

**HIGH VOLTAGE  
POWER SUPPLY  
Model 3105**

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**Operator's Manual**

**NSCL-ELECTRONIC**

**HIGH VOLTAGE POWER SUPPLY  
MODEL 3105**

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# HIGH VOLTAGE POWER SUPPLY MODEL 3105

## Section 1 INTRODUCTION

### 1.1 GENERAL DESCRIPTION

The Canberra Model 3105 is a NIM high voltage power supply designed primarily for operation with semiconductor detectors. It is particularly well suited for use with high resolution detector systems. By design, the 3105 will accommodate all types of detectors requiring up to 5kV bias and up to 100 $\mu$ A of current.

The Model 3105 will withstand any overload or direct output short circuit for an indefinite period of time and provide normal output after the ON-OFF switch is reset. Output voltage is continuously adjustable over the full range from 0 to  $\pm$  5000 volts by means of a five turn control. The output voltage can also be turned on and off through the INHIBIT BNC on the rear panel. Grounding the INHIBIT BNC shuts it down. This feature is desirable for detector and preamplifier protection in numerous applications. A large edgewise front panel meter is provided to monitor the output voltage.

A polarity reversal connector provides selection of positive or negative output polarity. To prevent inadvertent polarity reversal, the connector is located inside the module. The polarity is indicated by illumination of either the positive or negative LED on the front panel for the safety and the convenience of the user.

## Section 2 SPECIFICATIONS

### 2.1 INPUTS

INPUT POWER Powered from standard NIM bin and power supply, such as Model 2000.

### 2.2 OUTPUTS

REGULATED HIGH VOLTAGE 0 to  $\pm 5000$  VDC, continuously adjustable; 0 to  $100\mu\text{A}$  output current capability; one rear panel SHV high voltage coaxial connector.

### 2.3 CONTROLS

#### 2.3.1 FRONT PANEL

ON-OFF Front panel 2-position toggle switch to enable or disable output.

OUTPUT VOLTAGE Front panel 5-turn direct readout dial permits continuous adjustment of the output voltage from 0 to  $\pm 5000$  VDC.

#### 2.3.2 REAR PANEL

INHIBIT Rear panel BNC to turn off the high voltage. Short circuit turns it off. Open circuit resumes output.

#### 2.3.3 INTERNAL

POLARITY Internal connector changes output polarity by reversing orientation.

### 2.4 INDICATORS

OUTPUT VOLTAGE Edgewise panel meter to monitor output voltage.

POLARITY Front panel LED indicator lights for positive or negative polarity indication.

### 2.5 PERFORMANCE

RIPPLE AND NOISE  $\leq 2\text{mV}$  peak to peak.

OUTPUT STABILITY Long term drift of output voltage is  $\leq 0.01\%/hr.$  and  $\leq 0.02\%/8$  hr. at a constant input line voltage, load, and ambient temperature after a 30 minute warmup.

REGULATION  $\leq 0.001\%$  variation in output voltages for line and load changes within the operating range at constant ambient temperature.

TEMPERATURE COEFFICIENT	$\leq \pm 50\text{ppm}/^\circ\text{C}$ after 30 minute warmup, operating range 0 to 50°C.
OVERLOAD PROTECTION	Power supply will withstand any overload, including a short circuit for an indefinite period, and will resume normal operation after manual reset.
CALIBRATION ACCURACY	0.5% of dial setting +0.25% of full scale.
RESETABILITY	Output voltage can be reset to within 10 volts.
OUTPUT LOAD CAPACITY	0 to 100 $\mu\text{A}$ .
OUTPUT RANGE	0 to $\pm 5000$ VDC.
<b>2.6 CONNECTORS</b>	
OUTPUT VOLTAGE	Rear panel SHV.
INHIBIT	Rear panel BNC, UG 1094/U.
<b>2.7 POWER REQUIREMENTS</b>	Provided by Model 2000 BIN/power supply as required:
	+12V – 50mA
	- 12V – 50mA
	+24V – 83mA
	- 24V – 83mA
<b>2.8 PHYSICAL</b>	
SIZE	Standard single width NIM module (1.35 x 8.714 inches), (3.42 cm x 22.13 cm) per TID-10893 (rev.).
NET WEIGHT	2 lbs. (0.9 kg).
SHIPPING WEIGHT	7 lbs. (3.15 kg).

