECTED POWER.

DIMENSIONS: OPTIONAL PER CUSTOMER'S REQUIREMENTS.
STANDARD FORMAT - 43" HIGH X 22" DEEP X 23" WIDE RACK CABINET.

WEIGHT (STANDARD FORMAT) - 1500D - 400 POUNDS 2000D - 500 POUNDS.
 2500D - 550 POUNDS 3000D - 600 POUNDS.

FREQUENCY: OPTIONAL PER CUSTOMER'S REQUIREMENTS.
STANDARD FORMATS - 13.56 MHZ, 27.12 MHZ, 40.68 MHZ.
RANGE OF OPTIONAL FREQUENCIES - 1.8 TO 400 MHZ.

DUTY CYCLE: CONTINUOUS DUTY AT MAXIMUM RATED OUTPUT POWER.

TUBE COOLING: FORCED AIR COOLING.

HARMONIC AND OTHER SPURIOUS RADIATION: REDUCED IN ACCORDANCE WITH FCC SPECIFICATIONS - TYPICALLY - 60 dB OR BETTER DOWN.

EXCITER: COMPLETELY SOLID STATE SELF-CONTAINED CRYSTAL CONTROLLED
 EXCITER BUILT INTO THE POWER GENERATOR.

OUTPUT IMPEDANCE: 50 OHMS UNBALANCED WITH SWR NOT TO EXCEED 2:1.

WARRANTY: LIMITED 1 YEAR WARRANTY ON PARTS AND LABOR.

FRONT PANEL CONTROLS: OPTIONAL PER CUSTOMER'S REQUIREMENTS.
STANDARD FORMAT - POWER SET POTENTIOMETER, STANDBY SWITCH, POWER

SWITCH, LOCAL/REMOTE CONTROL, METER SWITCH, CONSTANT POWER SWITCH.

CABINETS: OPTIONAL PER CUSTOMER'S REQUIREMENTS.
STANDARD FORMAT - 19" RACK PANEL STEEL CABINET ON CASTERS.

SPECIAL FEATURES: CONSTANT POWER FEEDBACK CIRCUIT - 1% TOLERANCE.
AC RIPPLE LESS THAN 1% ON OUTPUT SIGNAL.
LINE VOLTAGE TAPS ON ALL TRANSFORMERS.
SIMPLIFIED (NON-TECHNICAL) OPERATING CONTROLS.
BUILT-IN ADJUSTABLE LEVEL AND DELAY REFLECTED POWER PROTECTION.
REMOTE CONNECTOR TO ACCEPT MICROPROCESSOR CONTROL SIGNALS.
0 TO 5 VDC REMOTE POWER LEVEL ADJUST SIGNAL ACCEPTED.
OTHER LEVELS PER CUSTOMER'S OPTIONAL REQUIREMENTS.
POWER LEVEL ADJUSTABLE FROM 0 TO FULL OUTPUT.
CONSERVATIVE HEAVY DUTY COMPONENTS USED FOR MAXIMUM LIFE.
SELF-CONTAINED BIRD POWER SENSOR FOR FORWARD AND REFLECTED POWER.
A 25 YEAR HISTORY OF RUGGED RELIABLE RF POWER GENERATORS.

-----SECTION 1. OPERATION.

CAUTION: THERE ARE LETHAL HIGH VOLTAGES WITHIN THE CABINET OF THIS POWER GENERATOR. NEVER ATTEMPT TO OPERATE THE EQUIPMENT WITH ANY OF THE PANELS REMOVED. WHERE APPROPRIATE A CABINET INTERLOCK HAS BEEN PROVIDED TO DISABLE THE HIGH VOLTAGE WHEN AN IMPORTANT PANEL IS REMOVED.

Unpack the generator on arrival and make sure that there is no shipping damage incurred during transit. Because of their weight and special components, RF power generators are vulnerable to shipping damage. If any shipping damage is evidenced, be certain to make careful visual inspection of the entire generator before turning it on.

All power generators (unless otherwise specified) are shipped with no AC power plug. There is no standard plug for 208 VAC operation. It is the purchasers responsibility to obtain and correctly install the proper AC plug to mate with the AC receptacle at the operating position.

Single phase power supplies are provided with a three-conductor AC power cable. Connect the cable with an appropriate plug in the following manner.

Black and White Wires - Connect to one of the 208 VAC wires.
Green Wire - Connect to the neutral or ground wire.

Three phase power supplies are provided with a four-conductor AC power cable. Connect the cable with an appropriate plug in the following manner.

Black, White, and Red Wires - Connect to the 208 VAC wires.
Green Wire - Connect to the neutral/ground wire.

CAUTION: THE POWER SUPPLY SECTION CAN BE DAMAGED IF THE POWER CABLE IS INCORRECTLY CONNECTED.

The generator should always be tested into a 50 ohm dummy load before connection to a plasma system. The generator was tested for several hours at the factory into a 50 ohm dummy load before shipment. A copy of the test data sheet is normally taped to the outside of the generator for your information.

CAUTION: THE GENERATOR WILL BE DAMAGED IF IT IS OPERATED WITHOUT A LOAD OR OPERATED INTO AN UNMATCHED LOAD.

Connect the generator to your load with 50 ohm coaxial cable capable of carrying the full rated output of the generator. No output cable is provided with the generator unless it has been ordered specially by the customer. Recommended RF cable is as follows.

1500D	- R68, R6213, or Belden 9913	Type N connector.
2000D	- R68, R6213, or Belden 9913	Type N connector.
2000D (above 20 MHz)	- R6225 or R6216	Type N connector.

2500D - R6225 or R6216
3000D - R6225 or R6216

Type N connector.
Type HN connector.

The connector listed above is the output connector at the power sensor on the back of the RF generator. The connector is inside the cabinet so you must open the back door, or remove the back panel and connect the appropriate RF cable to the generator through one of the grommeted cabinet holes provided.

Plug the AC line into the power source. Turn on the circuit breaker and the light next to the circuit breaker should come on. The STANDBY light on the control panel should also come on. The tubes used on these generators are instant on devices and require no warm-up period.

Turn the output level control fully counter-clockwise (minimum output) before activating the generator. When you are ready, push the POWER switch (red) button to activate the plate voltage in the generator. The STANDBY light will go off as the POWER light latches. The output level control can now be advanced clockwise to increase the RF power out of the generator.

The generator normally is supplied with a LOCAL/REMOTE switch. The switch should be in the LOCAL position unless you are using a remote control panel or microprocessor controller.

Turn the multiple turn OUTPUT LEVEL potentiometer for the desired RF output as shown on the FORWARD (OR INCIDENT) POWER meter. The REFLECTED POWER meter will show the power level reflected from the load. If you are operating into a 50 ohm dummy load there should be little or no reflected power.

CAUTION: THE GENERATOR SHOULD NOT BE OPERATED CONTINUOUSLY INTO A LOAD WHOSE SWR EXCEEDS 2:1. THIS IS INDICATED BY THE REFLECTED POWER EXCEEDING 10% OF THE FORWARD POWER. THE GENERATOR MAY BE OPERATED FOR SHORT PERIODS OF TIME INTO A BAD LOAD, BUT CONTINUOUS OPERATION COULD DAMAGE THE EQUIPMENT.

If the reflected power is too great, the load or matching network must be adjusted to match the 50 ohm output of the generator. The generator is designed for continuous operation at full rated output. When operation is finished, push the STANDBY switch to turn off the high voltage. Turn the equipment off by switching off the circuit breaker on the front panel.

The next section explains the proper operating parameters of the generator. You should check these parameters before putting the generator into full operation.

If the generator does not operate correctly as described above, or if the operating parameters are not correct as described in the next section, you should refer to the trouble shooting section later in this manual.

SECTION 2. OPERATING PARAMETER VARIFICATION-----

The generator was factory tested before shipment and the test parameters were noted on the test data sheet attached to the power generator. The parameters listed below are approximate and are less important than the values listed on the test sheet.

Please remember that all of these figures are assuming the AC line voltage listed on the test data sheet. All the parameters will vary with the AC line voltage.

	Grid Current	Plate Current	Filament Volts	Plate Volts
1500D	175-200 ma	550-650 ma	7.4-7.6 VAC	3900-4100 VDC
2000D	190-210 ma	700-900 ma	7.4-7.6 VAC	4000-4200 VDC
2500D	210-230 ma	.9-1.0 amp	7.4-7.6 VAC	3900-4100 VDC
3000D	230-260 ma	1.1-1.3 amp	7.4-7.6 VAC	4000-4200 VDC

When you install the RF generator you should check the tube parameters as listed above. If they are significantly different from the ranges listed above or from the test data provided with the generator you must trouble shoot the generator to find the problem.

SECTION 3. MICROPROCESSOR/REMOTE CONTROL-----

A socket is provided on the back of the control panel for external control of the generator. If this feature is desired, you must wire the provided plug to use your own remote control device. There is a jumper in this plug which must be installed for the generator to operate. The pin outs on this plug are described on the block diagram and the control section schematic.

The functions available at this connector vary according to customer's requests, but the standard configuration is shown in this manual.

SECTION 4. CONTROLS-----

The following list of controls is for a generator supplied in the standard configuration. Any special customer requirements are different from this list.

EXTERNAL CONTROLS

- Circuit Breaker - Turns on the primary AC power to the generator.
- AC MAINS Light - A pilot light for the primary AC power.
- STANDBY Control - A light/switch combination to switch the generator out of the operate (high voltage) condition. When the power generator's overload circuit has tripped this button must be pushed to reset the circuit before the generator can be reactivated.

- POWER Control** - A light/switch combination to switch the generator out of the standby (no high voltage) condition.
- CONSTANT Power** - This rotary switch, sometimes labeled differently for different customers turns the constant power feedback circuit on and off. It must be turned off to test or tune the power generator.
- FORWARD POWER** - This meter measures the RF output power out of the generator as measured by the Bird line section located on the back panel of the final output section.
- REFLECTED POWER** - This meter measures the RF power reflected from the load back into the generator as measured by the Bird line section located on the back panel of the final output section.
- MULTIMETER** - Reads grid current, filament voltage, and plate voltage - depending on the position of the multimeter switch.
- MULTI SWITCH** - Selects the function of the MULTIMETER.
- REMOTE** - This 14-pin connector is the interface between the generator and an external control panel or a micro-processor controller.
- PLATE CURRENT** - This meter reads the plate current of the final.

INTERNAL CONTROLS

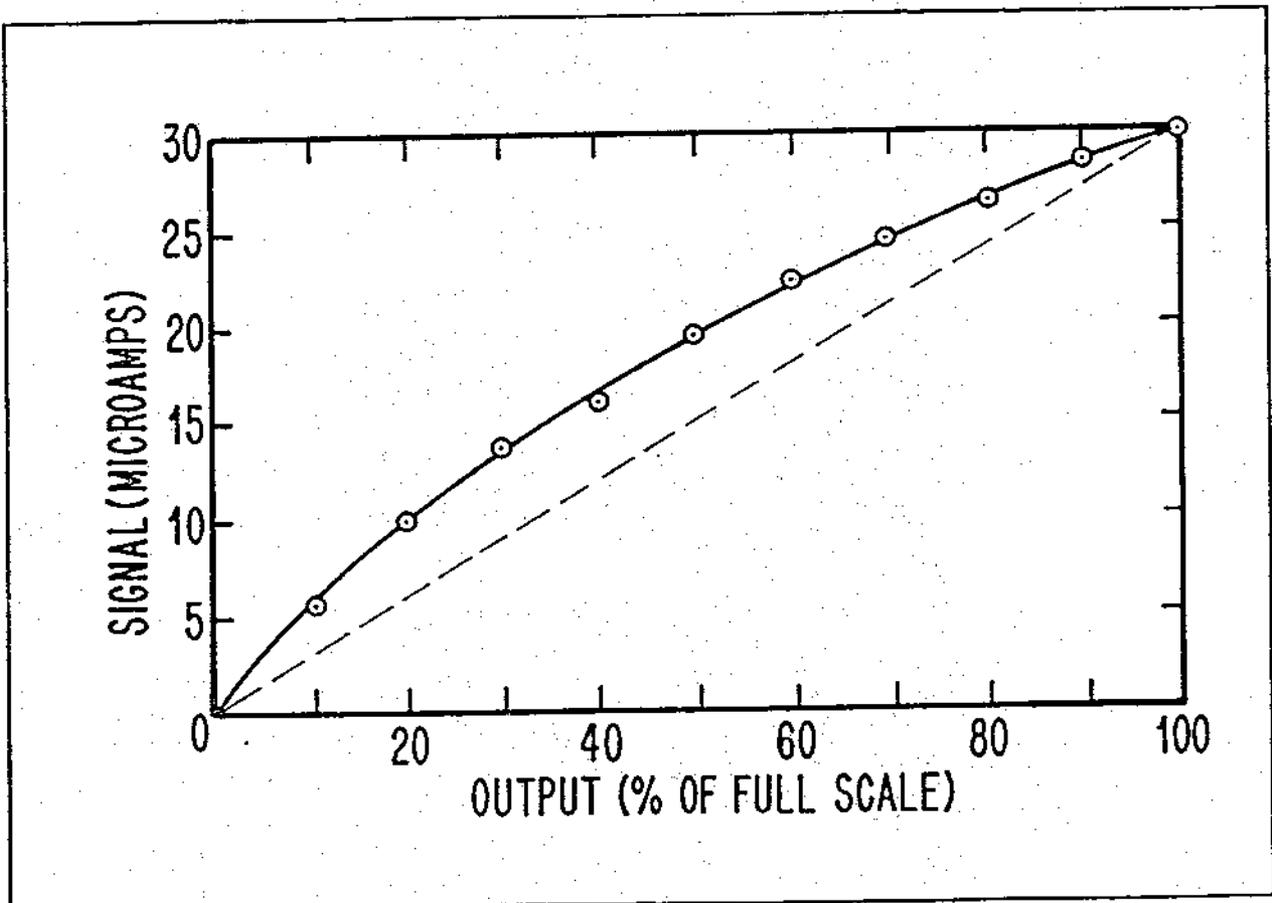
The following list of control devices are factory adjusted and require no field adjustment unless a problem is found.

- Final Section** - Plate current signal calibration potentiometer.
Grid current fuse.
Grid current test point (must be jumpered).
Grid current signal calibration potentiometer.
Filament voltage signal calibration potentiometer.
TUNE control to adjust resonance of final section.
LOAD control to adjust final section output impedance.
- Control Section** - Plate current overload set adjustable resistor.
Stepdown transformer AC tap adjustments.
Filament transformer AC tap adjustments.
- 13.8 V Section** - AC primary fuse.
DC secondary fuse.
Output voltage adjust potentiometer.
- Constant Power Section** - Reflected power signal calibration.
Forward power signal calibration.
Reflected power overload set point.
Forward power overload set point
Reflected power delay set point.
- Cabinet Section** - AC primary fuses - protect circuits except HV.

BIRD POWER SENSOR MICROAMPERE SIGNAL VERSUS OUTPUT POWER SIGNAL

Microamp. of Signal	% of Full Scale Output
6.00 μ a	10%
10.05 μ a	20%
13.50 μ a	30%
16.70 μ a	40%
19.65 μ a	50%
22.10 μ a	60%
24.30 μ a	70%
26.30 μ a	80%
28.25 μ a	90%
30.00 μ a	100%

Allowable error of 2% of full scale.
 Calculated internal resistance at 6 μ a is 1400 ohms \pm 5% at 25° C.



HENRY 2000D THEORY OF OPERATION

GENERAL DESCRIPTION

The 2000D is a 0 to 2000 watts radio frequency power generator operating at 13.56 MHz. It is designed for industrial use for any manufacturing process requiring radio frequency. The generator requires 208 VAC, 1 phase, 50/60 Hz, about 30 amps nominal. The output connector is a type N RF connector designed to interface into a 50 ohm coax which interfaces into a 50 ohm load. The generator is modularly built - - comprising 10 different sections assembled into a 19 inch wide steel rack cabinet. Each section serves a separate and unique function as described below. Refer to the interconnection diagram to clarify the identity and interconnections of each section.

The 2000D is a complex electronic instrument which can be damaged if serviced or operated incorrectly. Some of the basic precautions when operating the generator are as follows:

Never operate the generator with no load, or into a non-50 ohm load. the equipment has protection circuit in the generator will turn the equipment off if such an occurrence happens.

The equipment is factory assembled for 208, 50/60 Hz operation. If any other voltage is to be used for operation, internal adjustments must be made in the cabinet.

A significant amount of heat is generated during the operation of the equipment. Make certain that nothing is blocking the air flow into the bottom of the cabinet and out of the top of the cabinet.

The remainder of the discussion of the equipment will focus on the design and function of each of the separate sections which make up the generator.

CABINETRY

The door of the cabinet is interlocked. When the door is open the high voltage circuits of the generator are disabled. The relay which controls this function is located on the control deck and will be discussed in that section. The cabinet fan located on the top panel of the generator operates from 110 VAC. The screened opening for that fan must never be blocked or the equipment will overheat. In the event of a failure of that fan, repair should be made immediately to prevent other damage to the generator. The cabinet is on 4 casters to facilitate moving it to different locations. The main circuit breaker which turns the equipment on and off is located on the front door of the generator along with a AC MAINS indicator-pilot light. In the event of any short in the high voltage circuits, the circuit breaker will trip. All other circuits are protected by 8 amp fuses, located inside the door of the cabinet. If these fuses blow, it indicates a short in the control, filament, signaling, blower, etc. circuits - rather than in the high voltage circuit.

The control panel is located either inside or on top of the cabinet, but will be discussed in a separate section.

HIGH VOLTAGE SECTION

This section accepts the 208 VAC from the power source and distributes to - 1. The high voltage circuit and - - 2. All other circuits. The power into the generator is controlled by the circuit breaker discussed in the cabinetry section. 208 VAC passes into the cabinet on the power cord, is distributed through TB701 to the circuit breaker and back into the generator through TB701.

AC LINE VOLTAGE TAP ADJUSTMENTS FOR HENRY POWER GENERATORS

MODEL 500D	No Tap Adjustments Necessary	
MODEL 1000D	Power Transformer - ECA-0055	220 - 240 VAC Taps 1 and 4 200 - 215 VAC Taps 1 and 3
	Filament Transformer - ECA-1063	See tap label on the transformer
	Step-Down Transformer - ECA-1082	220 - 240 VAC Taps 1 and 3 200 - 215 VAC Taps 1 and 2
MODEL 2000D	Power Transformer - ECA-1028	220 - 240 VAC Taps 1 and 3 200 - 215 VAC Taps 1 and 2
	Filament Transformer - ECA-1102	220 - 240 VAC Taps 1 and 4 200 - 215 VAC Taps 1 and 2
	Step-Down Transformer - ECA-1082	220 - 240 VAC Taps 1 and 3 200 - 215 VAC Taps 1 and 2
MODEL 3000D	Power Transformer - ECA-1028 X 2	Same as Model 2000D
	Filament Transformer - ECA-1102	Same as Model 2000D
	Step-Down Transformer - ECA-1082	Same as Model 2000D
MODEL 5000D	Power Transformer - ECA-26008	220 - 240 VAC Taps 1 and 6 Taps 3 and 5 Taps 2 and 4 200 - 215 VAC Taps 2 and 7 Taps 3 and 8 Taps 9 and 1
	Filament Transformer - ECA-1102	Same as Model 2000D
	Step-Down Transformer - ECA-1082	Same as Model 2000D
MAGNETRODE	Power Transformer - ECA-0055	220 - 240 VAC Taps 1 and 4 200 - 215 VAC Taps 1 and 3
	Filament Transformer - ECA-1116	Common Tap C 200 - 210 VAC Tap 1 210 - 220 VAC Tap 2 220 - 230 VAC Tap 3 230 - 240 VAC Tap 4 240 - 250 VAC Tap 5

NOTE: All of these adjustments are generally made at the factory during final check out. They should require change only if the unit is being operated off of a different line voltage than originally specified.

The 208 VAC to the high voltage circuits passes through a step-start relay system to prevent current surges on thrun on. R701 is a surge control ballast resistor for the same purpose. D701 is a diode transient protector to blow the circuit breaker if the line voltage exceeds 240 VAC. T701 is the high voltage transformer which generates the high voltage for the 2000 watt section. D702 and D703 form a rectifier bridge assembly whose output passes through swinging choke L201. C703 is a filter capacitor and R702 through R705 are bleeder resistors to bleed the high voltage when the equipment is turned off. R707 through R711 are a high voltage meter signal circuit.

The 208 VAC for all the other circuits is fused and then passes through TB702 into the other sections of the generators to operate all of the other functions of the generator. Pin 6 of TB702 is the 12 VDC control signal which operates the step-start relay circuit when the generator is switched into the POWER mode. Pin 4 is the B- signal which is used for several purposes described later. Pin 5 is the high voltage metering signal.

CONTROL SECTION

The control section of the generator is located on the second level of the cabinet. It serves several different functions, including filament voltage for the 2000 watt section, 110 VAC step down transformer, interlock relay, and plate current overload relay.

T901 is the 110 VAC stepdown transformer, which generates 110 VAC for constant power circuit, the cabinet fan, and the 2000 watt section. The primary is tapped for various input voltages from 200 to 240 VAC.

T902 is the filament transformer which provides 7.5 VAC and a center tap to the 2000 watt section. The primary is tapped for various input voltages from 200 to 240 VAC.

RY901 is the interlock relay which turns the high voltage circuits off when the door of the cabinet is opened. T903 and T904 are the 12 VDC relay circuit transformers which operate into a bridge rectifier and capacitor filtering circuits. The 12 VDC passes through RY901 when the vabomet door is closed and onto the overload relay.

RY902 is the overload relay which switches the generator out of the POWER mode if the plate current in the 2000 watt section exceeds a preset value. R904 is an adjustable resistor which sets the trip point of that relay.

On TB901 – Pin 1 is the primary 208 VAC input to the stepdown transformer – Pin 2 is 110 VAC out of the transformer – Pin 3 is the primary 208 VAC input to the stepdown transformer – Pin 4 is the primary 208 VAC input to the filament transformer – Pin 5 is the primary 208 VAC input to the filament transformer – Pins 6, 7, and 8 are not used.

On TB902 – Pin 1 is 208 VAC from the high voltage section, not interlocked – Pin 2 is 208 VAC from the high voltage section, not interlocked – Pin 3 is 110 VAC from the 2000 watt section which is interlocked by an airflow switch on the blower in the 2000 watt section – Pin 4 and 5 are 208 VAC after the cabinet interlock. Pin 4 is also the common line for all the 110 VAC circuits – Pin 6 is a plate current signal from the 2000 watt section to control the overload relay – Pin 7 is B- to complete the plate current signal off of Pin 6 – Pin 8 is the 12 VDC control voltage out of the control section after the interlock relay and the overload relay.

OSCILLATOR SECTION

The oscillator section is the first stage in the RF circuits. It contains a 13.56 MHz crystal and an oscillator circuit. VCA201 is a balanced modulator circuit that controls the output level of this section and of the whole generator. The circuit operates from 8 VDC which comes from the driver section. The VCA level control signal comes from the control panel. The output feeds

into the DRIVER stage. This stage would normally be replaced as a complete section and repaired at the factory.

DRIVER SECTION

The 100 mv signal from the OSCILLATOR section is amplified by the DRIVER section to about 10 to 15 watts. This section operates from 13.8 VDC from the 13.8 VDC power supply. IC302 is an 8 VDC regulated power supply which generates the voltage for the OSCILLATOR section. Q303 and Q304 comprise a broadband power amplifier. This stage would normally be replaced as a complete section and repaired at the factory. RF from this stage is used to drive the 100 watt section.

100 WATT SECTION

The 100 watt section is a broad band, 13.8 VDC, solid state power amplifier with about 10 dB of gain. The 10 watt DRIVER section output is used to drive this stage to about 100 watts output. FL501 is a band pass filter to drop the harmonic output of the amplifier below -50 dB. The RF output from this stage drives the 2000 watt section. 13.8 VDC comes from the 13.8 VDC power supply section. The cooling fan on the amplifier and the power supply is run by 208 VAC off of the primary of the 13.8 VDC power supply transformer.

13.8 VDC POWER SUPPLY

This section is a simple, regulated switching power supply which provides 13.8 VDC to the DRIVER and 100 WATT stages. VR401 adjusts the output voltage. 208 VAC for this section comes off of the primary of the high voltage transformer in the HIGH VOLTAGE section.

2000 WATT SECTION

The 2000 WATT section is a power amplifier employing a ceramic triode power circuit in a grounded grid circuit. There is about 13 dB of RF gain in this section, amplifying the 100 watt RF signal from the 100 WATT section to up to 2000 watts.