## **BASIC WARRANTY**

Equipment manufactured by Canberra Industries, Inc. is warranted against defects in materials and workmanship for a period of twelve months from date of shipment, provided that the equipment has been used in a proper manner as detailed in the instruction manuals. During the warranty period, repairs or replacement will be made at Canberra's option on a return to factory basis. The transportation cost, including insurance, to and from Canberra, is the responsibility of the Customer except for defects discovered within 30 days after receipt of equipment where shipping expense will be paid by Canberra to and from Canberra.

The customer must obtain an authorized customer service return number before returning any equipment to the Canberra factory. *Compliance with this provision by the customer shall be a condition of this warranty.* In giving shipping instructions, Canberra shall not be deemed to have assumed any responsibility or liability in connection with the shipment.

The Canberra Basic Warranty applies only to equipment manufactured by Canberra which is returned to the factory. If equipment must be repaired at the customer's site, the actual repair labor and parts will be provided at no charge during the warranty period. However, travel expenses to and from the customer's site, (travel time labor, and living expenses while on site), shall be paid by the customer unless an On-Site Warranty Option has been purchased. This option may only be purchased prior to shipment of the equipment to the customer.

The express warranties set forth herein are the only warranties with respect to the products, or any materials or components purchased from others and furnished by Canberra, and there are no other warranties, expressed or implied. The warranty of merchantability is expressly limited as herein provided and all warranties of fitness are expressly disclaimed and excluded. Canberra shall have no liability for any special, indirect or consequential damages, whether from loss of production or otherwise, arising from any breach of warranty hereunder or defect or failure of any product or products sold hereunder.

### **EXCLUSIONS**

Warranty service is contingent upon the proper use of all equipment and does not cover equipment which has been modified without Canberra's written approval or which has been subjected to unusual physical or electrical stress as determined by Canberra Service personnel. Canberra Industries shall be under no obligation to furnish warranty service (preventive or remedial): (1) if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electrical power, air conditioning, humidity control, transportation, or causes other than ordinary use; (2) if the equipment is maintained or repaired or if attempts to repair or service equipment are made by other than Canberra personnel without the prior approval of Canberra.

This warranty does not cover detector damage caused by warm-up or by neutrons or heavy charged particles. Damage from these causes is readily identifiable as described in the manual accompanying each detector.

Although Canberra may frequently supply, as part of systems, equipment manufactured by other companies, the only warranty that shall apply to such non-Canberra equipment is that warranty offered by the original manufacturer, if any.

Canberra will, upon request, offer, as an option, warranty coverage for non-Canberra equipment such as computers and peripherals sold as part of a system supplied by Canberra. Quotations on this coverage may be obtained by contacting Canberra Customer Service or any of our sales staff.

### **SOFTWARE**

Canberra warrants software media from defects discovered within 30 days after receipt.

Canberra assumes no responsibility for user-written programs or programs published as part of information exchange in Canberra periodicals.

Engineering assistance for software development is available and can be contracted through the Sales Department.

### **INSTALLATION**

Installation of equipment purchased from Canberra shall be the sole responsibility of the customer unless the installation is specifically contracted for at the prevailing Canberra field service rates. To insure timely

installation after receipt of equipment, it is recommended that installation be contracted for at the time the equipment is ordered.

### **ON-SITE WARRANTY OPTION**

The On-Site Warranty Option provides for free on-site warranty work (Canberra pays all travel and living expenses) within the first 90 days after delivery of equipment to the customer. If installation is ordered from Canberra, the 90 day period commences upon completion of the initial installation. After the 90 day period, labor and materials used on site will still be covered by the basic warranty, but the customer shall pay for all travel expenses—travel time labor and living expenses incurred for any on-site service.

A maintenance contract may be purchased covering the period after the 90 days on-site warranty period, or after initial installation of the equipment. This is to be contracted through Canberra Customer Service.