The blower for this section is operated from 110 VAC fed into the section on pins 1 and 10 of the 11 pin harness connection. S802 is an airflow switch which disables the 110 VAC back to the interlock relay in the CONTROL section if the blower fails. This protects the final power tube against blower failure. The 110 VAC airflow signal is fed onto pin 3 of the 11 pin harness socket.

L806 is a tuned input circuit so that the RF signal from the 100 WATT section sees a 50 ohm load at the 2000 WATT section. L807 is an RF choke to keep RF off of the filament lines. The Pi-L output circuit of the section is tuned by the TUNE control (C806) and the LOAD control (L804). These controls are factory tuned for resonance and should not require readjustment until the final tube requires replacement.

Pins 2 and 5 of the harness connection and the circuits associated with them are the filament voltage signal which is fed to the meter test socket. Pin 4 is the positive grid current signal which is fed to the meter test socket. R808 is a potentiometer to calibrate that reading. Pin 6 is the plate current signal which is fed to the meter test socket. R803 is a potentiometer to calibrate that reading. Pin 9 is the negative side of the grid current and plate current signal. Pins 7 and 8 are not used, and Pin 11 is ground.

S801 is a high voltage shorting switch to ground the high voltage from the HIGH VOLTAGE section when the top panel of this section is removed. This is done for the safety of service personnel.

C804 and C805 are blocking capacitors to keep the high voltage off of the output circuit. C801,

C802, and C803 are bypass capacitors to keep RF off of the high voltage line. The 2000 watt RF signal from this section is fed through coax to the SWR section.

SWR SECTION

The SWR section is a precision Bird line section which provides a forward power signal and a reflected power signal to the control panel both to indicate the meter readings, and to control the constant power circuit. Both of those signals use a floating ground for maximum isolation from all other circuits. The RF output from this section is available at an N type connector to feed to the load. This line section includes a plug in 2500 watt forward power sensing element and a 500 watt reflected power sensing element.

REMOTE CONTROL PANEL

The control panel is used for manual control of the generator. Computer control is accomplished through the computer interface socket. The manual control panel includes the power level potentiometer, a latching relay to switch from the STANDBY to the POWER mode, STANDBY and POWER lighted switches, and forward and reflected power meters.

A 30 pin socket interfaces the panel into the rest of the generator. Pins 1 through 15 are not used. Pin 16 is 12 VDC in from the CONTROL section. Pin 17 is 110 VAC in from the CONTROL section. Pin 18 is 12 VDC during the STANDBY mode. Pin 19 is not used. Pin 20 is 110 VAC in from the CONTROL section. Pin 21 is 12 VDC out to control the relays in the HIGH VOLTAGE section to turn on the high voltage in the POWER mode. Pin 22, 23, and 24 are not used. Pin 25 is the floating ground for the reflected power signal. Pin 26 is the reflected power signal. Pin 27 is the VCA signal to control the power level of the generator. Pin 28 is a floating ground for the forward power signal. Pin 29 is the forward power signal. Pin 30 is a floating ground for the VCA signal on pin 27.

METER TEST SOCKET

The 30 pin meter test socket is provided to troubleshoot the generator with an accessory meter test box. Pins 1 and 4 are the filament voltage signal. Pins 2 and 5 are the plate voltage signal. Pins 3 and 6 are the grid current signal. Pins 7 and 8 are the plate current signal. Pins 9 through 30 are not used.

CONSTANT POWER SECTION

The CONSTANT POWER section basically holds the output power level constant at a preset level despite minor load variations, line voltage variations, or other outside influences. It also has a few other functions built into it. IC5 and its circuits control the unlatching of the control panel latching relay for a plate current overload, or for a high SWR signal. R109 sets the reflected power setting that will unlatch the relay.

IC1 and IC3 are reflected power circuits. R105 calibrates the reflected power reading which feeds to the reflected power meter. IC2 and IC4 are forward power circuits. R118 calibrates the forward power reading which feeds to the forward power meter. R123 sets the forward power level which unlatches IC5. IC6 controls the output level signal (VCA). IC7, IC8, IC9, and IC10 control the 1 volt feedback circuit controller. IC111 is a highly regulated 15 VDC power supply which provides 15 volts to all of the CONSTANT POWER circuits. The pin descriptions are on the interconnecting diagram.

COMPUTER INTERFACE SOCKET

The function of each of the 14 pins in this socket is described in detail on the interconnection diagram.

TROUBLESHOOTING OPERATING PARAMETER CHART - 2000D, 3000D

TEST PARAMETER:		2000D 1 PHASE	2000D 3 PHASE	3000D 1 PHASE	3000D 3 PHASE
13.8 VDC SUPPLY AT POWER SUPPLY	- 0 OUTPUT - FULL OUTPUT	13.0-14.0 VDC 13.0-14.0 VDC	13.0-14.0 VDC 13.0-14.0 VDC	23.0-25.0 VDC 23.0-25.0 VDC	23.0-25.0 VDC 23.0-25.0 VDC
FREQUENCY AT OUTPUT	- 0 OUTPUT - FULL OUTPUT	13.56 MHZ 13.56 MHZ	13.56 MHZ 13.56 MHZ	13.56 MHZ 13.56 MHZ	13.56 MHZ 13.56 MHZ
8 VDC AT OSCILLATOR	- 0 OUTPUT - FULL OUTPUT	7.9 TO 8.1 VDC 7.9 TO 8.1 VDC			
20 WATT OUTPUT AT DRIVER	- 0 OUTPUT - FULL OUTPUT	0 WATTS 15-20 WATTS	0 WATTS 15-20 WATTS	0 WATTS 15-20 WATTS	0 WATTS 15-20 WATTS
100 WATT OUTPUT AT 100 W SECTION	- 0 OUTPUT - FULL OUTPUT	0 WATTS 90-110 WATTS	0 WATTS 90-110 WATTS	0 WATTS 90-110 WATTS	0 WATTS 90-110 WATTS
RF OUTPUT AT OUTPUT	- 0 OUTPUT - FULL OUTPUT	0 WATTS 2000 WATTS	0 WATTS 2000 WATTS	0 WATTS 3000 WATTS	0 WATTS 3000 WATTS
LATCH VOLTAGE AT RELAY SUPPLY	- 0 OUTPUT - FULL OUTPUT	14-16 VDC 14-16 VDC	14-16 VDC 14-16 VDC	14-16 VDC 14-16 VDC	14-16 VDC 14-16 VDC
GRID CURRENT AT PANEL METER	- 0 OUTPUT - FULL OUTPUT	0 MA 210-230 MA	0 MA 210-230 MA	0 MA 230-260 MA	0 MA 230-260 MA
PLATE CURRENT AT PANEL METER	- 0 OUTPUT - FULL OUTPUT	300-500 MA 700-900 MA	300-500 MA 700-900 MA	300-500 MA 1.1-1.3 AMP	300-500 MA 1.1-1.3 AMP
FILAMENT VOLTS AT PANEL METER	- 0 OUTPUT - FULL OUTPUT	7.4-7.6 VAC 7.4-7.6 VAC	7.4-7.6 VAC 7.4-7.6 VAC	7.4-7.6 VAC 7.4-7.6 VAC	7.4-7.6 VAC 7.4-7.6 VAC
HIGH VOLTAGE AT PANEL METER	- 0 OUTPUT - FULL OUTPUT	4000-4200 VDC 3800-4000 VDC	4000-4200 VDC 3800-4000 VDC	4000-4200 VDC 3800-4000 VDC	4000-4200 VDC 3800-4000 VDC

ALL VOLTAGES NOMINAL FOR 208 VAC AC LINE VOLTAGE.
IF THE AC LINE VOLTAGE IS NOT 208 VAC THE ABOVE VOLTAGES WILL VARY ACCORDINGLY.

TROUBLESHOOTING PROCEDURE FOR 2000D POWER GENERATOR

- STEP 1. Plug the accessory meter box into the metering socket behind the front door of the generator.
- STEP 2. Plug the power generator into the AC power source.
- STEP 3. Attach the output connector to a 50 ohm dummy load capable of accepting 2000 watts at 13.56 MHz.
- STEP 4. Turn on the AC MAINS circuit breaker and check that the AC MAINS light is lighted. If there is any problem here turn to troubleshooting procedure 1. If no problem continue.
- STEP 5. Check that the STANDBY light is lighted and that the top fan is operating. If there is any problem here turn to troubleshooting procedure 2. If no problem continue.
- STEP 6. Set the function switch to TUNE.
- STEP 7. Set the OUTPUT LEVEL control for zero output (fully counterclockwise).
- STEP 8. Push the POWER switch to put the generator into the operate mode, the STANDBY light should go out and the POWER light should come on. If there is any problem here turn to troubleshooting procedure 3. If there is no problem, continue.
- STEP 9. Check the tube operating parameters. They should be: resting plate current - 300 to 500 ma, resting grid current - 0 to 10 ma, filament voltage - 7.0 to 8.0 VAC, and plate voltage - 3800 to 4200 VDC. If there is any problem here turn to troubleshooting procedure 4. If there is no problem, continue.
- STEP 10. Increase the OUTPUT LEVEL control until the generator is giving 2000 watts output. If there is any problem here turn to troubleshooting procedure 5. If there is no problem, continue.
- STEP 11. Check the tube parameters at full output. They should be: plate current - 700 to 900 ma, grid current - 150 to 250 ma, and plate voltage - 3600 to 4000 VDC. If there is any problem here turn to troubleshooting procedure 6. If there is no problem, continue.
- STEP 12. If you have reached this point the generator is operating properly and is ready to use.

INSPECTION PROCEDURE FOLLOWING RECEIPT OF HENRY 2000D RF GENERATOR

1. Remove the generator and the remote control panel from their packing materials.
2. Plug the remote control panel into the matching plug on the back of the generator.
3. Remove the generator's rear panel and jumper the safety interlock with another magnet.
4. Plug the generator into an appropriate AC outlet.
5. Connect the generator to an appropriate 50 ohm dummy load.
6. Check the TUNE and LOAD control settings (located on the front panel of the 2000 watt section) and make sure that they are still at the readings indicated by the factory installed label adjacent to the controls.
7. Turn the output level control to zero output (full counter-clockwise).
8. Plug a meter test box into the metering plug behind the front door.
9. Switch on the circuit breaker on the front door of the generator and make certain that the AC MAINS light comes on.
10. Check the filament voltage of the generator on the meter test box. It should nominally be 7.5 VAC.
11. Check the high voltage of the generator on the meter test box. It should nominally be between 4000 and 4400 VDC.
12. Check the grid current of the generator on the meter test box. It should nominally be near 0, definitely below 10 ma.
13. Increase the output of the generator to 2000 watts by turning the output level clockwise. Turn the TUNE and LOAD controls alternately very slightly to peak the reading for maximum output on the forward power meter.
14. Check the tube parameters at full output: Nominal readings are Filament Volts - 7.5 VAC, Plate Current - 750 to 900 ma, Grid Current - 150 to 250 ma, High Voltage - 3800 to 4200
15. If there is any discrepancy in the forward or reflected power readings, put the generator into the standby mode and check that the Bird power sensing elements are firmly seated into the line section on the back of the 2000 watt section and that the forward power element is pointing towards the output and that the reflected power element is pointing towards the generator.
16. If there are any problems at this point refer to the troubleshooting procedure in the manual.

Procedure I. --- Problem with AC MAINS circuit, circuit breaker or AC line.

CAUTION: THE VOLTAGES INSIDE THE POWER GENERATOR CAN BE LETHAL. ALWAYS DISCONNECT THE POWER CORD AND TURN OFF THE CIRCUIT BREAKER BEFORE WORKING ON THE UNIT!

CIRCUIT BREAKER BLOWS IMMEDIATELY - - The most likely cause is a short in the high voltage circuit, and if this is the case it will not show up until the POWER switch is engaged. If this occurs, isolate the source by disconnecting the high voltage lead at the back of the 2000 watt section. If the short persists it is in the high voltage power supply section or in the lead. If the short disappears it is in the 2000 watt section.

If the short is in the high voltage power supply section, physically examine the supply for signs of burned components or arc traces. Next isolate the location by removing parts from the circuit, starting with the bleeder resistors, then the filter capacitor, then the filter choke, then the rectifier diodes, then the power transformer. The short should disappear when the bad component is removed from the circuit. An ohmmeter trace of the circuit will sometimes show the short, but sometimes it only occurs under voltage.

If the short is in the 2000 watt section, trace the circuit with an ohmmeter to locate the high voltage short to ground. Physically watch for arc traces, check the high voltage shorting switch, examine the high voltage bypass capacitors, examine the blocking capacitors, the RF plate choke, and finally the tube.

Excessive plate current can blow the cathode fuse of the 2000 watt section. Therefore check the continuity of the fuse before going back into operation.

CIRCUIT BREAKER WILL NOT TURN ON OR OFF - - If the circuit breaker has tripped it must be forced off to reset it, then it can be turned on again. Check the continuity of the circuit breaker with an ohm meter then replace it if necessary.

AC MAINS LIGHT WILL NOT COME ON - - Check the bulb (type 330) and replace it if bad. If the bulb is not bad check the voltage at the light holder. If no voltage at the holder, the circuit breaker is probably bad.

Procedure 2. --- STANDBY Light will not come on or top cabinet fan will not operate.

CAUTION: THE VOLTAGES INSIDE THE POWER GENERATOR CAN BE LETHAL. ALWAYS DISCONNECT THE POWER CORD AND TURN OFF THE CIRCUIT BREAKER BEFORE WORKING ON THE UNIT! PLEASE CHECK ALL FUSES WHENEVER THERE IS OR HAS BEEN A PROBLEM.

STANDBY LIGHT AND CABINET FAN INOPERATIVE -- Both of those circuits operate through a relay on the control section whose coil is protected by the magnetic interlock on the back panel of the generator. Therefore if the back panel is not on, the interlock is not closed, and the generator will not go into the STANDBY mode. If the interlock is correctly closed, or jumpered, and the problem persists then look at the relay itself. Be sure to check the AC line fuses too.

STANDBY LIGHT ONLY WILL NOT COME ON -- Check first if there is the required jumper between pins L and N on the REMOTE socket on the control panel. Then check and replace the bulb (type 330) if necessary. Next check if there is 11 to 18 VDC at the STANDBY light/switch assembly. If the voltage is present, suspect a bad switch assembly. If the voltage is not present then the most likely cause is a failure of the relay power supply chassis which is located in the control level section of the generator. Before changing this chassis assembly, measure the voltages at the terminal board on the chassis to insure that the chassis has voltage input and no voltage output. The chassis is located in the control level section of the generator, and the back panel must be removed to access it. If there is proper DC output from that chassis then the circuit must be traced through the harness to the interlock relay (perhaps a bad contact) then up to the control panel.

CABINET FAN ONLY WILL NOT COME ON -- Check first if there is 110 volts to the fan motor. If the voltage is present, then the motor is probably bad. If there is no voltage present, the problem probably lies at the interlock relay, or a bad relay contact or bad relay. The 110 volts for the top fan comes off of the step down transformer on the control level section, goes through the interlock system and then to the top fan. If the motor and interlock relay are good then trace the 110 VAC circuit.

Procedure 3 ---- Generator will not switch into the POWER mode from the STANDBY mode.

CAUTION: THE VOLTAGES INSIDE THE POWER GENERATOR CAN BE LETHAL. ALWAYS DISCONNECT THE POWER CORD AND TURN OFF THE CIRCUIT BREAKER BEFORE WORKING ON THE UNIT! PLEASE CHECK ALL FUSES WHENEVER THERE IS OR HAS BEEN A PROBLEM.

CIRCUIT BREAKER DROPS WHEN POWER SWITCH IS PUSHED - - This indicates a short in the high voltage circuit so refer back to procedure 1 for information.

POWER SWITCH WILL NOT LATCH ON - - There are plate current protection circuits, and power protection circuits that switch the generator into STANDBY when there is a problem. The first thing to check is to press the STANDBY switch for 1 second to reset the overload protection circuit. If the POWER switch will still not latch at zero output the problem probably lies in the latching relay circuit. An overload is normally seen at higher output power. However it is possible for a defective power tube to cause an immediate plate current overload at zero output.

The next thing to look for is a bad POWER switch. Check it with an ohmmeter to see that it is making and breaking properly. If the switch seems to be operating correctly then either an overload is causing the relay to immediately unlatch, or the latching relay on the control panel is not operating correctly.

If the problem lies in the latching relay you can solve it by replacing the control panel module or troubleshooting down to the relay, tracing the DC control signal to the relay.

Procedure 4 - - - - Operating parameters of the final tube are not within the recommended range.

CAUTION: THE VOLTAGES INSIDE THE POWER GENERATOR CAN BE LETHAL. ALWAYS DISCONNECT THE POWER CORD AND TURN OFF THE CIRCUIT BREAKER BEFORE WORKING ON THE UNIT! PLEASE CHECK ALL FUSES WHENEVER THERE IS OR HAS BEEN A PROBLEM.

FILAMENT VOLTAGE - - The nominal operating filament voltage of the 3CX3000A7 is between 7.0 and 8.0 VAC. If there is no filament voltage check the connection at the back of the 2000 watt section with a voltmeter (about ½ volt higher outside chassis). Make certain that the connection is tight. If there is no filament voltage at the 2000 watt section, check the voltage at the filament transformer on the control level section. You must remove the back panel to access the filament transformer. If the transformer is getting input voltage of 208 VAC and there is no output, replace it. If there is filament voltage to the 2000 watt section, the whole section will have to be pulled from the frame to trace the circuit on the bottom of the 2000 watt section schematic.

If the filament voltage is too high, it is a good indication that the line voltage is high. Bring the filament voltage into specification by adjusting the tap connections on the primary of the filament transformer. Nominally taps 1 and 4 should be used for AC line voltage above 220 VAC and taps 1 and 2 for AC line voltage below 220 VAC.

There is also a filament voltage metering adjustment potentiometer. It would be very rare for the circuit to change value or fail, but if the generator is operating properly and there appears to be filament voltage to the 2000 watt section, an out of range voltage might indicate a problem in the metering circuit.

If the filament voltage is too low, it is a good indication that the line voltage is too low. Bring the filament voltage into specification by adjusting the tap connections as described above.

PLATE VOLTAGE - - The high voltage should be between 3800 and 4200 VDC if the generator is operating correctly. If there is no plate voltage the probable cause is a failure of the DC relay circuit in the high voltage power supply section not allowing the high voltage to come on. Pin 6 of the terminal block in the high voltage power supply section is the relay signal so if there is 11 to 18 VDC on that terminal during the POWER mode then the high voltage should be turned on if the relays are working properly.

If the plate voltage is too low it is a good indication that there is low AC line voltage. The power transformer has primary taps for adjusting to different AC line voltages. Taps 1 and 3 are nominal for above 220 VAC. Taps 1 and 2 are nominal for AC line voltage below 220 VAC. A reading of plate voltage about half of the normal range might indicate that the ½ second delay relay in the high voltage power supply section is not operating properly.

If the plate voltage is too high it is a good indication that there is high AC line voltage and that the taps on the primary of the high voltage transformer must be adjusted as described above.

The plate voltage metering circuit also has an adjustment potentiometer in the circuit, but there is no easy way to monitor the plate voltage without a very special meter. A failure in this circuit is extremely rare.

PLATE CURRENT - - The normal resting (no output) plate current of the 3CX3000A7 is nominally 350 ma, but it is not unusual to see readings between 300 and 500 ma and still have the generator working properly. If the resting plate current is more than 500 ma the tube is bad and must be replaced. However usually if the tube goes bad, it goes all the way causing a plate current overload which would keep the generator from switching into the POWER mode.

If there is no resting plate current the cathode protection fuse on the front of the 2000 watt section is probably blown and must be replaced. Another possibility is a failure of the actual meter.

Low resting plate current is unknown, unless the adjustment potentiometer in the plate current metering circuit has failed. There is no easy way to measure plate current without a special meter, and such a metering failure is unusual. It would be more likely to be a failure of the meter itself.

GRID CURRENT - - With no output the grid current reading should be between 0 and 10 ma. If it is significantly higher there is probably a failure in the metering circuit adjustment. There is a grid current test point on the front of the 2000 watt section which allows you to monitor grid current with an external meter and compare it to the reading from the metering test box.

Procedure 5 - - - No output, improper output, or intermittant output from the generator.

CAUTION: THE VOLTAGES INSIDE THE POWER GENERATOR CAN BE LETHAL. ALWAYS DISCONNECT THE POWER CORD AND TURN OFF THE CIRCUIT BREAKER BEFORE WORKING ON THE UNIT! PLEASE CHECK ALL FUSES WHENEVER THERE IS OR HAS BEEN A PROBLEM.

UNIT SWITCHES BACK INTO STANDBY AS POWER IS TURNED UP - - There are two overload circuits in the generator. The first protects against excessive plate current to the tube and it is set by an adjustable resistor on the relay power supply chassis in the control level section. The circuit is factory adjusted so that the generator switches into STANDBY whenever the plate current exceeds 1 amp. If the overload circuit trips when the plate current is less than 1 amp, the circuit must be readjusted with the adjustable resistor. If the plate current actually exceeds 1 amp then there is a problem with the tuning of the 2000 watt section or with the tube itself. The STANDBY button must be pushed to reset the circuit after it has been tripped.

A second overload circuit causes the generator to switch into STANDBY whenever the reflected power exceeds 500 watts for more than 10 seconds or the forward power exceeds about 2200 watts for more than 10 seconds. These circuits are built into the constant power assembly attached to the control panel. Whenever such an overload occurs the STANDBY switch must be pressed to reset the circuit.

LOW OUTPUT OR NO OUTPUT - - The first thing to look for is defective power metering. You can tell by examining the tube parameters if it appears to be operating normally. If everything seems to be normal then suspect a bad power meter or a bad plug-in sensing element at the back of the 2000 watt section. Check also that the coaxial leads from the power sensor are tightly attached. An inadequate connection on the power signal or its floating ground can cause havoc with generator operation.

Also be sure to check the coaxial input and output cables to the 2000 watt section. Shorted or open cables will definitely cause output problems.

Next, check the tuning of the 2000 watt section. The tune-up procedure is attached to the back of this section. Examine the label on the front of the 2000 watt section to see if the TUNE and LOAD controls seem to be at about the correct settings. If they are near the proper settings try first to adjust the TUNE and then the LOAD controls slightly up and down for maximum attainable power output. Refer to the tuning procedure if this initial step does not solve the problem.

The next step should be to insert a Bird power meter in the coax drive line between the 100 watt section and the 2000 watt section to monitor the drive power into the 2000 watt section. In normal operation the output power of the generator should be about 20 times the drive power. For example for an output power of 2000 watts the nominal drive is approximately 100 watts. The 100 watt section is capable of about 150 watts output when operating normally. If you see a drive problem then go to procedure 7 (for example at full output you can only get 50 watts from the 100 watt stage). If the drive appears normal or if there seems to be excessive reflected power from the 2000 watt section (more than 10% of drive) the problem lies in the 2000 watt section.

Reflected power of more than 1/5 th of the drive power can cause low output from the generator. The 2000 watt section has a tuned input and unless there is a failure in the input circuit or the tube there is not likely to be a problem. Do not forget to check for a bad cable!

INTERMITTANT OUTPUT - - Fluctuating or sudden drops in output power must be isolated between the 100 watt driver stage and the 2000 watt section. Again monitor drive power with a Bird wattmeter and see if the problem shows in the cable between the two sections. If so then go to procedure 7. If not the problem lies in the 2000 watt section. Check for bad cables on the output first. If wiggling the cables causes fluctuating output there is probably a cable problem. Next start looking for a breakdown of some component in the high voltage and RF circuits of the 2000 watt section. Parts to suspect would be the blocking capacitors in the high voltage line (some break in transit or change value as they heat up), or the large variable inductor (check the contact point), or finally the tube itself. You can pinpoint the tube quite often by watching its operating parameters while the power is changing. For example if the plate current stays nearly normal as the power drops off it could be a bad tube or a loose connection around the plate tank circuit or output cable. A last potential cause would be a short in the input circuit or input cable which would show up as high reflected power in the drive cable.

Procedure 6 - - - Tube operating parameters at full output are not in range.

If the plate current or grid current are out of the recommended range the 2000 watt section probably requires retuning. The tune up procedure is at the end of this section. Follow the tuning instructions until the unit is operating correctly.

Procedure 7 - - - Problems in the drive to the 2000 watt section.

If there is low, no, or fluctuating drive seen in the drive cable between the 100 watt section and the 2000 watt section, insert a Bird power meter in the drive cable between the oscillator/driver section and the 100 watt section. If the same problem exists here the problem lies in the oscillator/driver section. If the problem does not show up there then the problem lies in the 100 watt section.

If the problem is in the 100 watt section, check the 13.8 VDC power supply to see if it is providing the necessary voltage to operate the 100 watt amplifier. Also check its fuse. If the fuse is not blown, or if the supply still does not operate after replacing the fuse then simply replace the whole 100 watt/13.8 VDC power supply assembly and return the defective assembly to the factory for repair.