### **REPAIRS**

Any Canberra-manufactured instrument no longer in its warranty period may be returned, freight prepaid, to our factory for repair and realignment. When returning instruments for repair, contact the Customer Service Department for shipping instructions and an Authorized Customer Service Return Number.

All correspondence concerning repairs should include the Model number and a description of the problem observed.

Once repaired, all equipment passes through our normal preshipment checkout procedure. Return shipping expense on out-of-warranty repairs will be charged to the customer.

For instruments out of warranty, the customer must supply a purchase order number for the repair before the item will be returned.

### **SHIPPING DAMAGE**

Shipments should be carefully examined when received for evidence of damage caused by shipping. If damage is found, immediately notify Canberra and the carrier making delivery, as the carrier is normally responsible for damage caused in shipment. Carefully preserve all documentation to establish your claim. Canberra will provide all possible assistance in processing damage claims.

**Due to the delicate nature of cooled detectors [Ge(Li) and Si(Li)], Canberra requires that delivery to and from air freight terminals be handled with special care. Do not ship such Detectors without first obtaining advice from our Traffic Department.**

### **RETURN SHIPMENTS**

Canberra Customer Service Department must be notified in advance if equipment is to be returned for any reason. Canberra can suggest the best means of shipping and will be able to expedite the shipment in case it is lost or delayed in transit.