If the problem is in the oscillator/driver stage, check that it is receiving 13.8 VDC to the driver stage. If there is voltage going into this section the next thing to check is to change the control panel, because the power level signals feed here from the control panel. If the problem persists, change out the whole oscillator/driver assembly and return it to the factory for repair.

If the problem lies in the control panel, change the assembly and return the defective one to the factory for repair.

POWER AMPLIFIER SECTION TUNE-UP PROCEDURE

This procedure is not possible without an accessory metering test box assembly to monitor the electronic operating parameters of the power tube and a 50 ohm dummy load capable of handling full output of the generator.

SET-UP: Attach the output of the generator to a 50 ohm dummy load capable of handling full RF output from the power generator. Open the front door and locate the 30-pin metering plug. Plug in an accessory metering box to allow monitoring of the plate current and grid current of the final tube. Turn the unit on and check that the AC MAINS light, STANDBY light, and top fan are operating. Turn the output level fully counter-clockwise so that the generator will have no output when it is switched into the power mode. Turn the function switch to the TUNE position. On the front panel of the power amplifier section (the top chassis in the generator) are the TUNE and LOAD controls and calibrated turn counters. Also there should be a label which indicates the factory determined settings for the TUNE and LOAD controls. Check that the TUNE and LOAD controls are at or near their factory settings. When the power generator is properly tuned the operating parameters should be as follows (plus or minus 10%):

	2000D
Plate Current (no output):	350 ma
Plate Current (full output):	800 ma
Grid Current (full output):	200 ma
Output-Maximum:	2000 watts

Check all of these operating parameters by pushing the POWER button to turn on the high voltage and increasing the output level control until the RF generator is operating at full output. Check the plate current and grid current of the output tube at full output. If they are not within the recommended range listed above, then continue with the tune-up procedure.

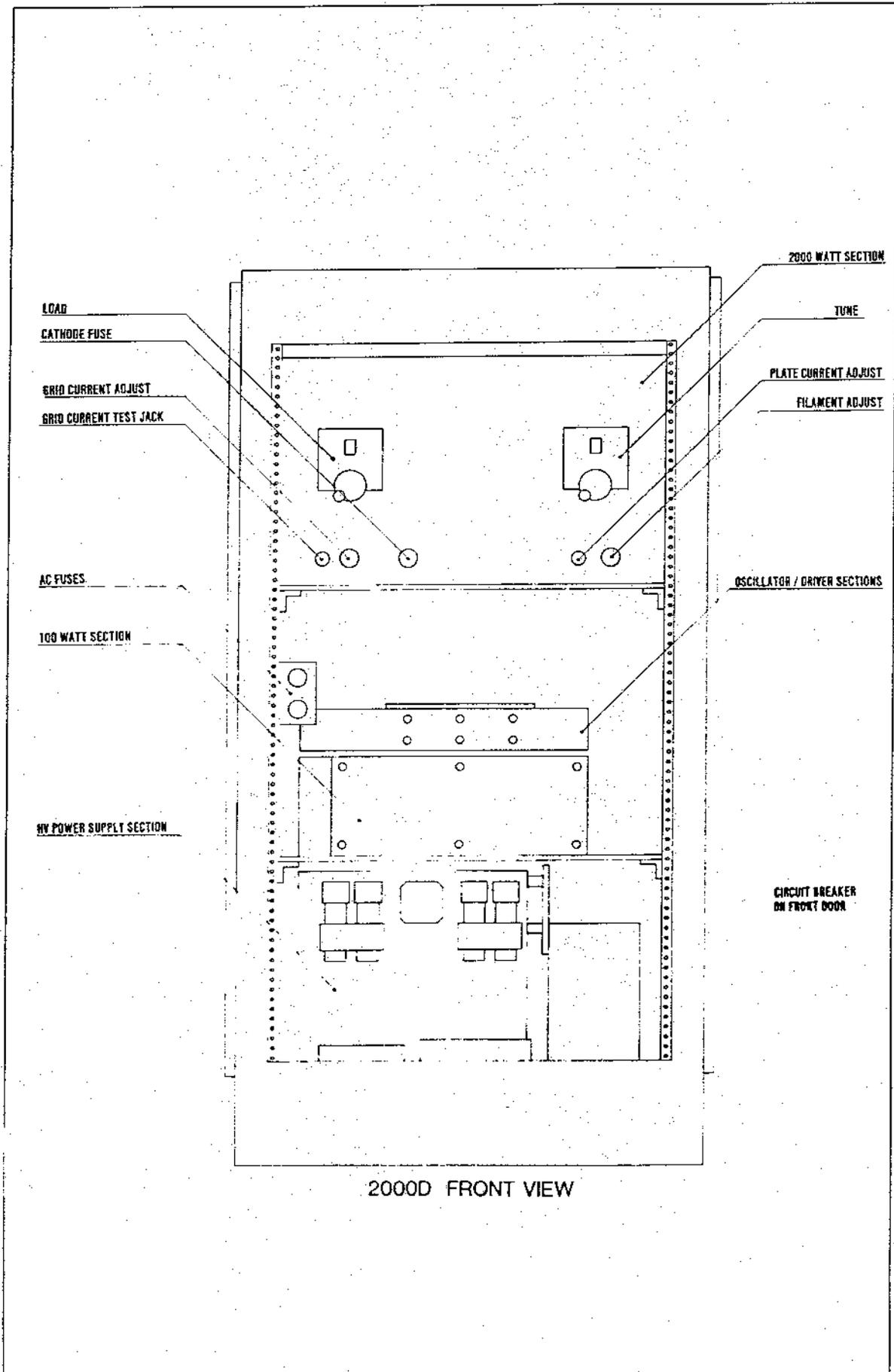
TOUCH-UP TUNING: Operate the power generator at approximately $\frac{1}{4}$ of full output. Locate the LOAD control on the front panel of the power amplifier section (inside the front door). Adjust the LOAD control slightly up and down for maximum output (peak the reading the the output meter). Then increase the level to full output and check each of the operating parameters listed above. If they are still not close or within the ranges listed then you will have to do a complete tune-up procedure as described in the next section.

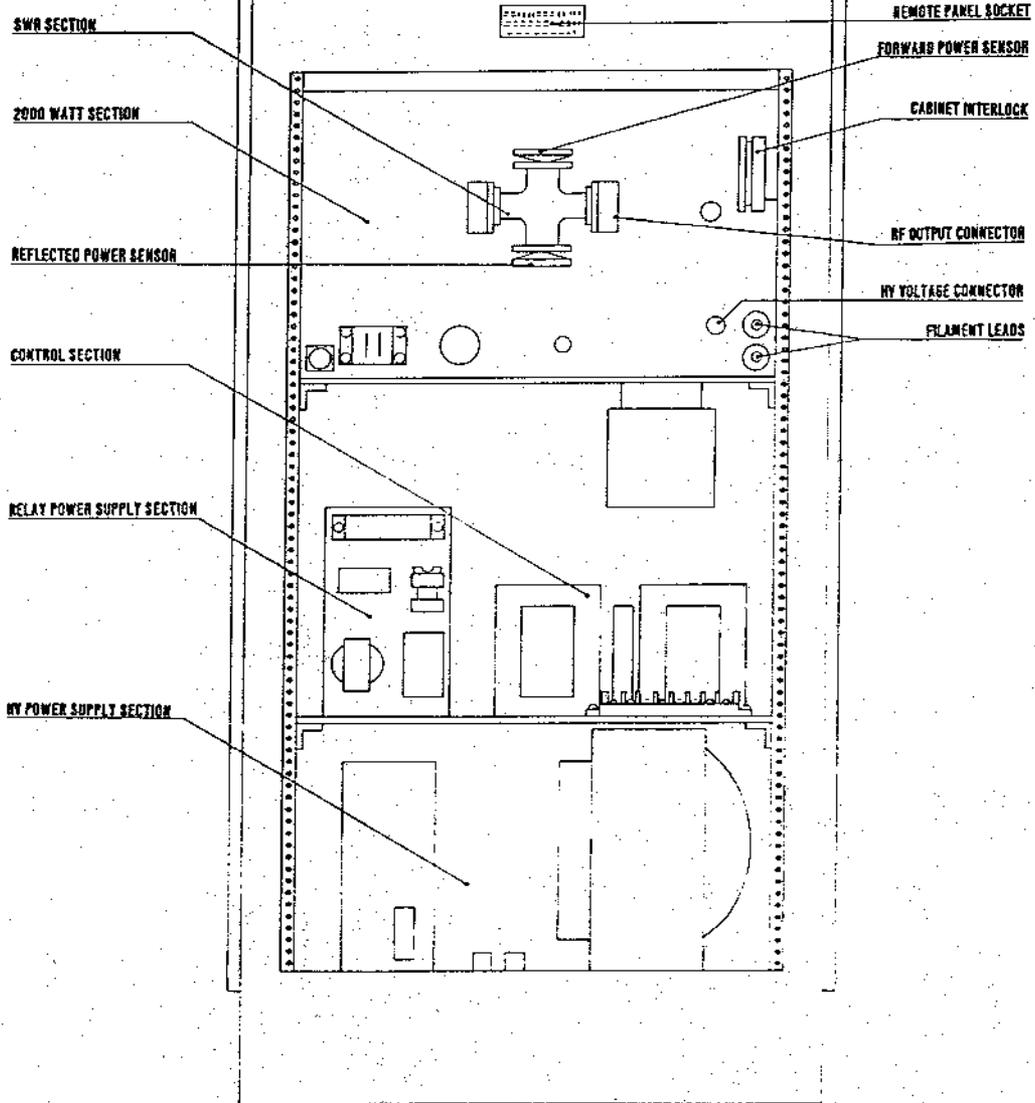
FULL TUNE-UP PROCEDURE: With the generator in the STANDBY mode, set the TUNE and LOAD control to 00.0 and turn the output level control fully counter-clockwise for no output. Then push the POWER button to turn on the high voltage to the power amplifier section. Note the plate current at no output and increase the output level control to increase the plate current about 50%. A) Carefully adjust the TUNE control to dip the reading on the plate current meter (tune for minimum plate current). B) Carefully adjust the LOAD control for maximum output. C) Readjust the TUNE control for minimum plate current.

Again increase the output level control to increase the plate current about 50% and repeat steps B and C above. Then increase the output level control so that the generator is putting out about 75% of full output and repeat steps B and C again several times until no further increase in output can be obtained.

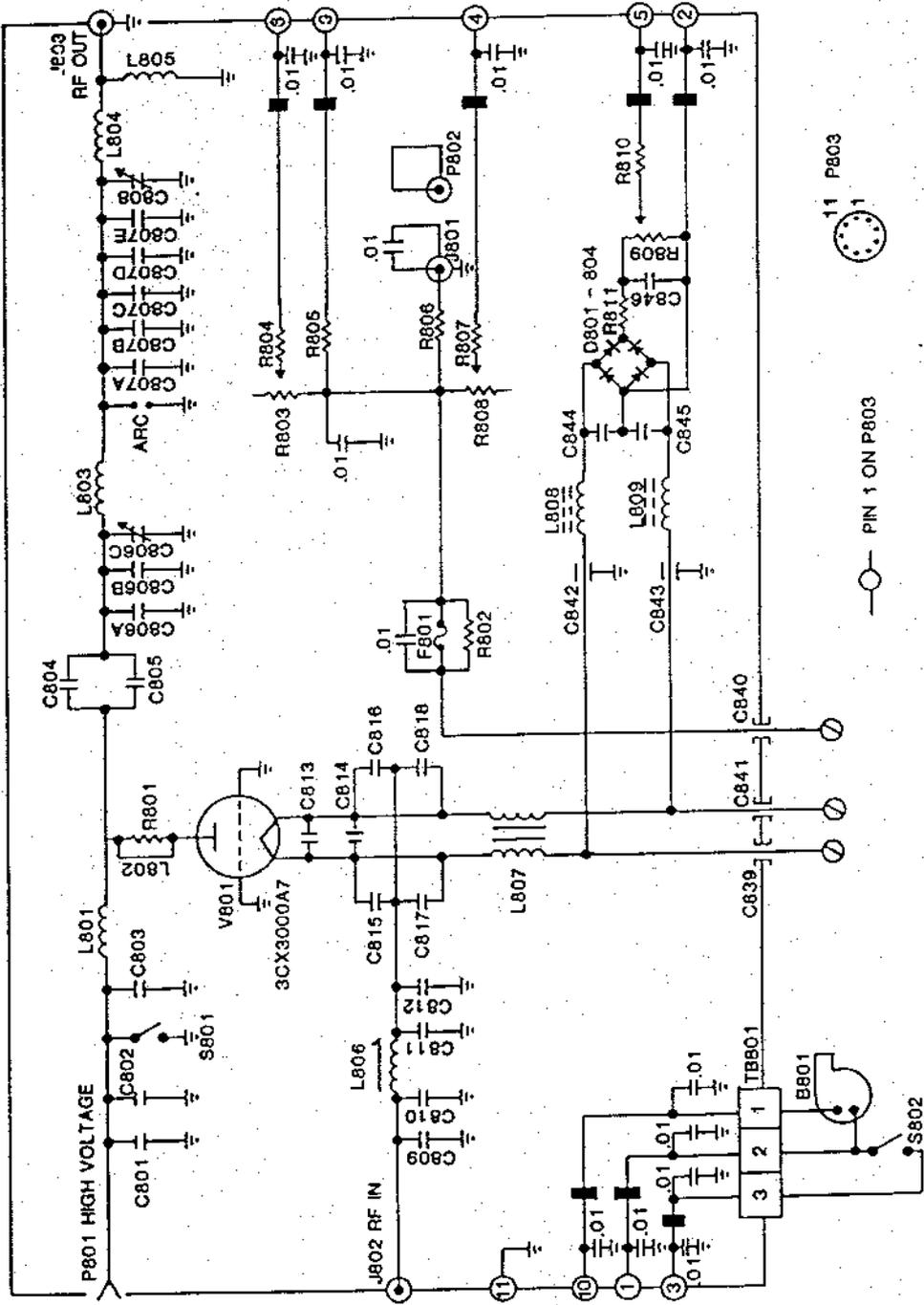
Increase the output level control to full output and repeat steps B and C again several times until no further increase in output can be obtained. Reduce the output level to 2000 watts and readjust the TUNE and LOAD controls to peak the output power reading.

If the equipment is tuned properly the operating parameters listed above should be close or within the ranges specified. Differences between tubes, circuits, loads, and line voltage make it impossible to predict an exact specification of these operating parameters. If it is not possible to approach those values then there is probably some malfunction of the equipment, and you should begin troubleshooting procedures.