The customer must obtain an authorized customer service return number before returning any equipment to the Canberra factory. *Compliance with this provision by the customer shall be a condition of this warranty.* In giving shipping instructions, Canberra shall not be deemed to have assumed any responsibility or liability in connection with the shipment.

Equipment should be returned to your area service center or to Canberra, Meriden. For shipment from outside the U.S., our shipping address is:

Kamino Air Transport, Inc.  
JFK International Airport, New York  
FOR: CANBERRA INDUSTRIES, INC.  
Meriden, Connecticut 06450 U.S.A.

### **SERVICE AND SERVICEABILITY**

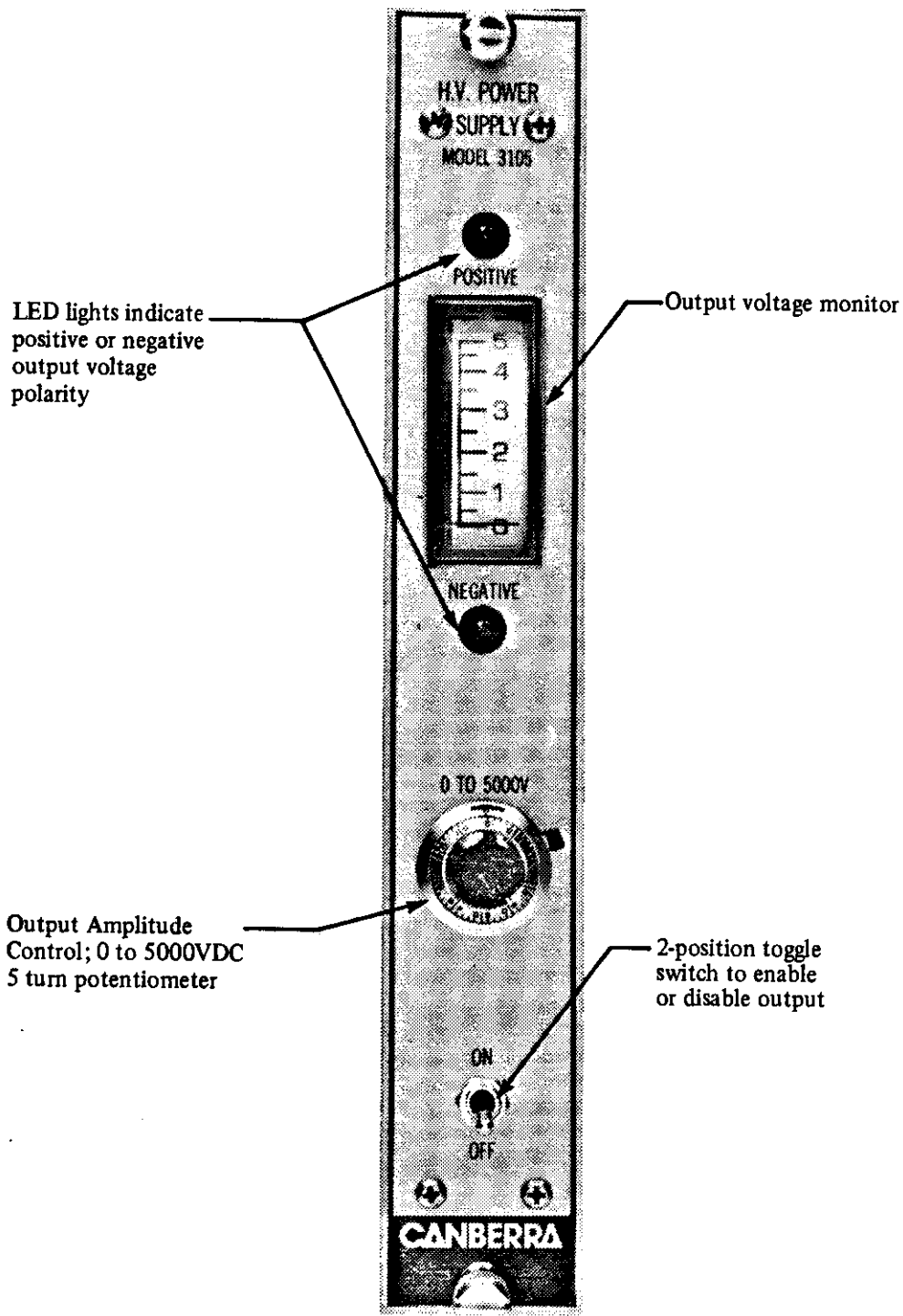
Canberra has gone to great lengths to insure that the instruments provided are functionally modular and therefore easy to service. In addition to modularity, Canberra has embarked on an extensive System Service Program to provide a totally responsive service capability. Complete Service Contracts with special arrangements for 24 hour response and weekend standby services are available from Canberra. For a detailed description of our Customer Service Program, please contact our Systems Service Department in Meriden, Connecticut, U.S.A.