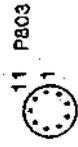
2000D REAR VIEW



2000D SCHEMATIC
2000 WATT SECTION

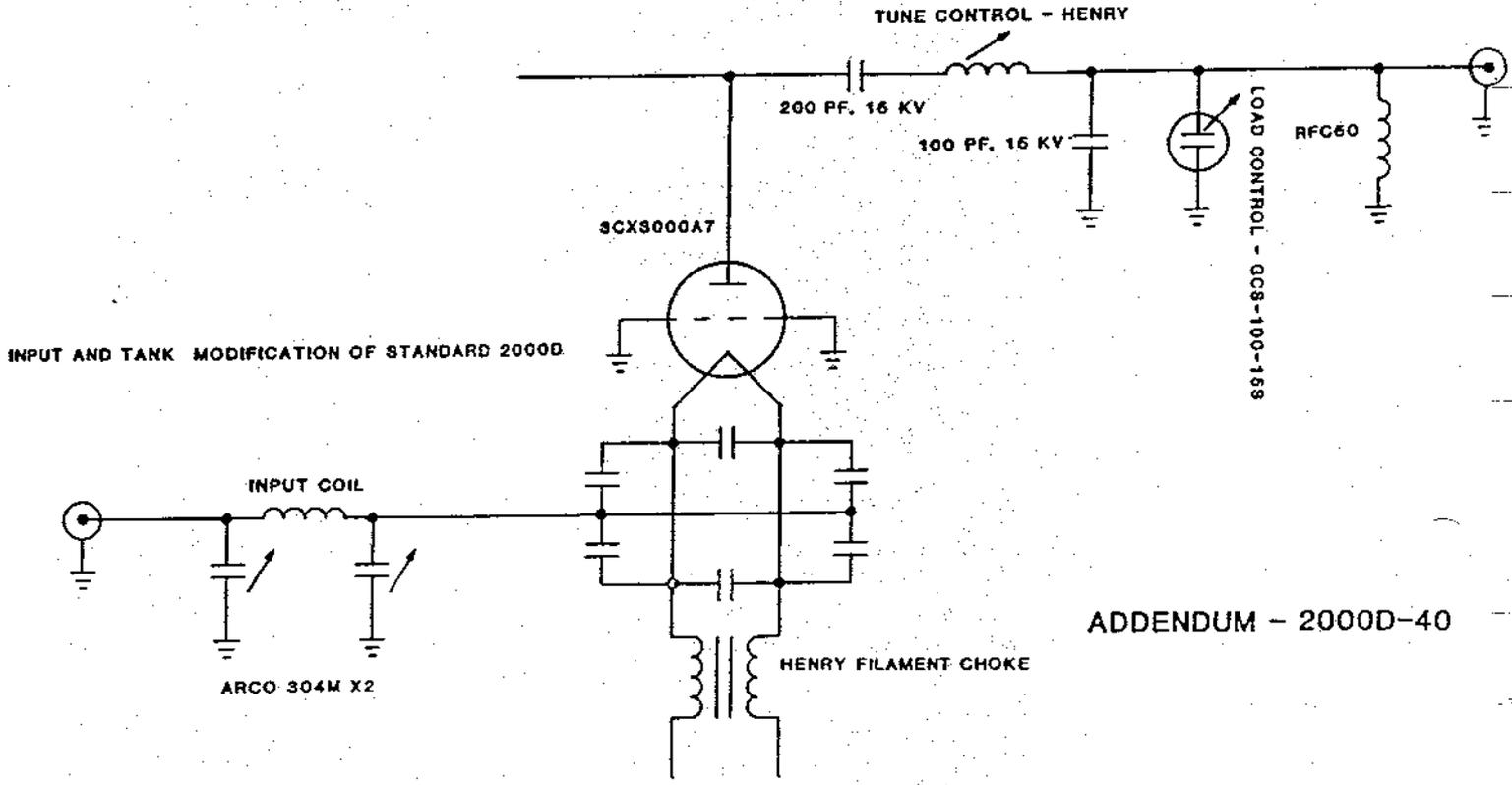
○ PIN 1 ON P803

⊢ FERRITE BEAD

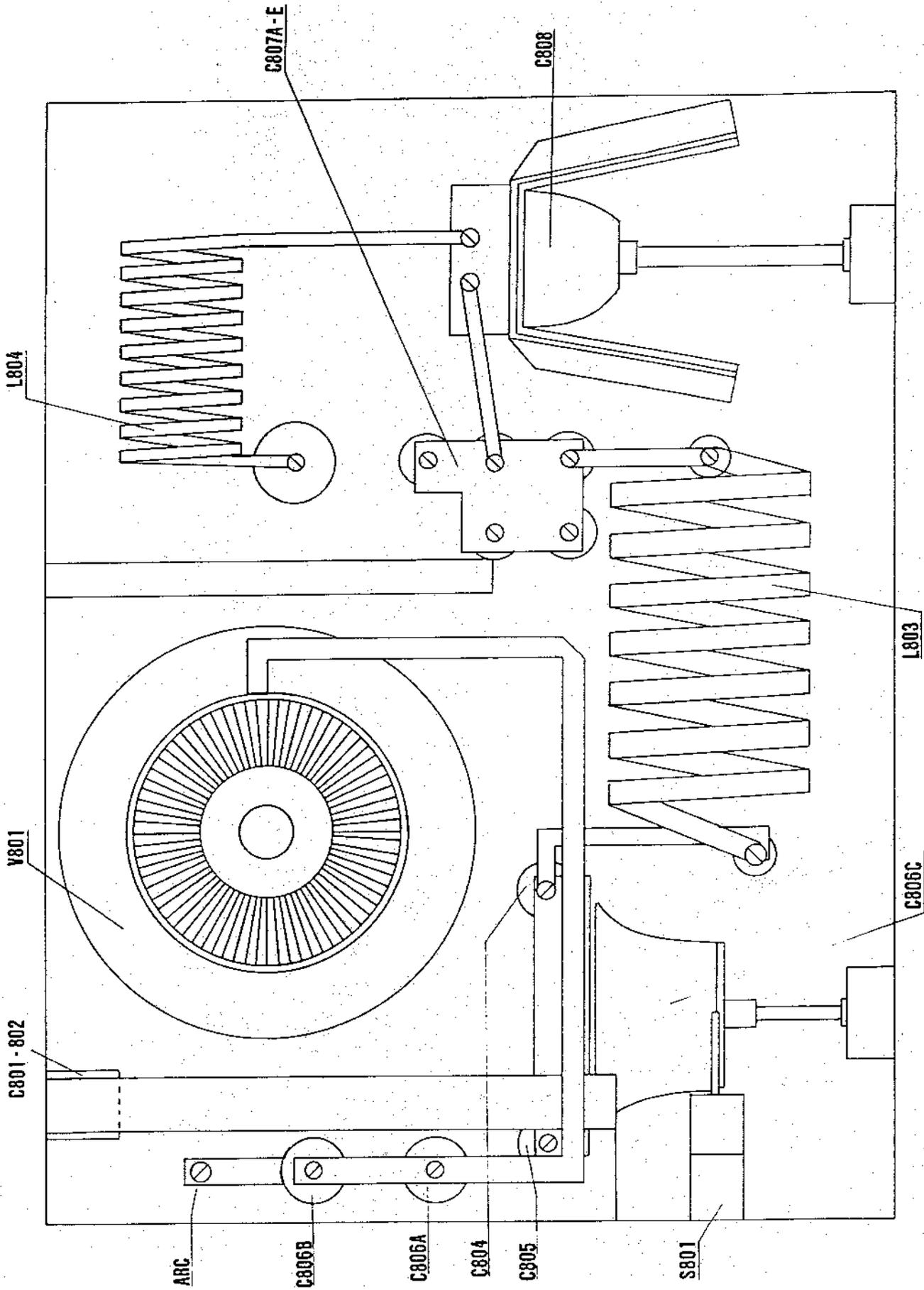


2000 WATT SECTION PARTS LIST - 2000D Power Generator

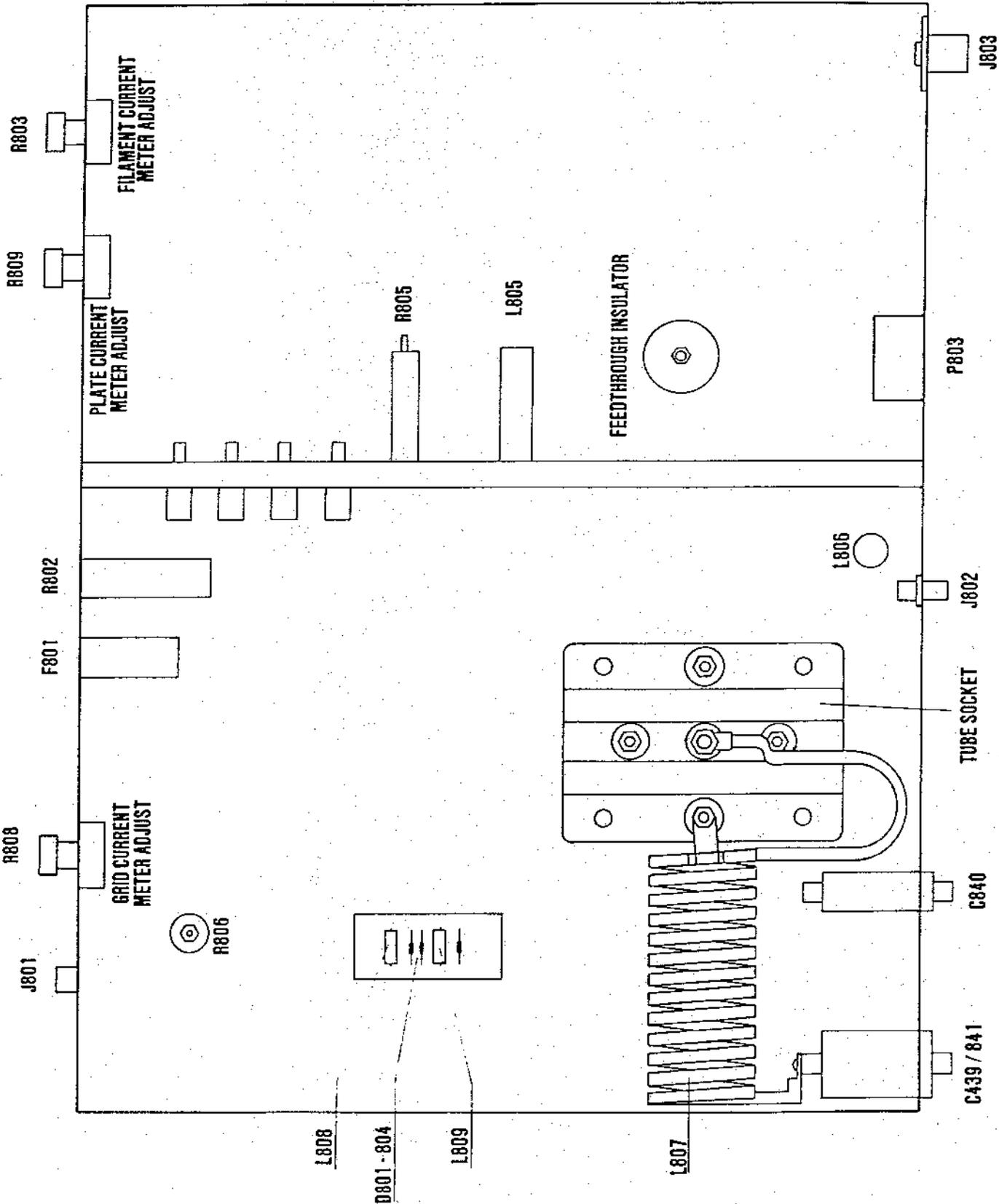
Schematic No.	Description	Manufacturer and No.
ARC	SPARK GAP	Henry ARC-2000D
B101	BLOWER	Dayton 4C006
C801, C802	CAPACITOR: Ceramic transmitting, 500 pf, 20 KV.	Sprague 20DKT5
C803	CAPACITOR: Ceramic disc, .0047 mf, 6 KV.	Sprague 60GAD47
C804, C805	CAPACITOR: Ceramic transmitting, 100 pf, 15 KV.	ITT Jennings 700010
C806	CAPACITOR: Tune Control, vacuum variable, 100 pf, 15 KV.	ITT Jennings GCS-100-15S
C807	CAPACITOR: Ceramic transmitting, 100 pf, 7.5 KV.	ITT Jennings 700066
C808*	CAPACITOR: Load Control, vacuum variable, 250 pf, 15 KV.	ITT Jennings UCSV-250-15S
C809 - C812	Part of L806 assembly.	
C813 - C818	CAPACITOR: Ceramic disc, .01 mf, 1 KV.	Centralab DD-103
C839 - C841	CAPACITOR: Feedthrough, .1 mf, 600 V.	Sprague 48P100
C842, C843	CAPACITOR: Feedthrough, 2000 pf, 1 KV.	Erie 202 M
C844, C845	CAPACITOR: Ceramic disc, .01 mf, 1 KV.	Centralab DD-103
C846	CAPACITOR: Electrolytic, 10 mf, 150 V.	Cornell WBR150-10
.01	CAPACITOR: Ceramic disc, .0 mf, 600 V.	Centralab DD6-103
D801-D804	DIODE: 200 PIV, 1 amp.	Motorola 1N458
F801	FUSE: 8 AG, 1½ amp. FUSEHOLDER: 8 AG.	Littelfuse 361 001.5 Littelfuse 342 004
J801	CONNECTOR: Grid current test jack, RCA type.	Switchcraft 3501FP
J802	CONNECTOR: RF in, BNC type.	Amphenol UG-657 A/U
J803	CONNECTOR: RF out, N type.	Amphenol UG-21 B/U
L801	INDUCTOR: Plate choke.	Henry L801-2000D
L802	INDUCTOR: Copper strap, parasitic assembly.	Henry L802-2000D
L803	INDUCTOR: Tank coil, copper tube.	Henry L803-2000D
L804**	INDUCTOR: L-Section coil, copper strap.	Henry L804-2000D
L805	INDUCTOR: RF choke, 14 MHz.	Ohmite Z-14
L806	INDUCTOR: Input adjust assembly, 4 capacitors.	Henry L806-2000D
L807	INDUCTOR: Filament choke, copper tube.	Henry L807-2000D
L808, L809	INDUCTOR: RF choke, 2.5 mH.	Miller 6302
P801	CONNECTOR: High voltage.	Henry P801-2000D
P802	CONNECTOR: Grid current test point jumpered.	Switchcraft 3504M
P803	CONNECTOR: Harness, 11-pin.	Amphenol 078-S11
R801	RESISTOR: Non-inductive, 50 ohms, 150 watts.	Carborendum 886SP500K
R802	RESISTOR: Carbon, 10 K ohm, 2 watt, 10%.	Resistor
R803	POTENTIOMETER: Plate current adjust, 1 K ohm.	Potentiometer
R804	RESISTOR: Carbon, 220 ohm, 2 watt, 10%.	Resistor
R805	RESISTOR: Wirewound, .5 ohm, 10 watt, 5%.	Resistor
R806	RESISTOR: Wirewound, 1 ohm, 25 watt, 5%.	Resistor
R807	RESISTOR: Carbon, 470 ohm, 2 watt, 10%.	Resistor
R808	POTENTIOMETER: Grid current adjust, 2 K ohm.	Potentiometer
R809	POTENTIOMETER: Filament voltage adjust, 1 K ohm.	Potentiometer
R810	RESISTOR: Carbon, 820 ohm, 1 watt, 10%.	Resistor
S801	SWITCH: High voltage shorting protection.	Henry S801-2000D
S802	SWITCH: Air flow protection switch.	Rotron 2A=1000
TB101	TERMINAL BOARD: 3 connector, blower.	Terminal Board
V801	ELECTRON TUBE: Ceramic triode, type 3CX3000A7. TUBE SOCKET: Air cooled.	Eimac 3CX3000A7 Henry SK801-2000D
	DESIGN CHANGE: S.N. 216, 217, 218, 222 and above.	
*C808	CAPACITOR: Ceramic transmitting, 200 pf, 7.5 KV.	ITT Jennings 700008
**L804	INDUCTOR: Variable, 16 turn.	Henry L-804A-2000D



ADDENDUM - 2000D-40

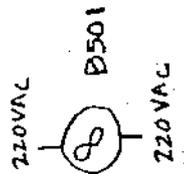
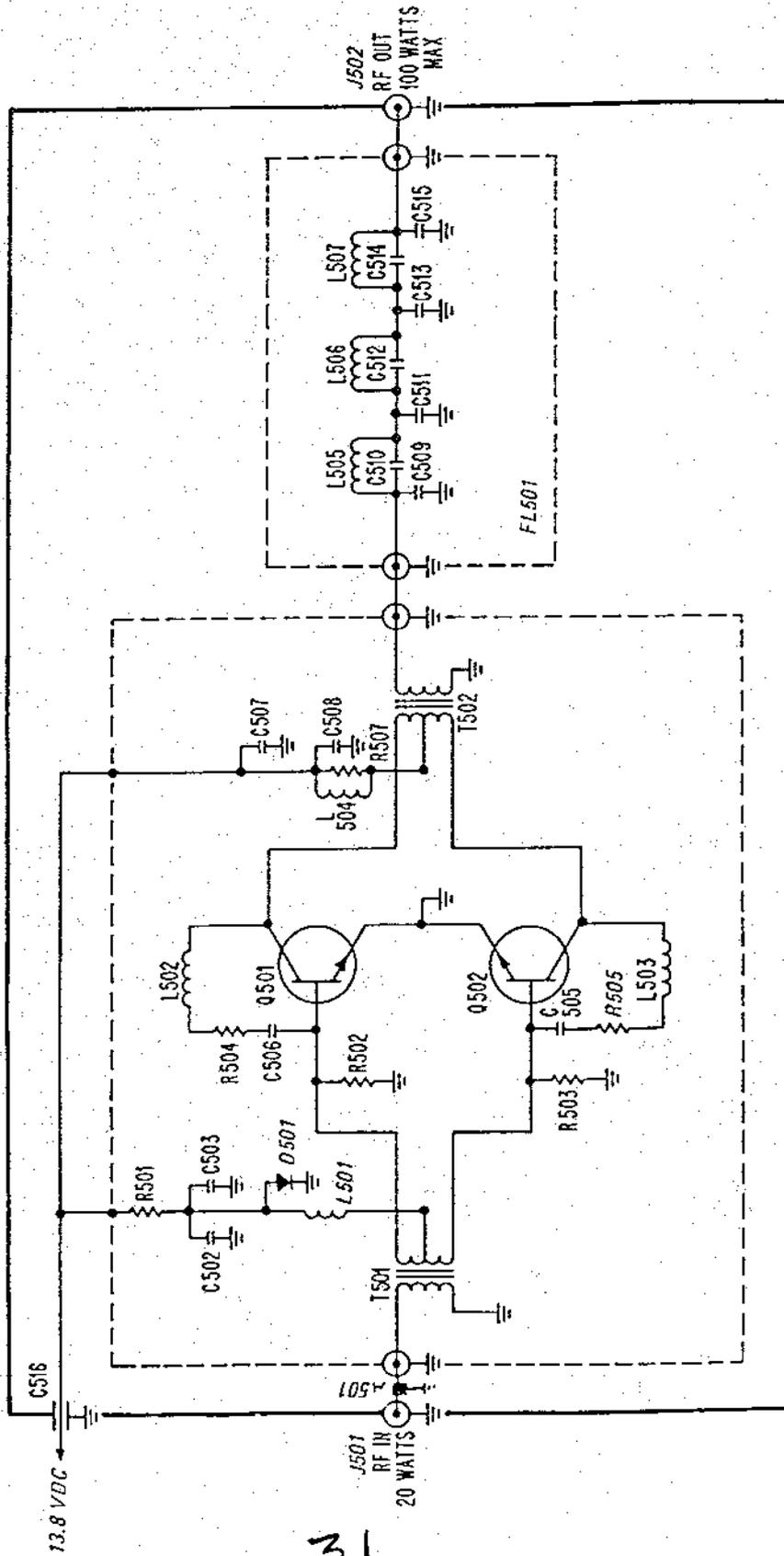


2000 WATT SECTION (TOP)



2000 WATT SECTION (BOTTOM)

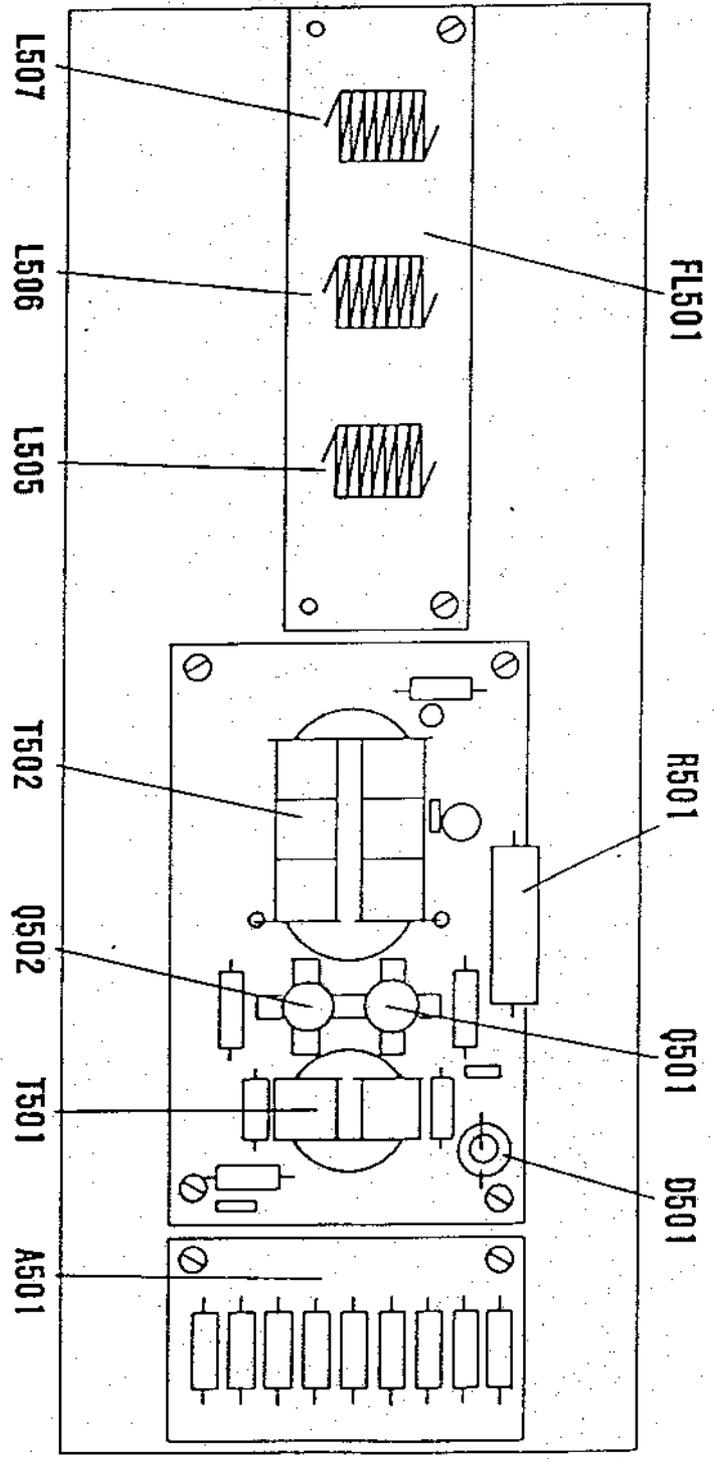
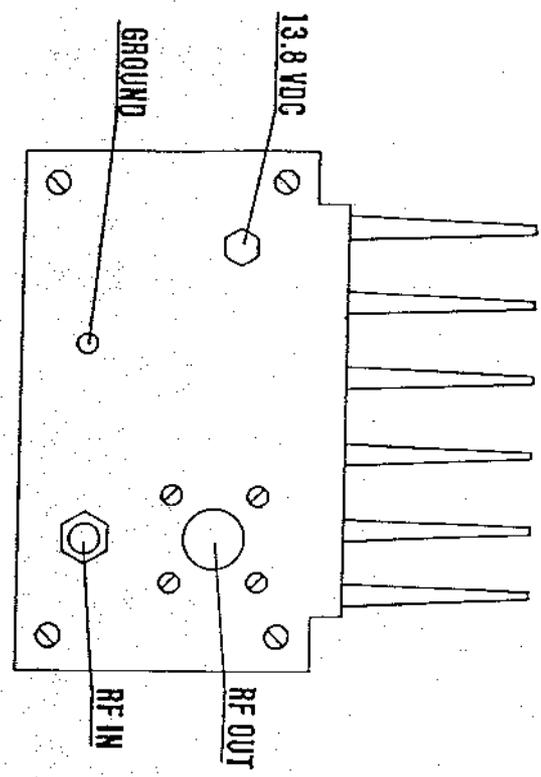
100 WATT SECTION SCHEMATIC - 1000D, 2000D, 3000D Power Generators
 Schematic Number: 8000510



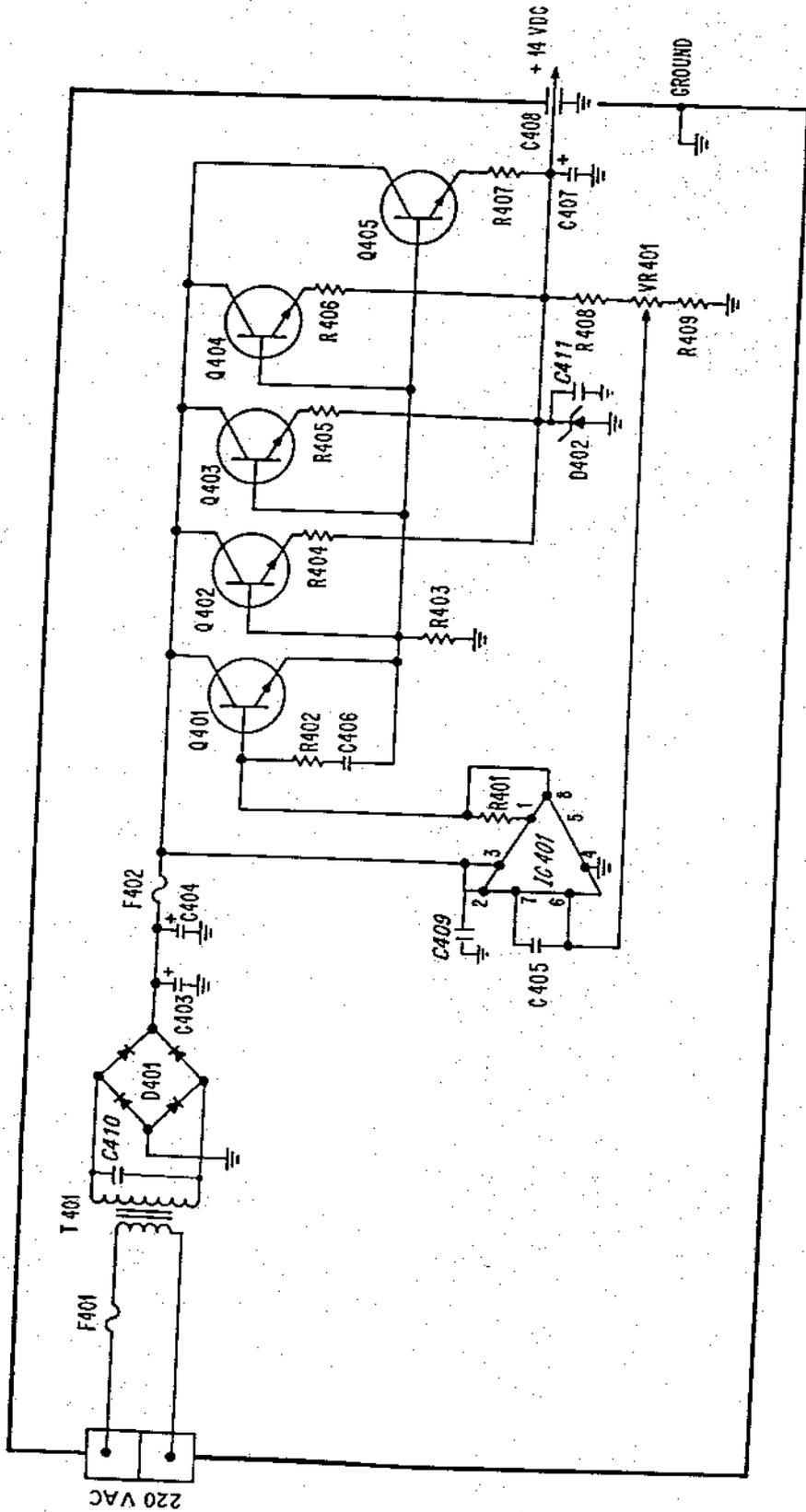
100 WATT SECTION PARTS LIST - 1000D, 2000D, 3000D Power Generators.

SCHEMATIC NO.	DESCRIPTION	MANUFACTURER and NO.
A501	ATTENUATOR: 3 dB.	Henry Assembly
C502 C503, C505, C506, C508 C507 C516	CAPACITOR: Electrolytic, 100 mf, 15 VDC. CAPACITOR: Ceramic Disc, .02 mf, 150 WVDC. CAPACITOR: Electrolytic, 25 mf, 50 VDC. CAPACITOR: Feed Through, 2000 pf.	COE WBR100-15 Centralab DDM-203 Arco RME-FJ-025 Erie 202M
J501 J502	CONNECTOR: RF In, RCA Phono Type. CONNECTOR: RF Out, SO-239.	Switchcraft 3501F Amphenol 083-1R
D501	DIODE: 50 PIV, 3 amp, 1N4997.	Motorola 1N4997
FL501	FILTER ASSEMBLY:	Henry Assembly
L501-L503 L504	COIL: 2.2 UH. FERRITE BEAD:	Miller 9250-222 Henry Assembly
R501 R502-R503 R504-R505 R506	RESISTOR: Wirewound, 75 ohm, 20 watt, 5%. RESISTOR: Carbon, 22 ohm, 1/2 watt, 5%. RESISTOR: Carbon, 220 ohm, 2 watt, 5%. RESISTOR: Carbon, 10 ohm, 1 watt, 5%.	Resistor Resistor Resistor Resistor
Q501-Q502	TRANSISTOR: CD-7012.	CTC CD-7012.
T501 T502	TRANSFORMER: RF. TRANSFORMER: RF.	Henry Assembly Henry Assembly
B501	BLOWER: 220 VAC.	Rotron MU3A1 - 220 VAC

100 WATT SECTION



13.8 VDC POWER SUPPLY SECTION SCHEMATIC - 1000D, 2000D, 3000D Power Generators
Schematic Number: 800908



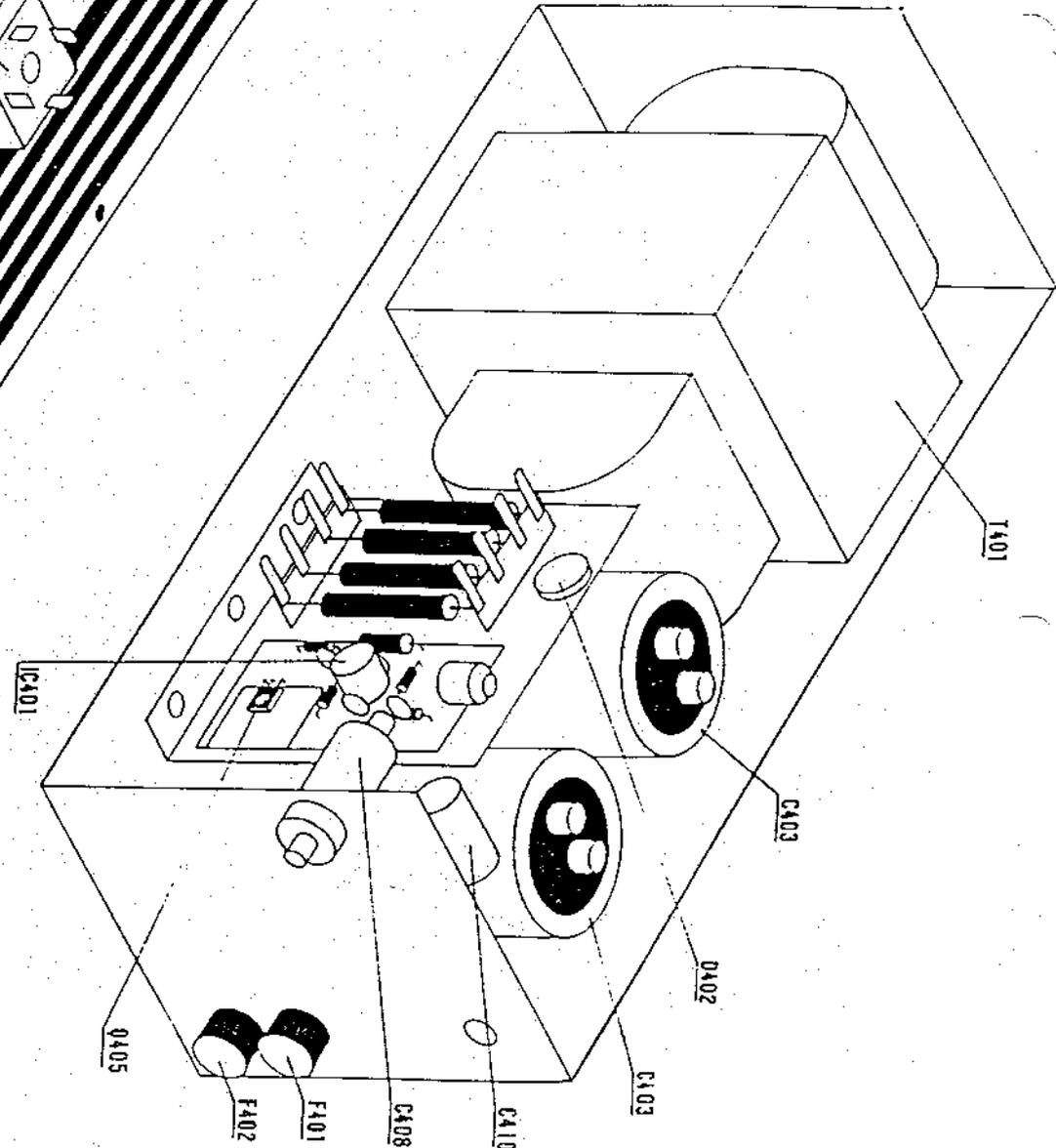
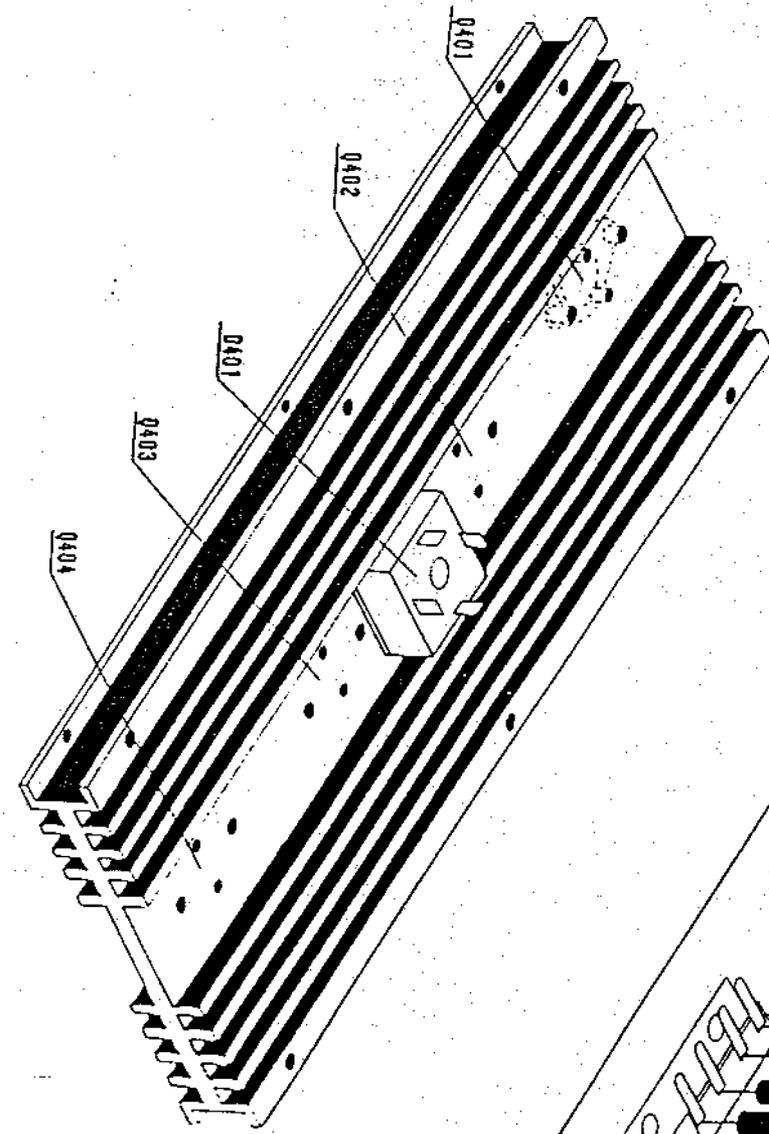
13.8 VDC POWER SUPPLY SECTION (28.0 FOR 3000D) PARTS LIST - 1000D, 1500D, 2000D, 2500D, 3000D