**Section 3**  
**CONTROLS, INDICATORS, ADJUSTMENTS AND CONNECTORS**

**3.1 GENERAL**

Complete understanding of the purpose of the various controls and connectors is required for the proper operation of the Model 3105, and it is recommended that this Section be read before proceeding with the operation of the instrument.

**3.2 FRONT PANEL**



**Figure 3-1**  
**Front Panel Controls**

### 3.3 REAR PANEL

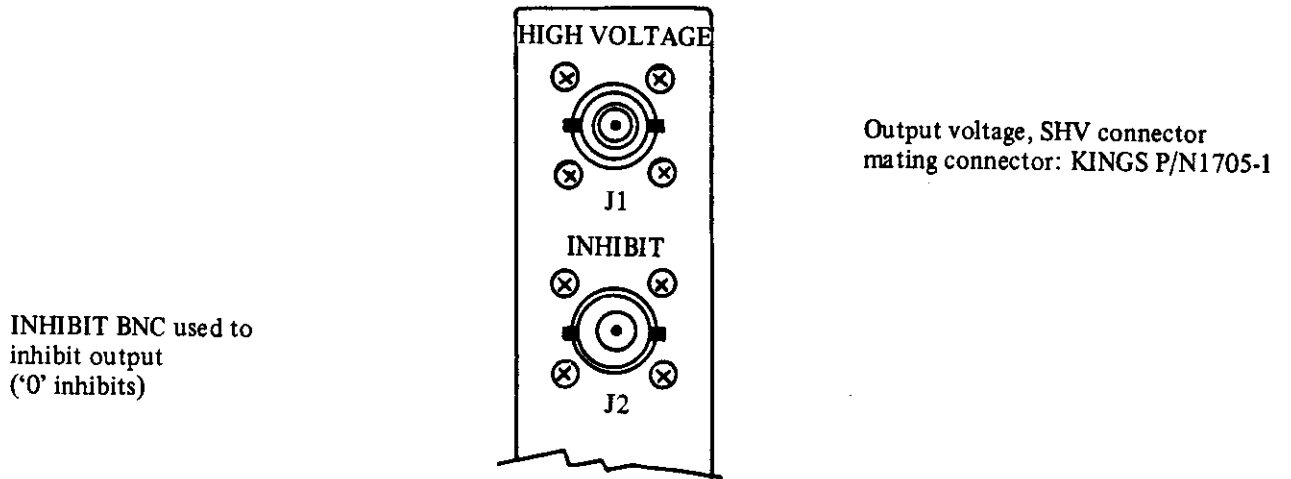


Figure 3-2  
Rear Panel Connectors

### 3.4 INTERNAL

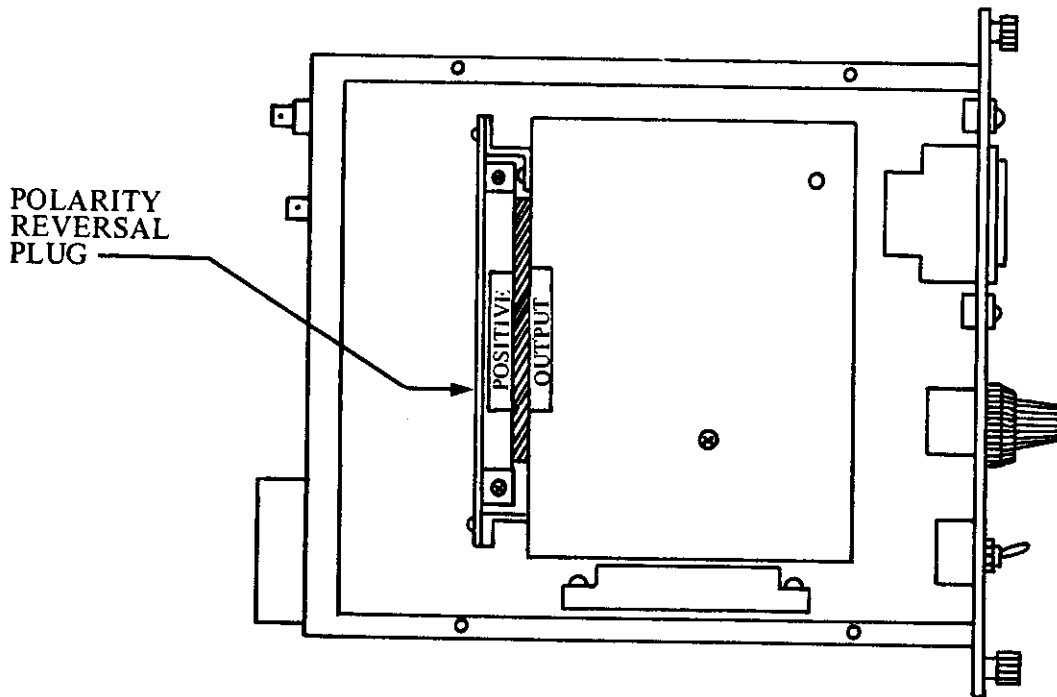


Figure 3-3  
Internal Controls



## Section 4 OPERATING INSTRUCTIONS

### 4.1 GENERAL

The purpose of this section is to familiarize the user with the operation of the Model 3105 High Voltage Power Supply and to check that the unit is functioning correctly. Since it is difficult to determine the exact system configuration in which the module will be used, explicit operating instructions cannot be given. However, if the following procedures are carried out, the user will gain sufficient familiarity with this instrument to permit its proper use in the system at hand.

### 4.2 INSTALLATION

The Canberra Model 2000 bin and power supply or other bin and power supply systems conforming with the mechanical and electrical standards set by AEC Report TID-20893 (Rev.) will accommodate the Model 3105. The right side cover of the NIM module acts as a guide for insertion of the instrument. Secure the module in place by turning the two front panel captive screws clockwise until finger tight. It is recommended that the NIM bin power switch be OFF whenever the module is installed or removed.