SCHEMATIC NUMBER	DESCRIPTION	MANUFACTURER OR EQUIVALENT
C403, C404	CAPACITOR: ELECTROLYTIC, 17,000 MF, 40 VDC.	WORLD CEC173CC040BC
C405, C406	CAPACITOR: CERAMIC DISC, .0022 MF, 1000 VDC.	CENTRALAB DD222
C407	CAPACITOR: ELECTROLYTIC, 500 MF, 50 VDC.	ARCO MEJ500
C408	CAPACITOR: FEEDTHROUGH, .1 MF, 150 VDC.	SPRAGUE 80P3
C409, C411	CAPACITOR: CERAMIC DISC, .02 MF, 1000 VDC.	CENTRALAB DDH203
C410	CAPACITOR: NYLAR, .22 MF, 200 VDC.	CORNELL DPHS2P22
D401	DIODE: FULL WAVE BRIDGE RECTIFIER, 200 PIV, 27 AMP.	MOTOROLA MDA990-2
D402 (EXCEPT 3000D)	DIODE: ZENER, OVER VOLTAGE PROTECTION, 1N3317A.	MOTOROLA 1N3317A
D402 (3000D)	DIODE: ZENER, OVER VOLTAGE PROTECTION, 1N3325.	MOTOROLA 1N3325
F401	FUSE: 3 AG, 6 AMP, 250 VAC.	LITTELFUSE 312 006
F402	FUSE: 3 AG, 20 AMP, 250 VAC.	LITTELFUSES 312 020
	FUSEHOLDER: 3 AG SIZE.	LITTELFUSE 342 001A
IC401	INTEGRATED CIRCUIT: VOLTAGE REGULATOR.	RCA CA3085B
Q401	TRANSISTOR: SILICON, MJES21, GENERAL PURPOSE.	MOTOROLA MJES21
Q402-Q405	TRANSISTOR: SILICON, 2N3055, SWITCHING.	MOTOROLA 2N3055
R401	RESISTOR: CARBON, 10 OHM, 1 WATT, 5%.	RESISTOR
R402	RESISTOR: CARBON, 1 K OHM, 1/2 WATT, 10%.	RESISTOR
R403	RESISTOR: CARBON, 820 OHM, 2 WATT, 10%.	RESISTOR
R404-R407	RESISTOR: WIRE WOUND, .25 OHM, 15 WATT, 5%.	RESISTOR
R408	RESISTOR: CARBON, 2.7 K OHM, 1/2 WATT, 10%.	RESISTOR
R409	RESISTOR: CARBON, 100 OHM, 1/2 WATT, 10%.	RESISTOR
T401 (EXCEPT 3000D)	TRANSFORMER: POWER TRANSFORMER, 220 VAC/13.8 VAC.	ECA 1088
T401 (3000D)	TRANSFORMER: POWER TRANSFORMER, 220 VAC/28.0 VAC.	ECA 1097

28 VDC Power Supply for 3000 Wall Generator

All Parts the same except:

D402	Diode Zener Overvoltage Protection	IN 3525
T401	Transformer: Rectifier 220 VAC	ECA 1097

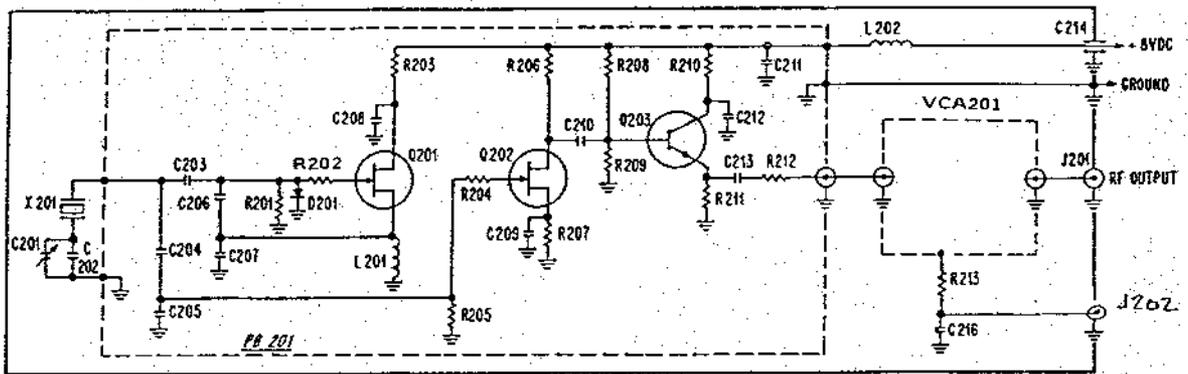


13.8 VDC POWER SUPPLY

OSCILLATOR UNIT SCHEMATIC - 500D, 1000D, 2000D, 3000D, 5000D Power Generators

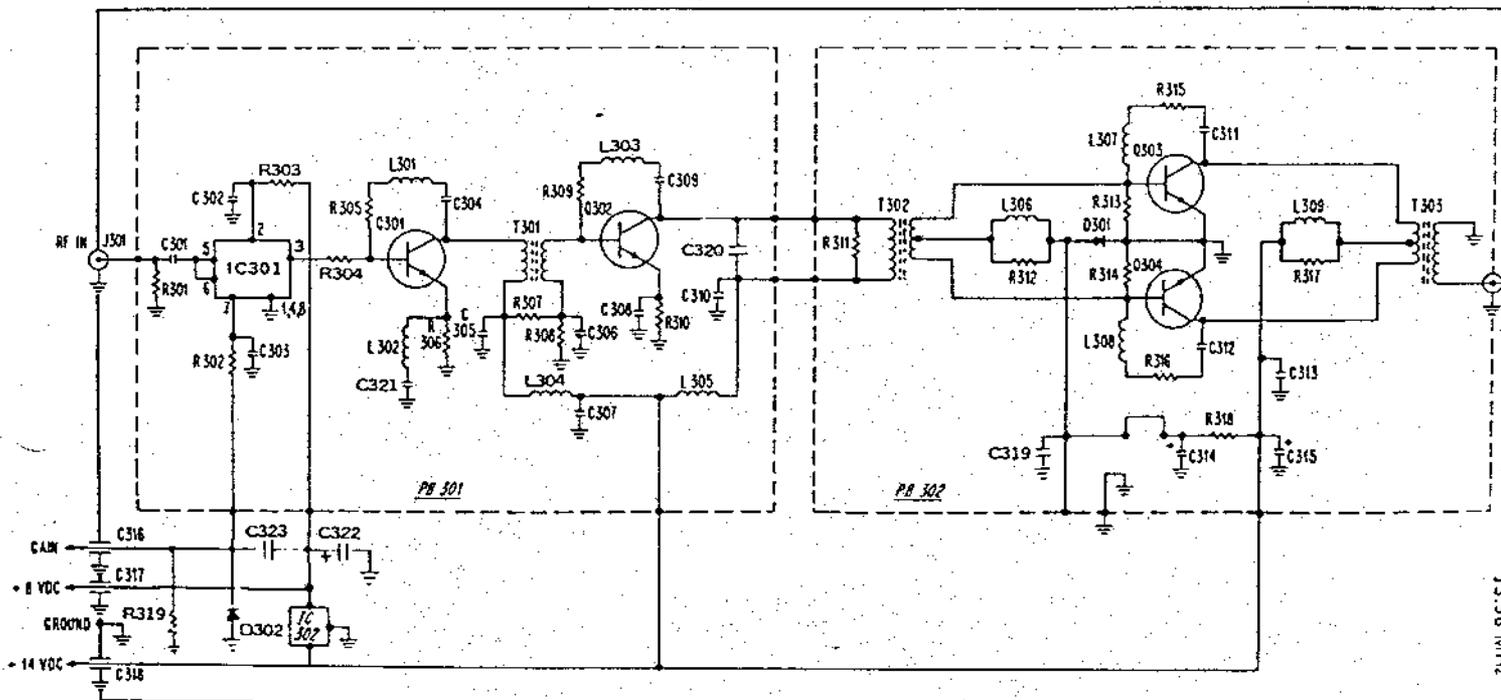
Schematic Number: 800906

13.56 MHz



DRIVER UNIT SCHEMATIC - 500D, 1000D, 2000D, 3000D, 5000D Power Generators

Schematic Number: 800907

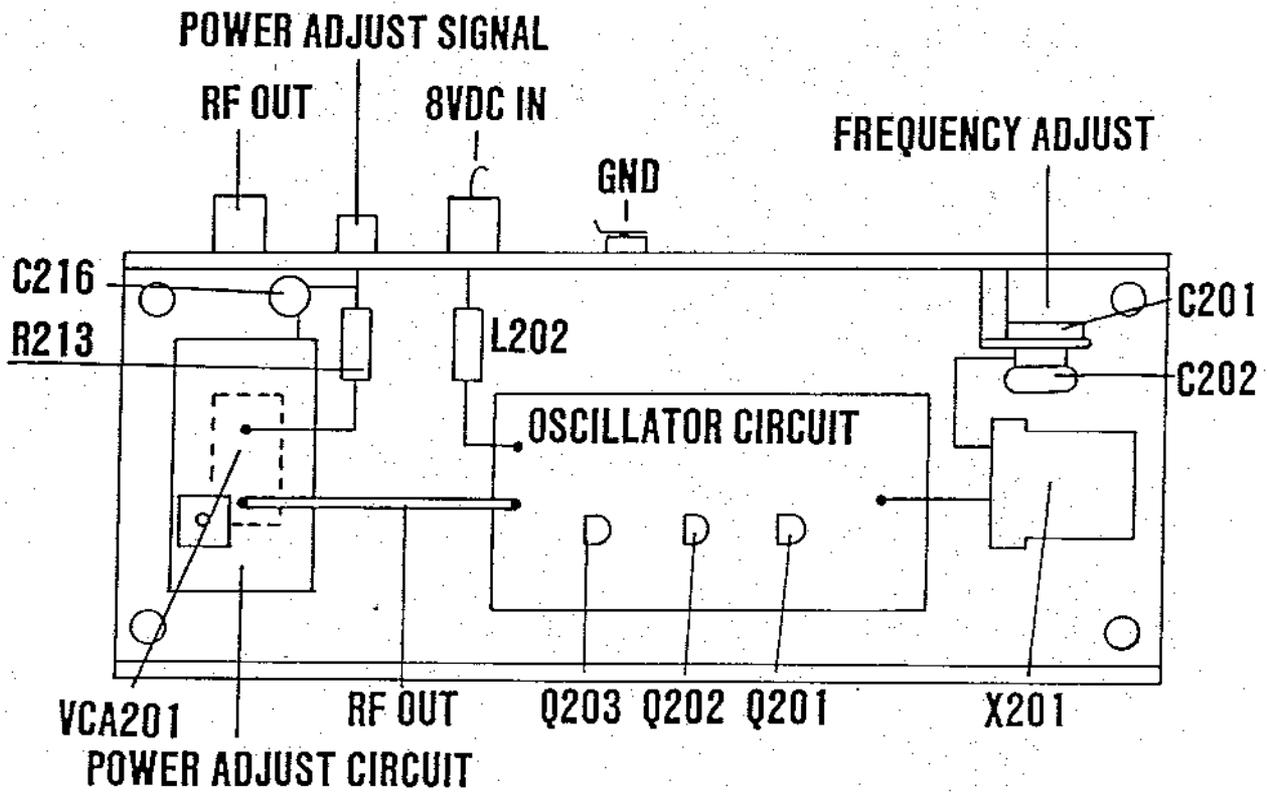


OSCILLATOR UNIT PARTS LIST - 500D, 1000D, 2000D, 3000D, 5000D Power Generators

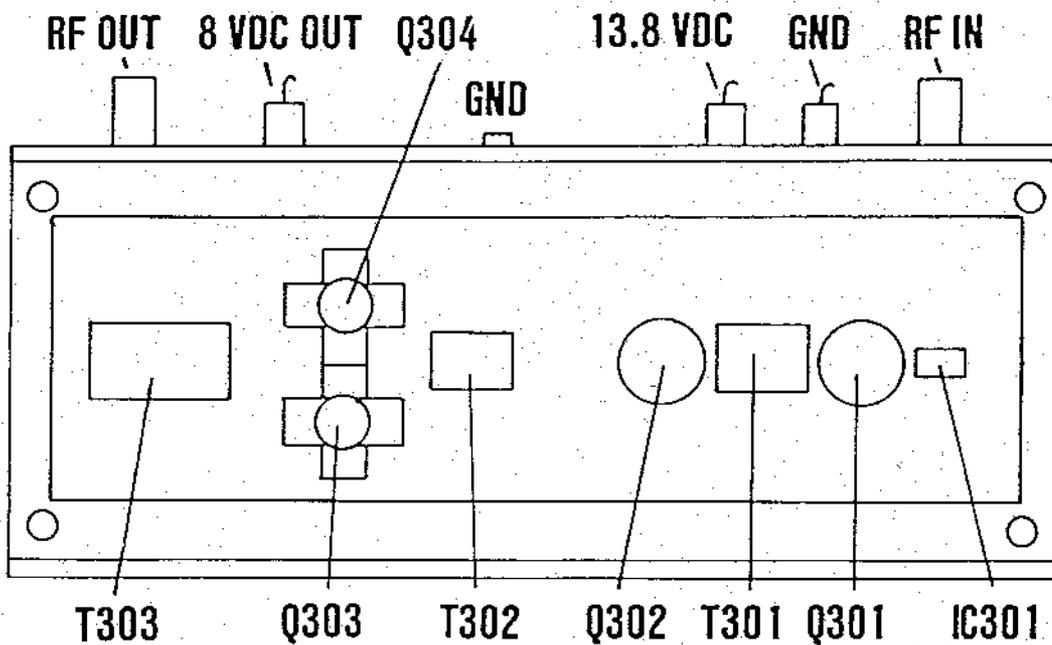
SCHEMATIC NO.	DESCRIPTION	MANUFACTURER and NO.
C201	CAPACITOR: Variable, 8-50 pf.	Erie 8-C-201
C202	CAPACITOR: Silver Mica, 32 pf, 350 WVDC.	Arco DM10-320J
C203	CAPACITOR: Ceramic Disc, .001 mf, 1000 WVDC.	Centralab DD-102
C204	CAPACITOR: Silver Mica, 10 pf, 350 WVDC.	Arco DM10-100J
C205-C206	CAPACITOR: Silver Mica, 100 pf, 350 WVDC.	Arco DM10-101J
C207	CAPACITOR: Silver Mica, 220 pf, 350 WVDC.	Arco DM10-221J
C208-C213	CAPACITOR: Ceramic Disc, .01 mf, 150 VDC.	Centralab DDM-103
C214	CAPACITOR: Feed Through, 2000 pf.	Erie 202M
D201	DIODE: 1N4148.	Motorola 1N4148
J201	CONNECTOR: RF Out, BNC UG-657/U.	Amphenol UG-657/U
J202	CONNECTOR: Control, RCA Phono Type Jack.	Switchcraft 3501F
L201	INDUCTOR: 1 mH.	Miller 9230-92
L202	INDUCTOR: 3.3 uH.	Miller 9250-332
Q201-Q202	TRANSISTOR: Oscillator and 1st Amplifier, 2N5486.	Motorola 2N5486
Q203	TRANSISTOR: 2nd Amplifier, 2N4124.	Motorola 2N4124
R201	RESISTOR: Carbon, 27 K ohm, 1/4 watt, 5%.	Resistor
R202-R204	RESISTOR: Carbon, 10 ohm 1/4 watt, 5%.	Resistor
R205	RESISTOR: Carbon, 470 K ohm, 1/4 watt, 5%.	Resistor
R206	RESISTOR: 1 K ohm, 1/4 watt, 5%.	Resistor
R207	RESISTOR: Carbon, 470 ohm, 1/4 watt, 5%.	Resistor
R208-R209	RESISTOR: Carbon, 27 K ohm, 1/4 watt, 5%.	Resistor
R210	RESISTOR: Carbon, 10 ohm, 1/4 watt, 5%.	Resistor
R211	RESISTOR: Carbon, 470 ohm, 1/4 watt, 5%.	Resistor
R212	RESISTOR: Carbon, 100 ohm, 1/4 watt, 5%.	Resistor
R213	RESISTOR: Carbon, 51 ohm, 1/4 watt, 5%.	Resistor
VCA201	VOLTAGE CONTROL ATTENUATOR: Output.	Henry Assembly
X201	CRYSTAL: CR18, 13.56 MHZ.	ICM CS-F700

DRIVER UNIT PARTS LIST - 500D, 1000D, 2000D, 3000D, 5000D Power Generators

SCHEMATIC NO.	DESCRIPTION	MANUFACTURER and NO.
C301, C303, C308	CAPACITOR: Ceramic Disc, .001 mf, 1000 VDC.	Centralab DD-102
C302-C305, C307, C309-C313	CAPACITOR: Ceramic Disc, .01 mf, 150 VDC.	Centralab DDM-103
C306, C319, C321	CAPACITOR: Ceramic Disc, .05 mf, 20 VDC.	Centralab UK20-503
C314	CAPACITOR: Electrolytic, 100 mf, 16 VDC.	CDE WBR100-16
C315	CAPACITOR: Electrolytic, 25 mf, 50 VDC.	Arco RME-FJ-025
C316-C318	CAPACITOR: Feed Through, 2000 pf.	Erie 202M
C320	CAPACITOR: Silver Mica, 33 pf, 500 VDC.	Arco DM15-330J
C322, C323	CAPACITOR: Electrolytic tantalum, 47 mf, 20 VDC.	Mallory CSR13-E476KL
D301-D302	DIODE: 400 PIV, 1 amp.	Motorola 1N4004
IC301	INTEGRATED CIRCUIT: Input amplifier.	Plessey SL-1610
IC302	INTEGRATED CIRCUIT: Voltage Regulator.	National LM340-T8
J301-J302	CONNECTOR: Input-Output, BNC.	Amphenol UG-657/U
L301-L305, L307-L308	INDUCTOR: 1 uH.	Miller 9230-20
L306	INDUCTOR: 3.3 uH.	Miller 9250-332
L309	FERRITE BEAD	Henry Assembly
R301	RESISTOR: Carbon, 51 ohm, 1/4 watt, 5%.	Resistor
R302	RESISTOR: Carbon, 100 ohm, 1/4 watt, 5%.	Resistor
R303, R310, R312, R317	RESISTOR: Carbon, 10 ohm, 1/4 watt, 5%.	Resistor
R304	RESISTOR: Carbon, 47 ohm, 1/4 watt, 5%.	Resistor
R305	RESISTOR: Carbon, 820 ohm, 1/4 watt, 5%.	Resistor
R306, R308, R313, R314	RESISTOR: Carbon, 22 ohm, 1/4 watt, 5%.	Resistor
R307	RESISTOR: Carbon, 220 ohm, 1 watt, 5%.	Resistor
R309	RESISTOR: Carbon, 150 ohm, 1/4 watt, 5%.	Resistor
R311	RESISTOR: Carbon, 470 ohm, 1/4 watt, 5%.	Resistor
R315-R316	RESISTOR: Carbon, 120 ohm, 1 watt, 5%.	Resistor
R318	RESISTOR: Carbon, 330 ohm, 1/2 watt, 5%.	Resistor
R319	RESISTOR: Carbon, 10 K ohm, 1/4 watt, 5%.	Resistor
Q301	TRANSISTOR: 1st Amplifier.	Motorola 2N5109
Q302	TRANSISTOR: 2nd Amplifier.	Motorola 2N3553
Q303-Q304	TRANSISTOR: Final Amplifier.	CTC S10-12
T301	TRANSFORMER: RF.	Henry Assembly
T302	TRANSFORMER: RF.	Henry Assembly
T303	TRANSFORMER: RF.	Henry Assembly

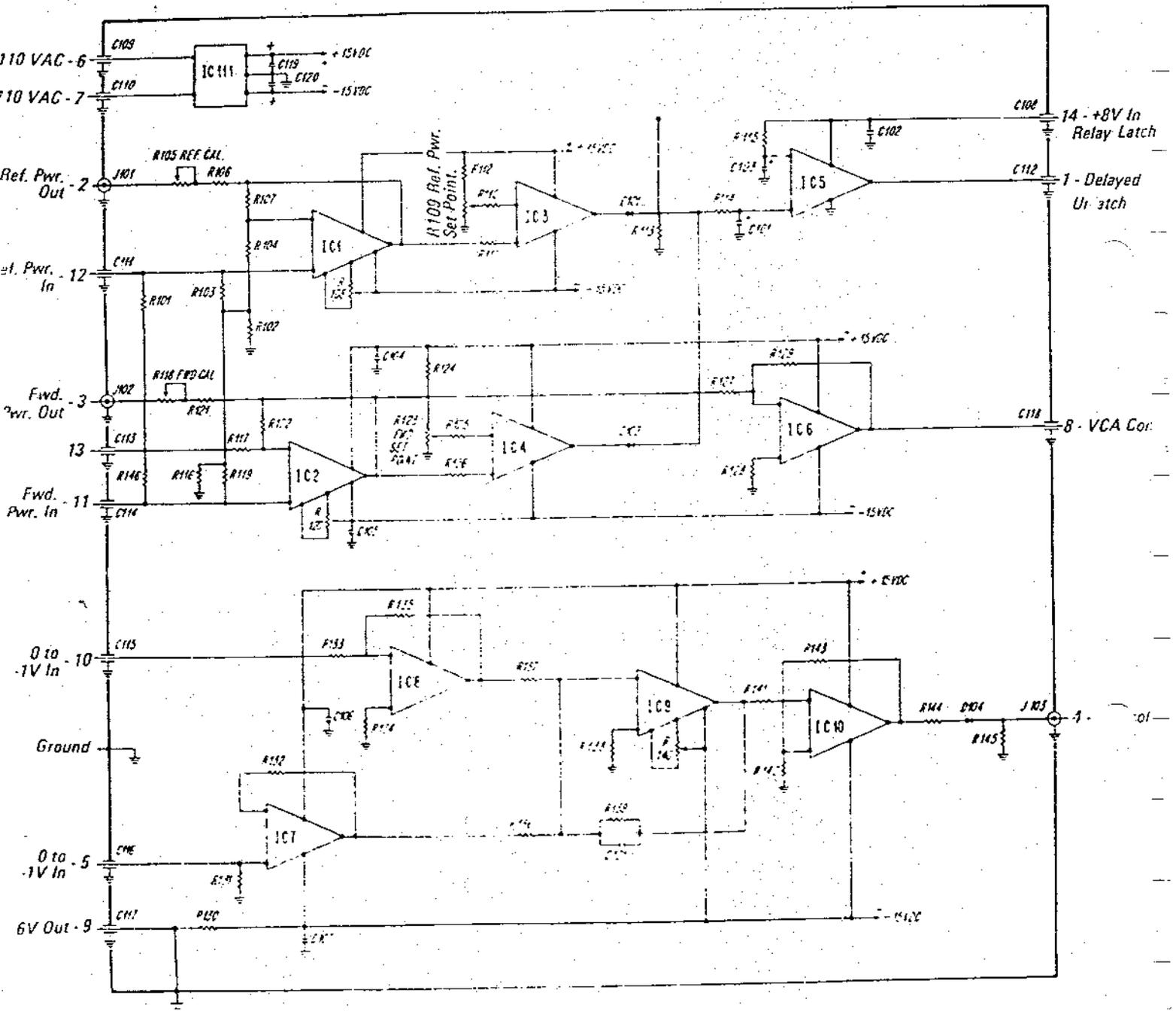


OSCILLATOR SECTION



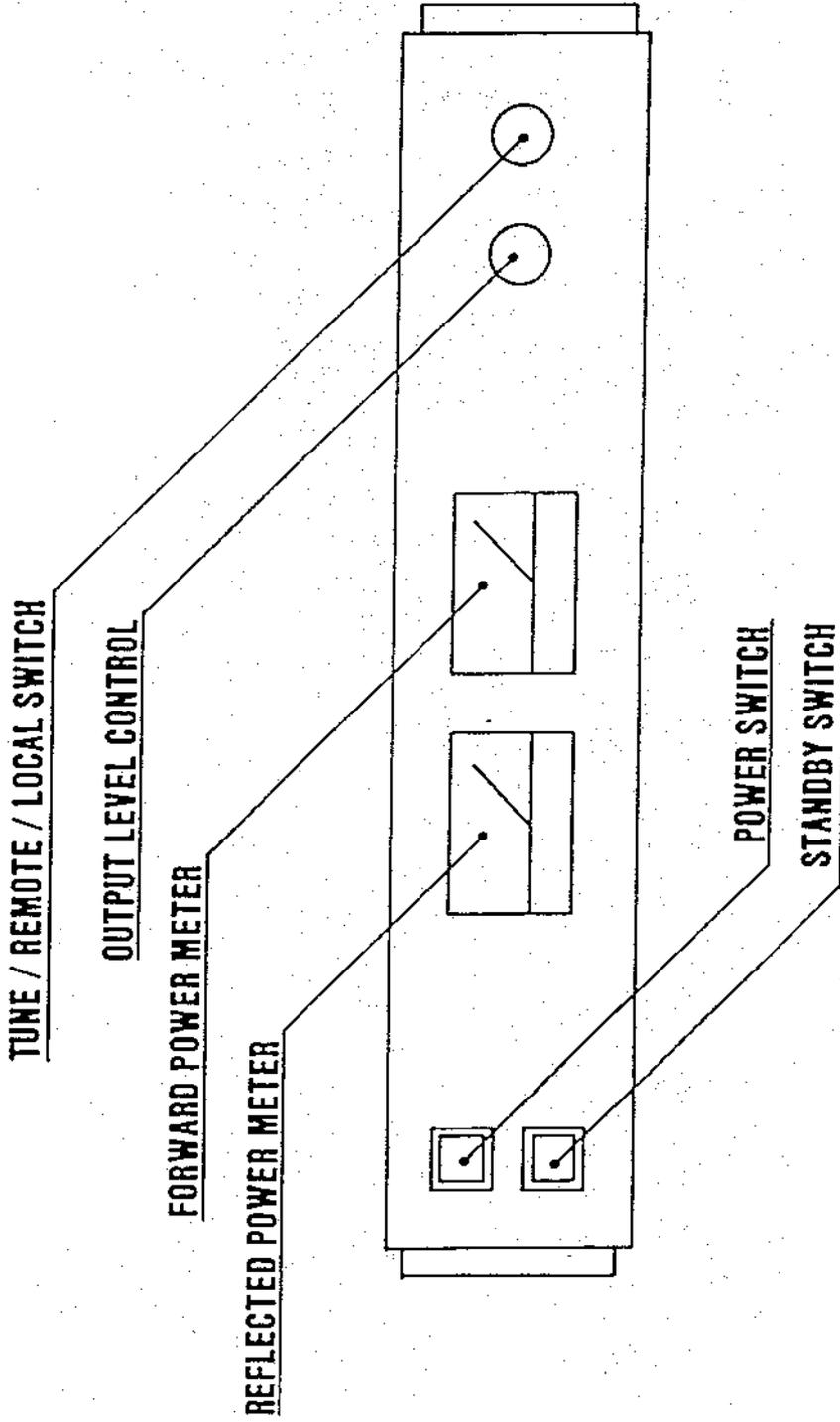
DRIVER SECTION

CONSTANT POWER UNIT SCHEMATIC - 500D, 1000D, 2000D, 3000D, 5000D Power Generators
 Schematic Number: 800611



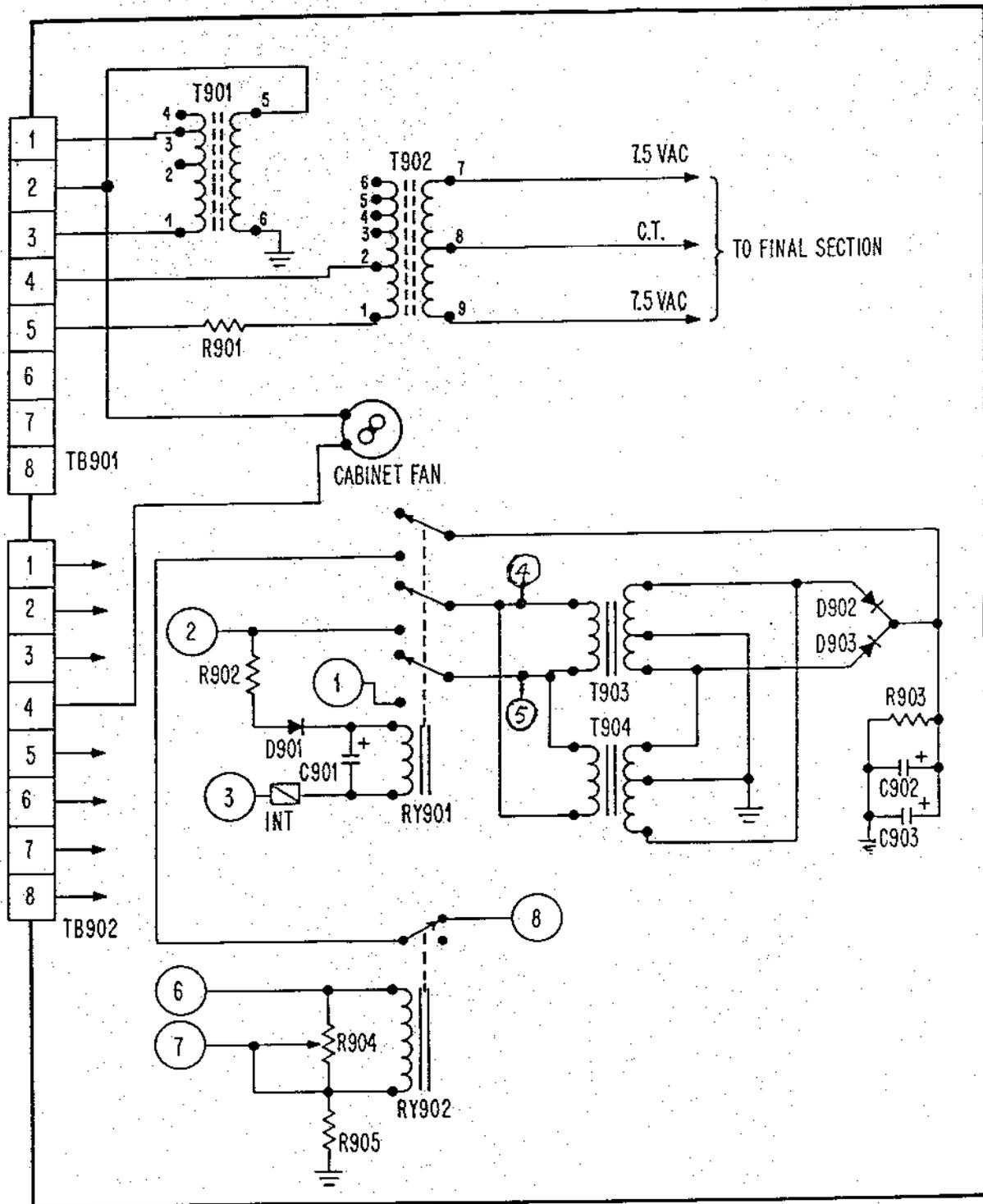
CONSTANT POWER UNIT PARTS LIST - ALL MODELS

SCHEMATIC NUMBER	DESCRIPTION	MANUFACTURER OR EQUIVALENT
C101, C119, C120	CAPACITOR: TANTALUM, 47 MF, 20 VDC.	CAPACITOR
C102, C104, C105, C122-C126	CAPACITOR: CERAMIC DISC, .05 MF, 20 VDC.	CENTRALAB UK20-503
C103	CAPACITOR: TANTALUM, 3.3 MF, 15 VDC.	CAPACITOR
C108, C111-C115, C117-C118	CAPACITOR: FEEDTHROUGH, 2000 PF, 1000 VDC.	TUSONIX 202M
C109, C110	CAPACITOR: FEEDTHROUGH, 1000 PF, 1000 VDC.	TUSONIX 101M
D101, D102, D104	DIODE: SILICON.	MOTOROLA 1N458A
D103	DIODE: REFERENCE, 6.2 VDC, 500 MW.	MOTOROLA 1N825A
IC101-IC104, IC106, IC107	INTEGRATED CIRCUIT: OP. AMP.	MOTOROLA MC1741G
IC105	INTEGRATED CIRCUIT: TIMER.	MOTOROLA MC1555G
IC111	POWER SUPPLY: 115 VAC TO \pm 15VDC.	ACOPIAN D15-D10A
J101-J102	CONNECTOR: RCA PHONO JACK.	SWITCHCRAFT 3501F
R102	RESISTOR: PRECISION, 100 OHM, 1/4 WATT, 1%.	RESISTOR
R104, R117, R119, R134	RESISTOR: PRECISION, 1.4 K OHM, 1/4 WATT, 1%.	RESISTOR
R103, R104, R117, R151	RESISTOR: PRECISION, 1.4 K OHM, 1/4 WATT, 1%.	RESISTOR
R106, R107, R121, R122	RESISTOR: PRECISION, 33.2 K OHM, 1/4 WATT, 1%.	RESISTOR
R105, R108, R109, R118, R120	POTENTIOMETER: 10 K OHM.	ALLEN BRADLEY SV1031
R110, R111, R113, R115, R127	RESISTOR: PRECISION, 10 K OHM, 1/4 WATT, 1%.	RESISTOR
R129, R131, R145, R149	RESISTOR: PRECISION, 10 K OHM, 1/4 WATT, 1%.	RESISTOR
R151, R152	RESISTOR: PRECISION, 10 K OHM, 1/4 WATT, 1%.	RESISTOR
R112, R115, R124, R143, R150	RESISTOR: PRECISION, 100 K OHM, 1/4 WATT, 1%.	RESISTOR
R114, R147	RESISTOR: PRECISION, 499 K OHM, 1/4 WATT, 1%.	RESISTOR
R130	RESISTOR: PRECISION, 604 OHM, 1/4 WATT, 1%.	RESISTOR
R143	RESISTOR: PRECISION, 8.25 K OHM, 1/4 WATT, 1%.	RESISTOR
R144	RESISTOR: PRECISION, 49.9 K OHM, 1/4 WATT, 1%.	RESISTOR
R149	RESISTOR: PRECISION, 9.09 K OHM, 1/4 WATT, 1%.	RESISTOR



2000D CONTROL PANEL

CONTROL SECTION SCHEMATIC - 2000D, 3000D Power Generators
 Schematic Number: 800901



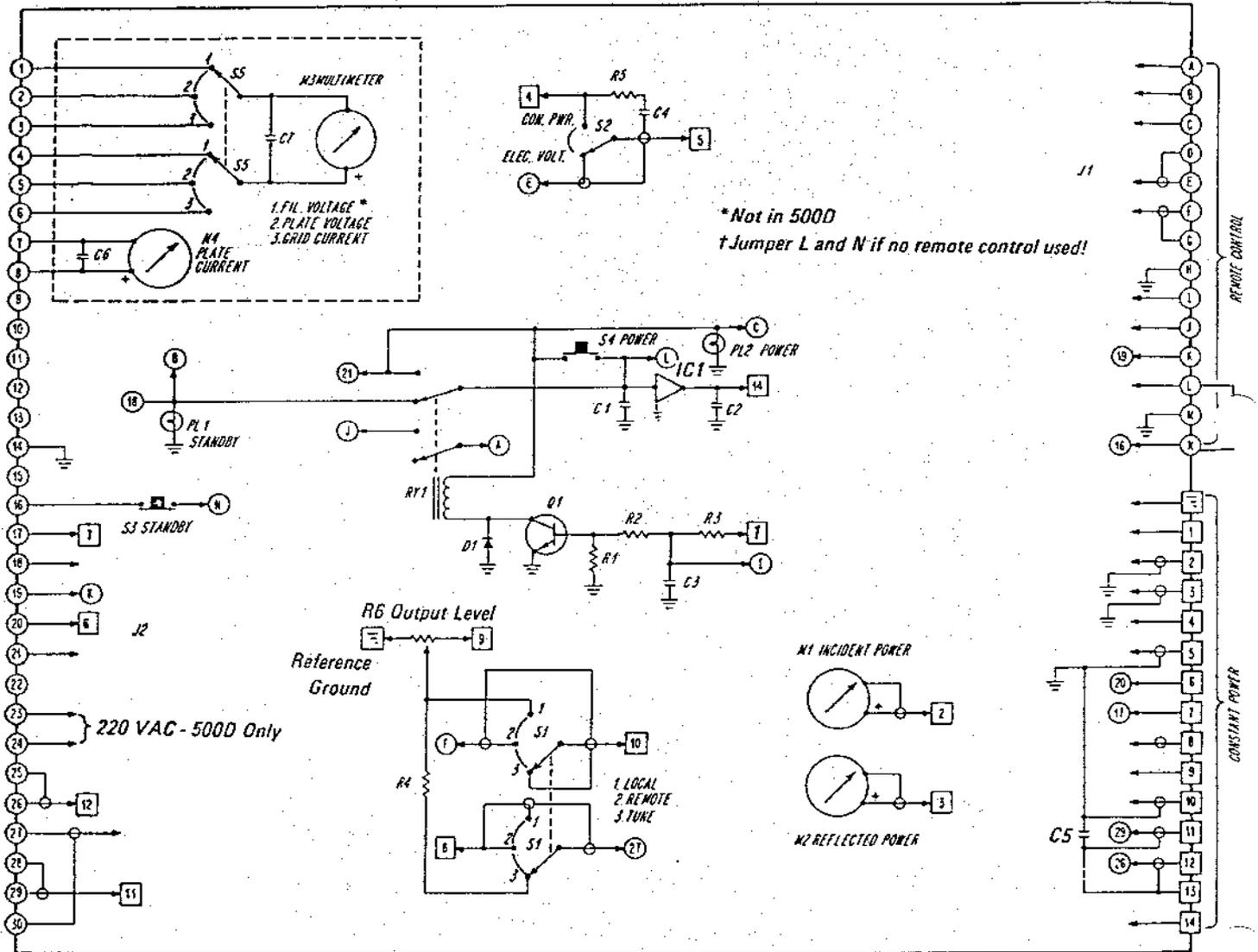
CONTROL SECTION PARTS LIST - 2000D, 3000D Power Generators

SCHEMATIC NO.	DESCRIPTION	MANUFACTURER and NO.
C901	CAPACITOR: Electrolytic, 20 mf, 350 V.	CDE WBR 20-350
C902, C903	CAPACITOR: Electrolytic, 1000 mf, 50 V.	Arco ME 1000-50
D901-D903	DIODE: Silicon, 1000 PIV, 1 amp.	GE-509
R901	RESISTOR: Wirewound Enamel, 10 ohm, 50 watt, 5%.	Resistor
R902	RESISTOR: Wirewound Enamel, 2 K ohm, 10 watt, 5%.	Resistor
R903	RESISTOR: Carbon, 70 ohm, 2 watt, 5%.	Resistor
R904	RESISTOR: Adjustable Wirewound Enamel, 7.5 ohm (3000D-5 ohm), 25 watt, 5%.	Resistor
R905	RESISTOR: Wirewound Enamel, 200 ohm, 20 watt, 5%.	Resistor
RY901	RELAY: Control, 3POT.	P&B MR14AY-240 VAC
RY902	RELAY: Overload, SPST.	P&B KA5AY-12VAC
T901	TRANSFORMER: Step Down, 220VAC Primary, 110 VAC Secondary.	ECA-1082
T902	TRANSFORMER: Filament.	ECA-1102
T903, T904	TRANSFORMER: Relay Supply.	Signal 230-241-6-24
TB901	TERMINAL BOARD: 8 Contact.	Cinch Jones 8-142
TB902	TERMINAL BOARD: 8 Contact.	Cinch Jones 8-140

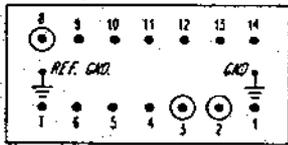
SWR SECTION PARTS LIST - 500D, 1000D, 2000D, 3000D, 5000D Power Generators

Schematic No.	Description	Manufacturer and No.
J1001	CONNECTOR: RF in, N type.	Bird 4240-063
	CONNECTOR: RF in, HN type (3000D).	Bird 4240-268
J1002	CONNECTOR: RF in, LC type (5000D).	Bird 4240-031
	CONNECTOR: RF out, N type.	Bird 4240-063
	CONNECTOR: RF out, HN type (3000D).	Bird 4240-268
J1003, J1004	CONNECTOR: RF out, LC type (5000D).	Bird 4240-031
	CONNECTOR: DC type, power signals.	Bird 7500-076
FWD	SENSING ELEMENT: 500 watt, 2 to 30 MHz.	Bird 500H (500D)
	SENSING ELEMENT: 1000 watt, 2 to 30 MHz.	Bird 1000H (1000D)
	SENSING ELEMENT: 2500 watt, 2 to 30 MHz.	Bird 2500H (2000D)
	SENSING ELEMENT: 2500 watt, 2 to 30 MHz.	Bird 2500H (3000D)
	SENSING ELEMENT: 5000 watt, 2 to 30 MHz.	Bird 5000H (5000D)
REF	SENSING ELEMENT: 100 watt, 2 to 30 MHz.	Bird 100H (500D)
	SENSING ELEMENT: 100 watt, 2 to 30 MHz.	Bird 100H (1000D)
	SENSING ELEMENT: 250 watt, 2 to 30 MHz.	Bird 250H (2000D)
	SENSING ELEMENT: 250 watt, 2 to 30 MHz.	Bird 250H (3000D)
	SENSING ELEMENT: 500 watt, 2 to 30 MHz.	Bird 500H (5000D)
SWR	LINE SECTION: Dual element.	Bird 4230-053

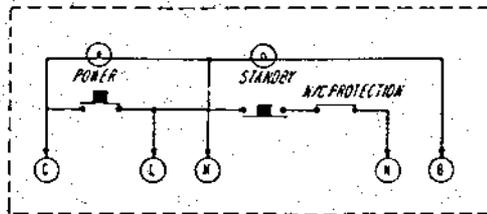
REMOTE PANEL SCHEMATIC - 500D, 1000D, 2000D, 3000D, 5000D Power Generators
 Schematic Number: 800805



*Not in 500D
 † Jumper L and N if no remote control used!



Constant Power Panel



REQUIRED REMOTE CONTROL CIRCUIT

REMOTE PANEL PARTS LIST - 500D, 1000D, 2000D, 3000D, 5000D Power Generators

SCHEMATIC NO.	DESCRIPTION	MANUFACTURER NO.
C1-C4	CAPACITOR: Ceramic Disc, .02 mf, 150 V.	Centralab DOM-203
C5	CAPACITOR: Ceramic Disc, .05 mf, 20 V.	Centralab UK20-503
D1	DIODE: Silicon, 400 PIV, 1 amp.	Motorola 1N4004
IC1	INTEGRATED CIRCUIT: Voltage regulator.	National LM340-T8
Q1	TRANSISTOR: 2N2222.	Motorola 2N2222
M1-M4	METER: Special Scales.	Specify model and number.
PL1-PL2	PILOT LAMP: 14 VDC.	Sylvania 330
R1-R3	RESISTOR: Carbon, 220 ohm, 1/2 watt, 5%.	Resistor
R4	RESISTOR: Carbon, 4.7 K ohm, 1/4 watt, 5%.	Resistor (selected value)
R5	RESISTOR: Carbon, 47 ohm, 1/4 watt, 5%.	Resistor
R6	POTENTIOMETER: Wirewound, 1 K ohm.	Bourns 35415-1-102
RY1	RELAY: DPDT.	P&B KA11DY-12VDC
S1-S2	SWITCH: 2 Pole.	Centralab PA-1003
S3-S4	SWITCH: DPDT, lighted.	Compulite 611-1291

REMOTE CONTROL PLUG

- A. Relay Contact (Normally open)
- B. Control Relay
- C. Control Relay
- D. 0 to -1 VDC Electrode Signal (Ground)
- E. 0 to -1 VDC Electrode Signal (Input)
- F. 0 to -5 VDC Output Control Signal (Input)
- G. 0 to -5 VDC Output Control Signal (Ground)
- H. Ground
- I. Vacuum Protection (Normally open)
- J. Relay Contact (Normally open)
- K. Spare
- L. Control Relay - Jumper to N if no Remote Control
- M. Ground
- N. Control Relay - Jumper to L if no Remote Control

CONSTANT POWER

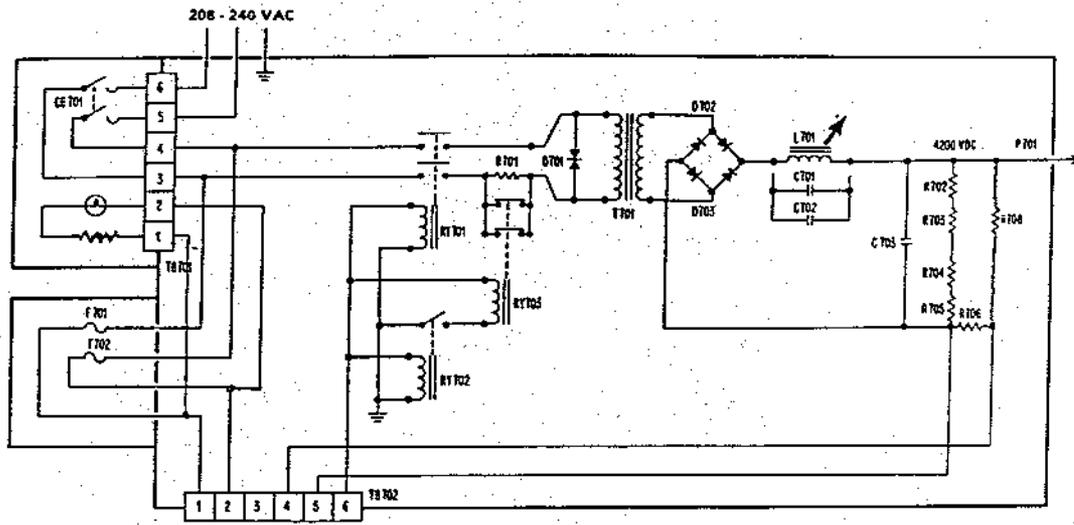
- 1. Latch Output
- 2. Reflected Power Meter
- 3. Incident Power Meter
- 4. 0 to -1 VDC Out
- 5. 0 to -1 VDC In
- 6. 110 VAC
- 7. 110 VAC
- 8. VCA (Control)
- 9. -6 VDC Reference
- 10. 0 to -5 VDC In
- 11. Incident Power Signal
- 12. Reflected Power Signal
- 13. Floating Ground
- 14. Overload Latch V_{CC}
- Reference Ground
- Common Ground