The Model 3105 can be safely operated where the ambient air temperature is between 0°C and +50°C (120°F maximum). Perforations in the top and bottom sides permit cooling air to circulate through the module. When relay rack mounted along with other "heat generating" equipment, adequate clearance should be provided to allow for sufficient air flow through both the perforated top and bottom covers of the NIM bin.

### 4.3 OPERATION

#### 4.3.1 POLARITY SELECTION

Polarity reversal is achieved by removing the smaller left side panel cover on the Model 3105 and rotating the polarity selector plug, on the high voltage potted assembly, 180°. A label containing the phrase OUTPUT POSITIVE or OUTPUT NEGATIVE as applicable will be visible when viewing the polarity selector plug on the side of the high voltage potted assembly. It is recommended that the output voltage controls be set to 0 and the output polarity indicator LEDs observed for indication of the proper output polarity before the power supply is reset for high voltage.

#### CAUTION:

**THE MODULE MUST BE REMOVED FROM THE BIN, INPUT POWER TURNED OFF AND HIGH VOLTAGE OUTPUT FULLY DISCHARGED TO GROUND AT THE OUTPUT CONNECTOR BEFORE ATTEMPTING TO REVERSE POLARITY.**

#### 4.3.2 SETUP

1. After selecting the proper output voltage polarity, connect load to output SHV connector and set all controls to their OFF or '0' positions. Set the ON-OFF toggle switch to ON. The applicable polarity LED should light.
2. Set the output amplitude control to the desired setting, remembering the output amplitude is equal to the setting of the fine control. The meter will provide a coarse indication at the output voltage.

### 4.3.3 INHIBIT FEATURE

The output voltage may be remotely commanded to turn off by using the INHIBIT input on the rear panel. This feature is achieved by presenting a ground or logic '0' (TTL Compatible) to the INHIBIT BNC. This INHIBIT functions at all voltage settings. The output voltage may be returned by removing the ground or driving the INHIBIT with a logic '1' (TTL compatible).

### 4.3.4 AUTOMATIC SHUTDOWN

The Model 3105 contains automatic protection against sustained overloading. A sustained overload will cause the high voltage to shut down completely. This will be clearly indicated by the 0 output reading on the meter independent of the voltage control settings. A short duration ARC-OVER or turn-on charging transient will not cause shut down. To reset, the unit must be turned OFF for approximately 5 seconds, then turned back on. Gating the unit off via the INHIBIT BNC will also reset the automatic shut down condition.

### 4.3.5 PERFORMANCE TESTS

1. The following test equipment is required to perform the measurements:
  - a) Oscilloscope.
  - b) Digital Voltmeter.
  - c) High Impedance, high voltage precision DC divider (1000:1), with capacitive coupled AC viewing circuit.
  - d) High Voltage load resistor, 50 meg ohms.
  - e) High Voltage shorting stick.

Connect the high voltage output of the Model 3105 to the 1000:1 DC voltage divider. Connect the low voltage output of the divider. Make sure a good ground is provided for all instruments.

2. Turn the front panel voltage controls to their maximum positions. The digital voltmeter should indicate the maximum rated output of the unit.
3. Connect an end of the load resistor to ground and the other end to the shorting stick. Then, with the shorting stick, connect the load resistor to the high voltage output and observe the change in output voltage. During this no-load to full-load test, the DVM reading should not change more than 0.001%.
4. With the load connected, measure the AC ripple. The ripple should be less than the specified peak to peak ripple under this condition of full load at maximum output.