HARNESS

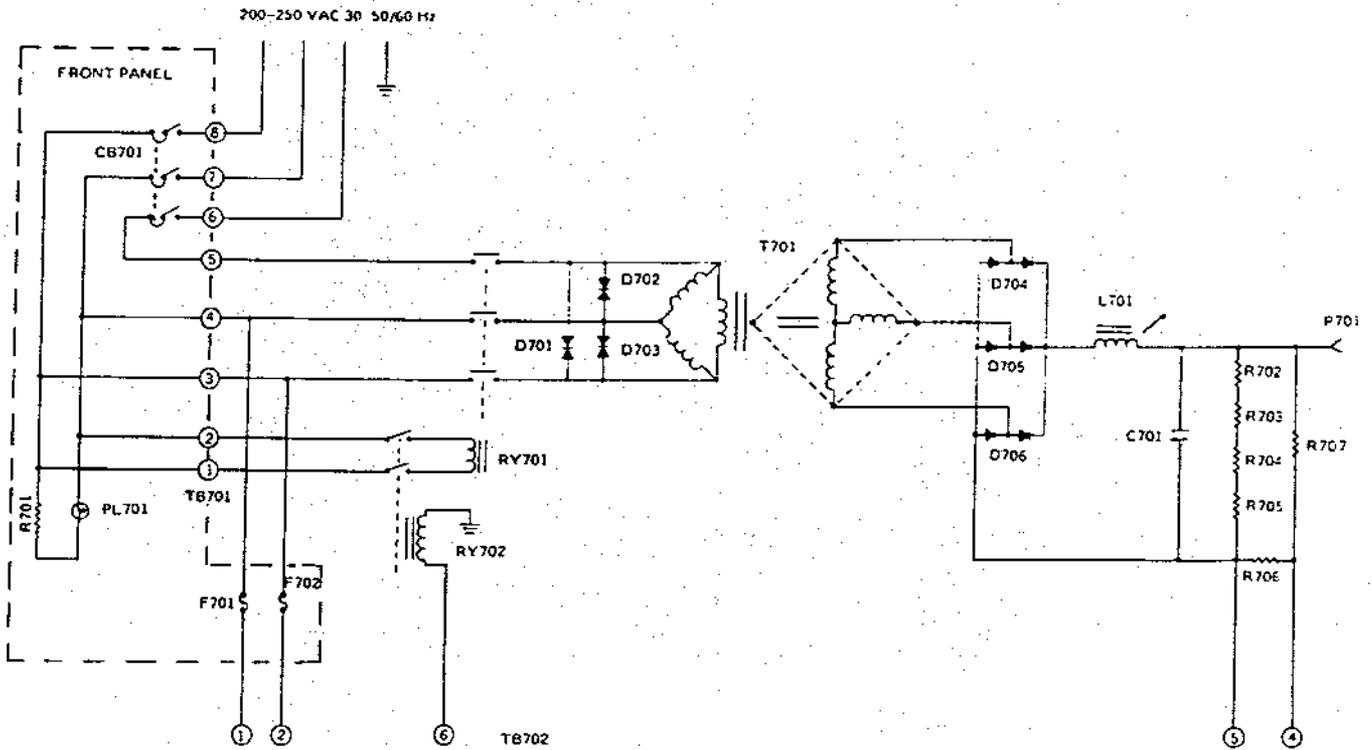
- 1. Filament Voltage Signal (-)*
- 2. Plate Voltage Signal (-)
- 3. Grid Current Signal (-)
- 4. Filament Voltage Signal (+)*
- 5. Plate Voltage Signal (+)
- 6. Grid Current Signal (+)
- 7. Plate Current Signal (-)
- 8. Plate Current Signal (+)
- 9. No Connection
- 10. No Connection
- 11. No Connection
- 12. No Connection
- 13. No Connection
- 14. Ground
- 15. No Connection
- 16. Control Relay
- 17. 110 VAC
- 18. Control Relay
- 19. Spare
- 20. 110 VAC
- 21. Control Signal
- 22. No Connection
- 23. 220 VAC†
- 24. 220 VAC†
- 25. Floating Ground - Reflected Power Signal
- 26. Reflected Power Signal
- 27. Output Control
- 28. Floating Ground - Incident Power Signal
- 29. Incident Power Signal
- 30. Ground - Output Control

* Not Available on 500D
 † Available on 500D only

HIGH VOLTAGE POWER SUPPLY SCHEMATIC - 2000D POWER GENERATOR (SINGLE PHASE)



HIGH VOLTAGE POWER SUPPLY SCHEMATIC - 2000D POWER GENERATOR (THREE PHASE)

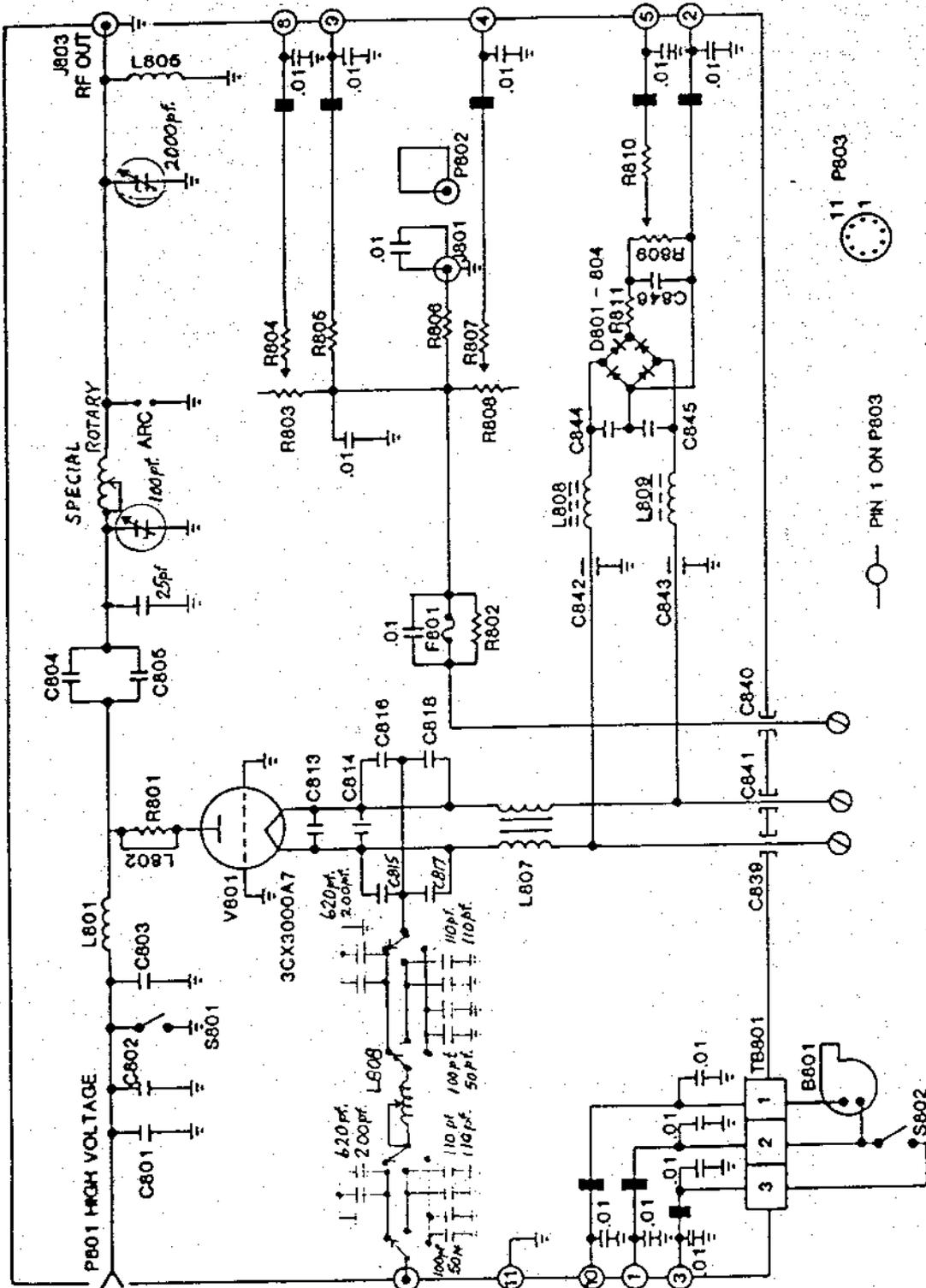


HIGH VOLTAGE POWER SUPPLY PARTS LIST - 2000D - 3000D

Schematic Number	DESCRIPTION	Manufacturer or Equivalent
C701-C702*	CAPACITOR: RESONATING, 0.1 MF, 7.5 KVDC.	PLASTIC CAP. LK80-104
C703	CAPACITOR: FILTER, 4.0 MF, 5.0 KVDC.	PLASTIC CAP. LK50-405
C8701 (2000D 1 PHASE)	CIRCUIT BREAKER: DUAL, 40 AMP, 230 VAC.	HEINEMANN AM2-A3-A40-2
C8701 (2000D 3 PHASE)	CIRCUIT BREAKER: TRIPLE, 20 AMP, 230 VAC.	GE THQL-20
C8701 (3000D 1 PHASE)	CIRCUIT BREAKER: DUAL, 50 AMP, 230 VAC.	HEINEMANN AM2-A3-A40-2
C8701 (3000D 3 PHASE)	CIRCUIT BREAKER: TRIPLE, 30 AMP, 230 VAC.	GE THQL-30
D701-D703 (3 PHASE)	DIODE: SURGE SUPPRESSOR.	GE V240LA40A
D702-D703 (1 PHASE)	DIODE: HIGH VOLTAGE RECTIFIER, 1.2 AMP, 15 KVDC.	CSDC 45XV246
D704-D706 (3 PHASE)	DIODE: HIGH VOLTAGE RECTIFIER, 1.2 AMP, 15 KVDC.	CSDC 45XV246
F701-F702	FUSE: 3 AG, 5 AMP, 230 VAC.	LITTELFUSE 312 005
L701	CHOKE: HIGH VOLTAGE FILTER CHOKE.	ECA 5024
P701	CONNECTOR: HIGH VOLTAGE PLUG.	HENRY
PL701	PILOT LIGHT: TYPE 330 BULB, 14 VDC.	SYLVANIA 330
PL701	PILOT LIGHT: HOLDER, AC MAINS.	DIALCO 554-1221 TYPE
R701 (1 PHASE)	RESISTOR: HEATING ELEMENT.	EAGLE 415A
R701 (3 PHASE)	RESISTOR: WIREWOUND ENAMEL, 2500 OHM, 25 WATT, 5%.	RESISTOR
R702-R705	RESISTOR: WIREWOUND ENAMEL, 20 K OHM, 100 WATT, 5%.	RESISTOR
R706	RESISTOR: CARBON, 10 K OHM, 2 WATT, 5%.	RESISTOR
R707	RESISTOR: PRECISION, 2 M OHMS, 8 WATTS. (NOTE 1: EARLY PRODUCTION UNITS USED 5 SEPARATE RESISTORS)	RESISTOR
RY701 (1 PHASE)	RELAY: POWER, MERCURY CONTACT, 2PST.	MAGNECRAFT M60AA-12VDC
RY701 (3 PHASE)	RELAY: POWER, MERCURY CONTACT, 3PST.	MAGNECRAFT M60AAA-12VDC
RY702 (1 PHASE)	RELAY: TIME DELAY, .5 SECOND.	MASTER DMDF12D.5
T701 (2000D 1 PHASE)	TRANSFORMER: HIGH VOLTAGE POWER TRANSFORMER.	ECA 1028
T701 (2000D 3 PHASE)	TRANSFORMER: HIGH VOLTAGE POWER TRANSFORMER.	ECA 26033
T701 (3000D 1 PHASE)	TRANSFORMER: HIGH VOLTAGE POWER TRANSFORMER.	ECA 1028 X 2
T701 (3000D 3 PHASE)	TRANSFORMER: HIGH VOLTAGE POWER TRANSFORMER.	ECA 26028
T8701 (1 PHASE)	TERMINAL BOARD: 6 TERMINALS.	CINCH JONES 6-142
T8701 (3 PHASE)	TERMINAL BOARD: 8 TERMINALS.	CINCH JONES 8-142
T8702	TERMINAL BOARD: 6 TERMINALS.	CINCH JONES 6-141

* USED ONLY IN EARLY PRODUCTION RF GENERATORS

PART NUMBERS AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.



2000D 5-20 SCHEMATIC
2000 WATT SECTION - WASHINGTON UNIVERSITY

RECOMMENDED SPARE PARTS - 2000D Power Generator

On-Site Recommended Spares:

AC MAINS Light Bulb - type 330
POWER Switch
POWER Light Bulb - type 327
STANDBY Switch
Eimac 3CX3000A7
Fuse: 3AG 6 amp.
Fuse: 3AG 20 amp.
Fuse: 8AG 1½ amp.
Fuse: 3AG 5 amp.

Warehouse Recommended Spares:

Exchange Parts:

Remote Panel Assembly
Oscillator Section Assembly
Driver Section Assembly
Constant Power Assembly
100 Watt Section Assembly
Relay Supply Assembly
13.8 VDC Power Supply Assembly

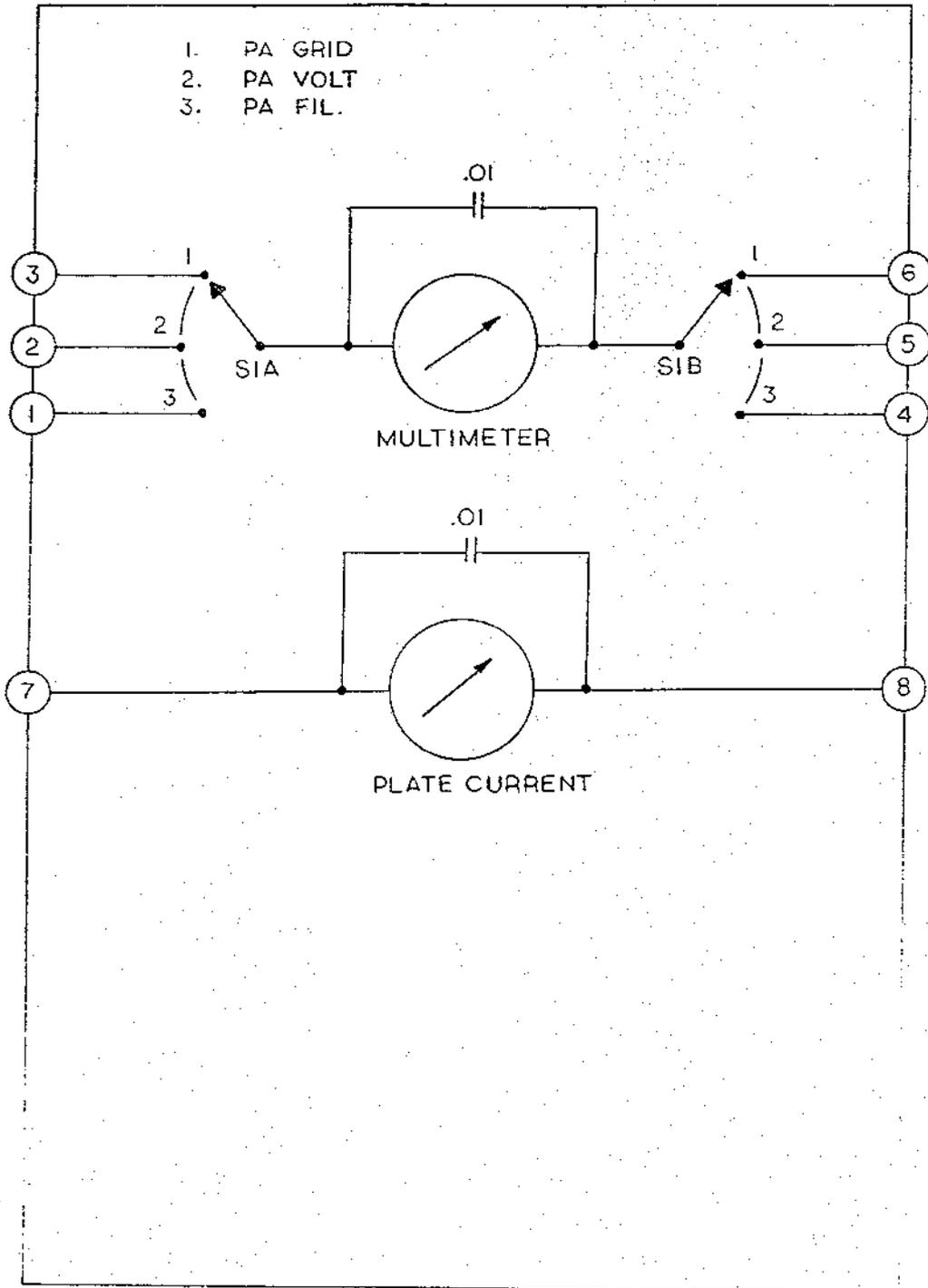
FOR APPLIED MATERIALS

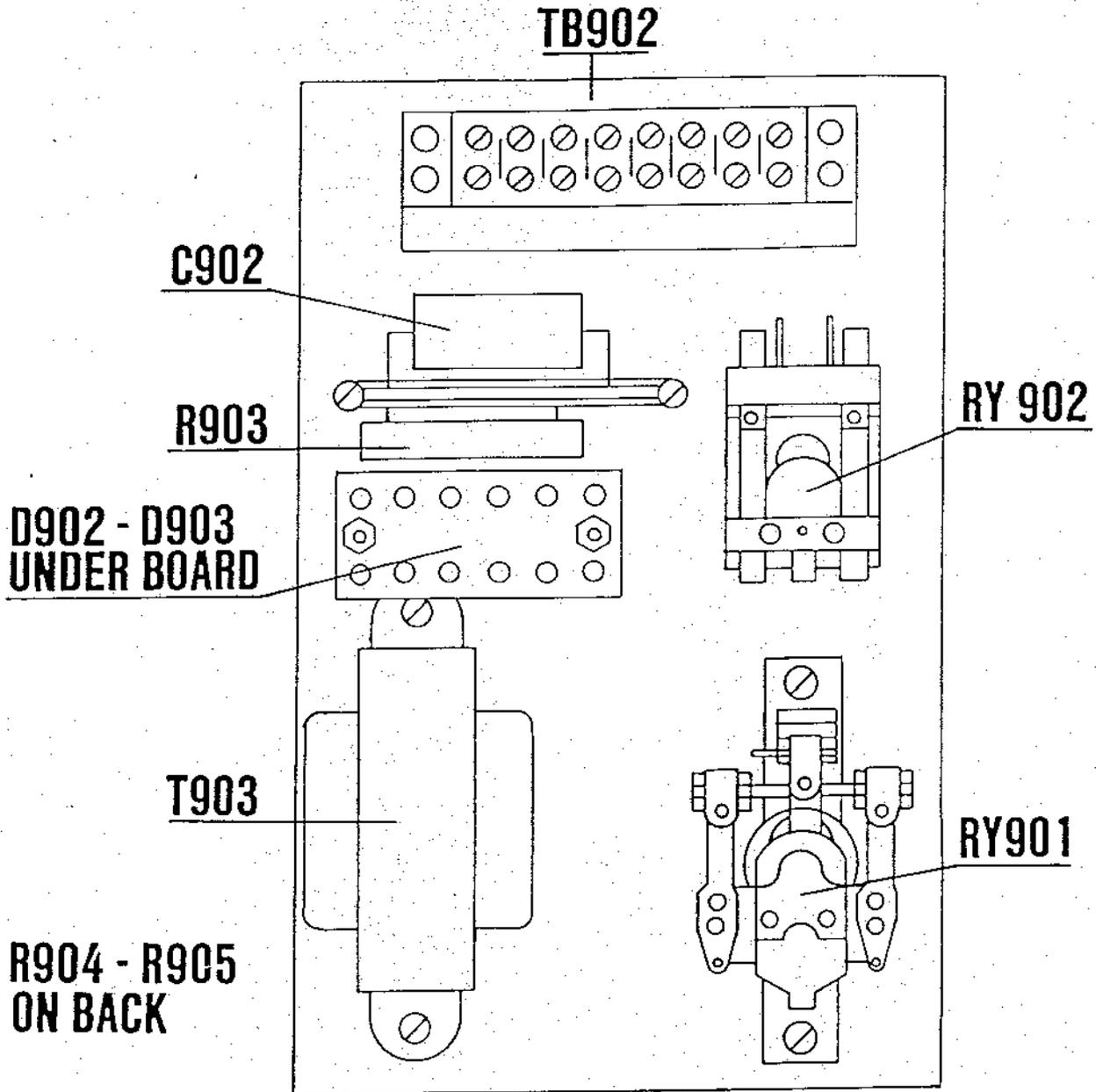
Forward Power Meter
Reflected Power Meter
ECA-5024 (after s.n. 222)
3 AG, 8 amp fuses.

Spare Parts:

Rotron MU3A1 100 Watt Section Cooling Fan
POWER Switch
STANDBY Switch
Light Bulb - 330
Light Bulb - 327
AC MAINS LIGHT
Eimac 3CX3000A7 Tube
Input Coil Assembly
Dayton 4C006 2000 Watt Section Blower
Rotron 2A-1000 Air Flow Switch
ECA-1102 Filament Transformer
ECA-1082 Step Down Transformer
ECA-1028 Power Transformer
ECA-5020 Filter Choke
Dayton 3M534 Cabinet Fan
P&B 40 amp Circuit Breaker
20 K ohm, 100 watt resistor
Coast CE-240TS Surge Suppressor
Semtech SA-8030 High Voltage Rectifiers
Capacitor: .1 mf, 8000 V
Capacitor: 4 mf, 5000 V
Magnacraft M60AA-12VDC Relay
Magnacraft M35AA-12VDC Relay
MEC DMOF12D.5 Delay Relay

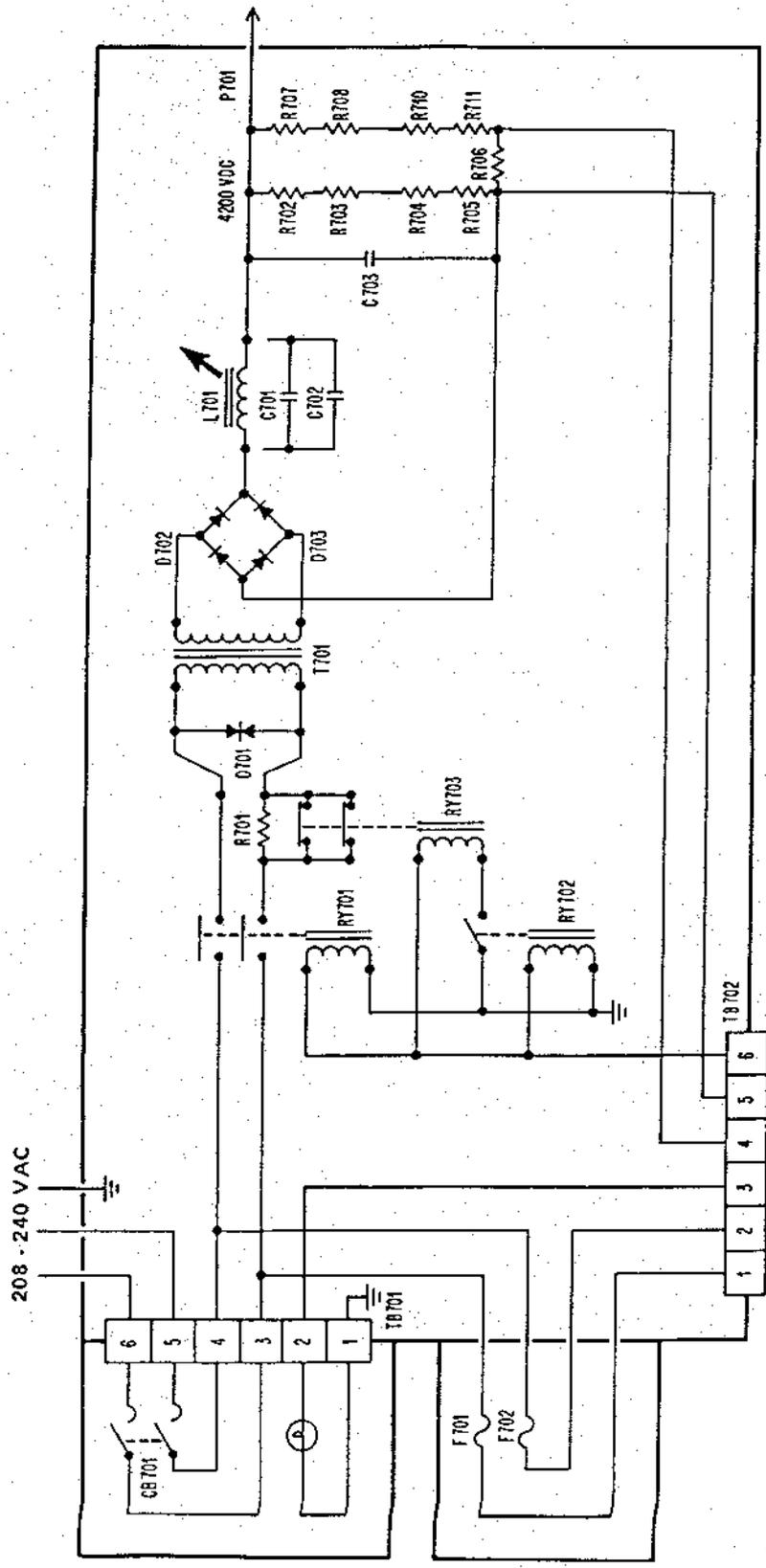
TEST BOX -- 2000D



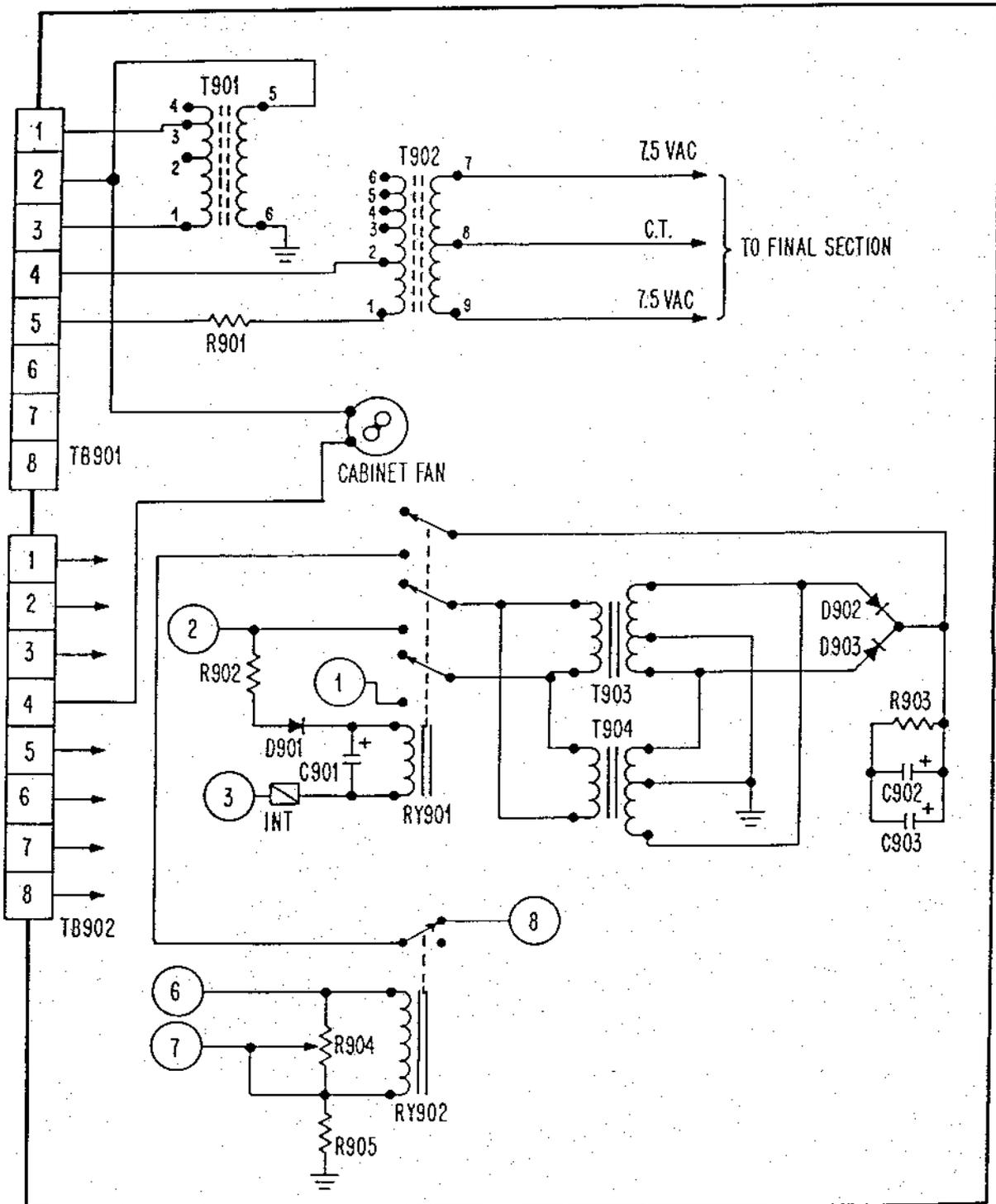


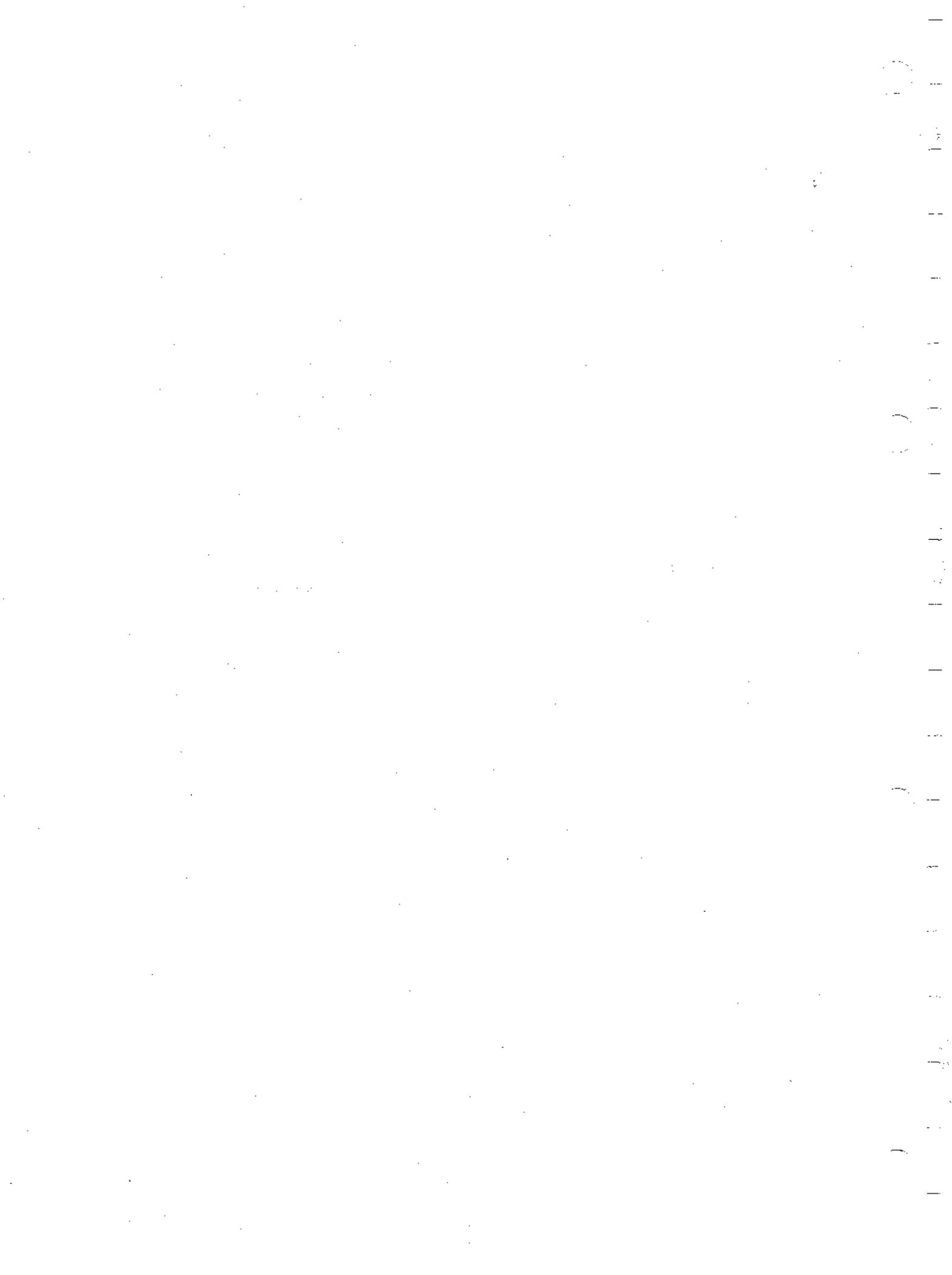
RELAY POWER SUPPLY SECTION

HIGH VOLTAGE POWER SUPPLY SCHEMATIC - 2000D Power Generator
Schematic Number: 800902

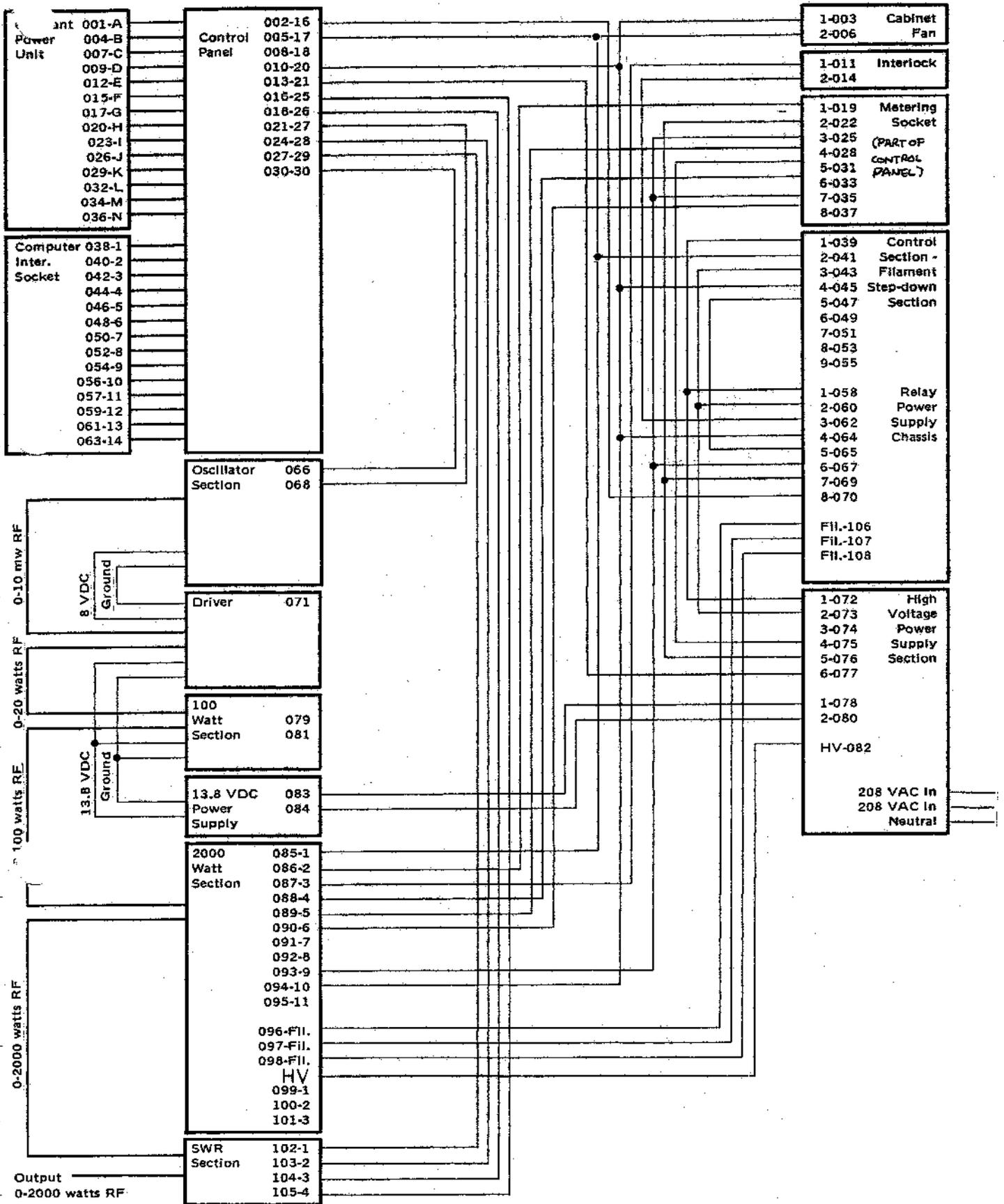


CONTROL SECTION SCHEMATIC - 2000D, 3000D Power Generators
 Schematic Number: 800901





HENRY 2000D INTERCONNECT DIAGRAM





INTERCONNECTION HARNESS — HENRY 1000D AND 2000D POWER GENERATORS

Point Terminal Function Common Points

CONTROL PANEL - J1 Remote Connections

1	A	.Spare relay contact - normally open to J in standby	.To optional remote control panel
2	B	.Control relay standby signal	.To optional remote control panel
3	C	.Control relay power signal	.To optional remote control panel
4	D	.Ground for pin E	.To optional remote control panel
5	E	.0 to -1 volt electrode input signal	.From optional remote control panel
6	F	.0 to -5 volt output level signal	.From optional remote control panel
7	G	.Ground for pin F	.To optional remote control panel
8	H	.Ground	
9	I	.Vacuum protection interlock - normally open	.From optional remote control panel
10	J	.Spare relay contact - normally open to A in standby	.To optional remote control panel
11	K	.No connection	
12	L	.Control relay - jumper to N if no remote control panel is used	.To optional remote control panel
13	M	.Ground	
14	N	.Control relay - jumper to L if no remote control panel is used	.From optional remote control panel

CONTROL PANEL - J2 Harness Connections

15	1	.Filament voltage signal (-)	.From point 100
16	2	.Plate voltage signal (-)	.From point 154
17	3	.Grid current signal (-)	.From point 107
18	4	.Filament voltage signal (+)	.From point 103
19	5	.Plate voltage signal (+)	.From point 153
20	6	.Grid current signal (+)	.From point 102
21	7	.Plate current signal (-)	.From point 107
22	8	.Plate current signal (+)	.From point 104
23	9	.No connection	
24	10	.No connection	
25	11	.No connection	
26	12	.No connection	
27	13	.No connection	
28	14	.Ground	
29	15	.No connection	
30	16	.Control relay - +12 volt relay supply	.From point 137
31	17	.110 VAC	.From point 123
32	18	.Control relay - +12 volt in standby mode	.No internal connection
33	19	.No connection	
35	21	.Control relay - +12 volt in power mode	.To point 155
36	22	.No connection	
37	23	.No connection	
38	24	.No connection	
39	25	.Floating ground for pin 26	.From point 118
40	26	.Reflected power signal	.From point 117
41	27	.0 to -5 volt output level control	.To point 76
42	28	.Floating ground for pin 29	.From point 116
43	29	.Forward power signal	.From point 115
44	30	.Ground for pin 27	

CONTROL PANEL - J3 Constant Power Connections

45	1	.Delayed unlatch signal (high SWR)	.From point 59
46	2	.Reflected power signal to meter	.From point 60
47	3	.Forward power signal to meter	.From point 61
48	4	.0 to -1 volt signal out	.To point 62
49	5	.0 to -1 volt signal in	.From point 63
50	6	.110 VAC	.To point 64
51	7	.110 VAC	.To point 65
52	8	.VCA controls output level	.From point 66
53	9	-.6 volt reference for output level control	.From point 67
54	10	.0 to -5 volt in	.From point 68
55	11	.Forward power signal	.To point 69
56	12	.Reflected power signal	.To point 70
57	13	.Floating ground	.To point 71
58	14	.Overload latch VCC	.From point 72

CONSTANT POWER SECTION - J101 Control Panel Connections

59	1	.Delayed unlatch signal (high SWR)	.To point 45
60	2	.Reflected power signal to meter	.To point 46
61	3	.Forward power signal to meter	.To point 47
62	4	.0 to -1 volt signal in	.From point 48
63	5	.0 to -1 volt signal out	.To point 49
64	6	.110 VAC	.From point 50
65	7	.110 VAC	.From point 51
66	8	.VCA controls output level	.To point 52
67	9	-.6 volt reference for output level control	.To point 53
68	10	.0 to -5 volt out	.To point 54
69	11	.Forward power signal	.From point 55
70	12	.Reflected power signal	.From point 56
71	13	.Floating ground	.From point 57
72	14	.Overload latch VCC	.To point 73

OSCILLATOR SECTION - Separate Connections

73	C214	.+8 volts	.From point 80
74		.Ground	
75	J201	.RF Output	.To point 77
76	J202	.Output level signal	.From point 41



DRIVER SECTION - Separate Connections

77.	J301	RF input	.From point 75
78.	J302	RF output	.To point 87
79.	C316	Gain - optional connection	
80.	C317	+8 volt	.To point 73
81.		Ground	
82.	C318	+13.8 volt	.From point 85

13.8 VDC POWER SUPPLY SECTION - Separate Connections

83.	TB401-1	.208 VAC	.From point 150
84.	TB401-2	.208 VAC	.From point 151
85.	C408	+13.8 volt	.To point 89 and 82
86.		Ground	

100 WATT SECTION - Separate Connections

87.	J501	RF input	.From point 78
88.	J502	RF output	.To point 92
89.	C516	+13.8 volt	.From point 85
90.		Ground	

1000 WATT AND 2000 WATT SECTIONS - Separate Connections

91.	J801	Grid current test point - must jumper to point 95	.To point 95
92.	J802	RF input	.From point 88
93.	J803	RF output	.To point 113
94.	P801	High voltage	.From point 138
95.	P802	Grid current jumper plug - jumpers point 91	.From point 91
96.	C839	Filament voltage	.From point 119
97.	C840	Filament center tap	.From point 120
98.	C841	Filament voltage	.From point 121

1000 WATT AND 2000 WATT SECTIONS - P803 Harness Connections

99.	1	.110 VAC common	.From point 123
100.	2	Filament voltage signal (-)	.To point 15
101.	3	.110 VAC switched by airflow switch	.To point 132
102.	4	Grid current signal (+)	.To point 20
103.	5	Filament voltage signal (+)	.To point 18
104.	6	Plate current signal (+)	.To point 20
105.	7	No connection	
106.	8	No connection	
107.	9	B- overload signal, Grid current (-), and Plate current (-)	.To points 135, 17, and 21
108.	10	.110 VAC	.From point 133
109.	11	Ground	

1000 WATT AND 2000 WATT SECTIONS - TB801 Blower Connections

110.	1	.110 VAC	.To B801
111.	2	.110 VAC	.To B801
112.	3	.110 VAC switched by airflow switch	.From S802

SWR SECTION - Separate Connections

113.	J1001	RF input	.From point 93
114.	J1002	RF output	.To 50 ohm load
115.	J1003	Forward Power Signal	.To point 43
116.		Ground for J1003	.To point 42
117.	J1004	Reflected power signal	.To point 40
118.		Ground for J1004	.To point 39

CONTROL SECTION - Separate Connections

119.		Filament voltage	.To point 96
120.		Filament center tap	.To point 97
121.		Filament voltage	.To point 98

CONTROL SECTION - TB901 Step/Down/Filament Harness Connections

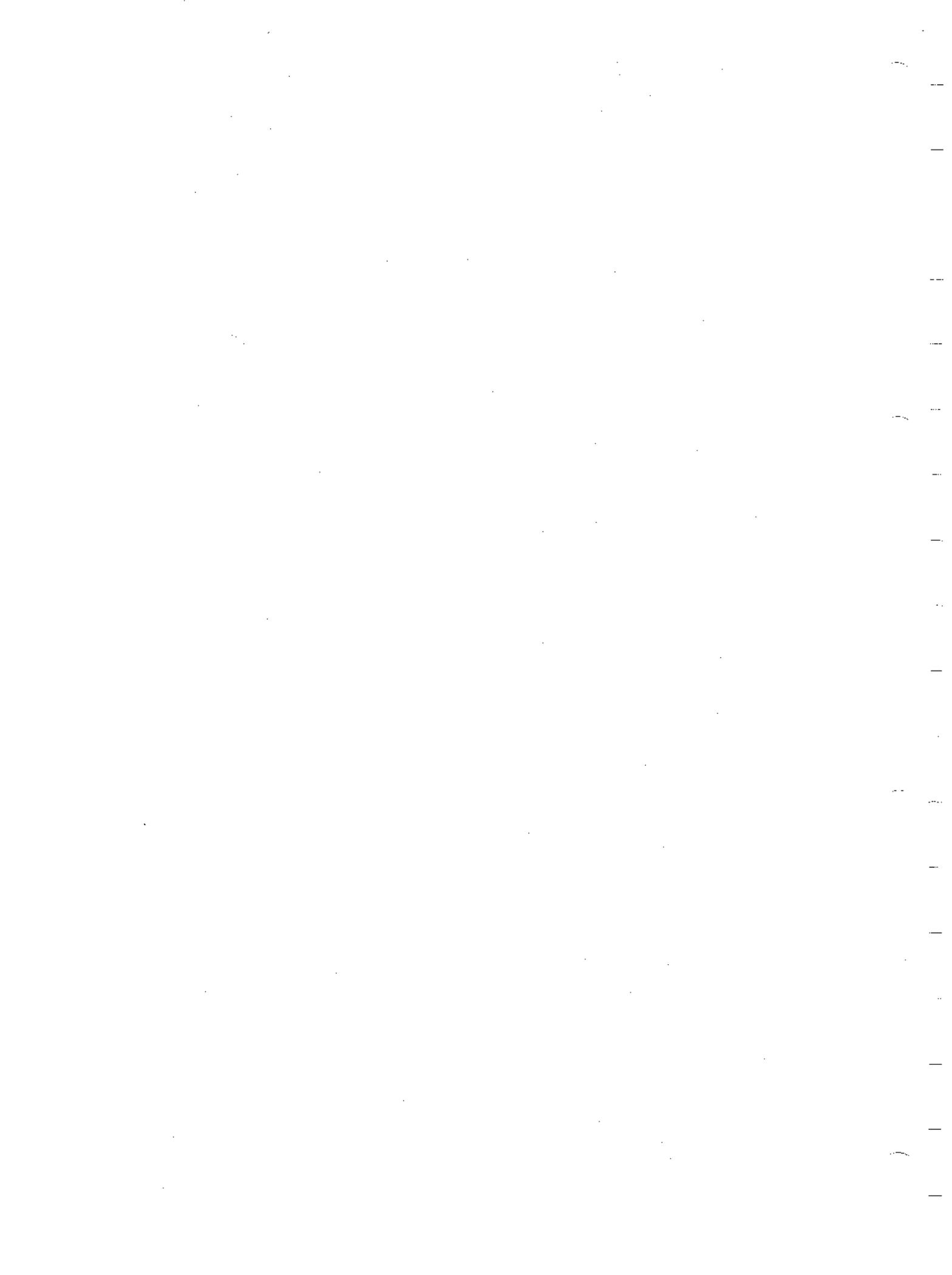
122.	1	.208 VAC	.From point 150
123.	2	.110 VAC	.To points 156, 31, 99
124.	3	.208 VAC	.From point 151
125.	4	.208 VAC	.From point 150
126.	5	.208 VAC	.From point 151
127.		No connection	
128.		No connection	
129.		No connection	

CONTROL SECTION - TB902 Relay Supply Harness Connections

130.	1	.208 VAC before interlock	.From point 150
131.	2	.208 VAC before interlock	.From point 151
132.	3	.110 VAC from airflow switch	.From point 101
133.	4	.208 VAC after interlock and relay (110 VAC common)	.To points 157, 34, and 101
134.	5	.208 VAC after interlock and relay	
135.	6	B- current overload signal	.From point 107
136.	7	B-	.From point 154
137.	8	+12 volt switched by overload signal	.To point 30

HIGH VOLTAGE POWER SUPPLY SECTION - Separate Connections

138.	P701	High voltage	.To point 94
139.		No connection	
140.		No connection	
141.		.208 VAC AC Line Black	.From power source
142.		.208 VAC AC Line White	.From power source
143.		Ground AC Line Green	.From power source



HIGH VOLTAGE POWER SUPPLY SECTION - TB701 AC Line Connections

144.	1	.208 VAC Line input	From point 141 to CB701
145.	2	.208 VAC Line Input	From point 142 to CB701
146.	3	.208 VAC to high voltage transformer	From CB701
147.	4	.208 VAC to high voltage transformer	From CB701
148.	5	.208 VAC control circuits	From CB701
149.	6	.208 VAC control circuits	From CB701

HIGH VOLTAGE POWER SUPPLY SECTION - TB702 Harness Connections

150.	1	.208 VAC	To points 130, 122, 125, 83
151.	2	.208 VAC	To points 131, 124, 126, 84
152.	3	No connection	
153.	4	Plate voltage signal (+)	To point 19
154.	5	Plate voltage signal and B-	To points 16 and 136
155.	6	+12 volt in power mode	From point 35

CABINET FAN

156.	.110 VAC	From point 123
157.	.110 VAC	From point 133