## Section 5 THEORY OF OPERATION

### 5.1 GENERAL

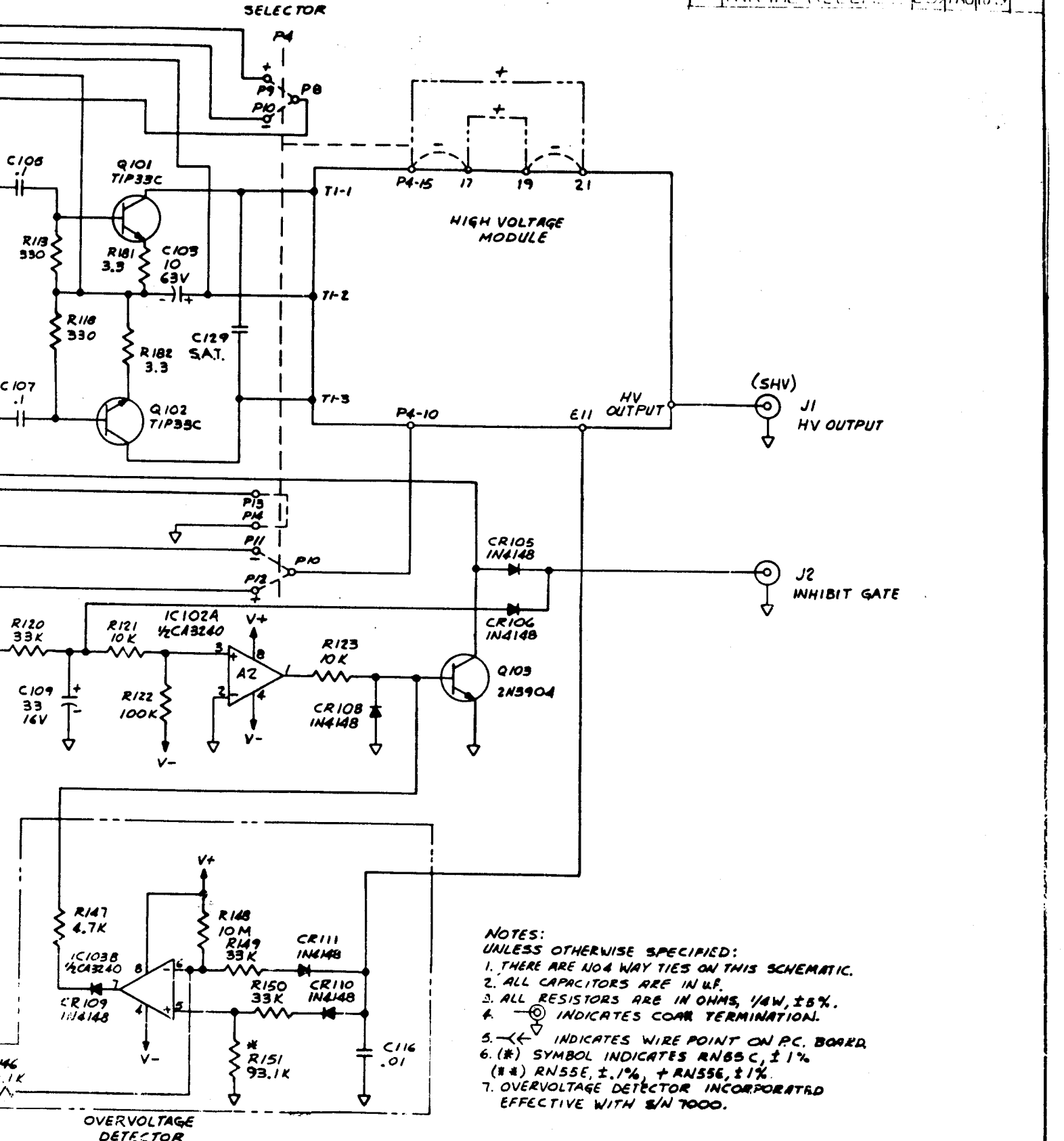
This Section describes the overall function, operation and circuitry of the Model 3105 High Voltage power supply.

### 5.2 CIRCUIT DESCRIPTION

A functional schematic of the Model 3105 is shown in Figure 6-1. The high voltage module is basically a DC to DC converter which converts low voltage DC power to a high voltage DC output. This output voltage is highly regulated and filtered and can be varied by the front panel controls. The input to the high voltage DC to DC converter is obtained from a conventional NIM power supply and utilizes  $\pm 12$  VDC and  $\pm 24$  VDC.

An oscillator determines a high frequency ( $\approx 20\text{kHz}$ ) at which all amplification, high voltage transformation, rectification and filtering occurs. The amplification is a function of a control voltage which performs the functions of control and regulation. A sample of the output voltage is compared with a reference voltage in the sensing circuit. The sensing circuit generates the control voltage to set and maintain a fixed high voltage output.





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