HIGH VOLTAGE POWER SUPPLY
MODEL 3102

Instruction Manual
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HIGH VOLTAGE POWER SUPPLY
MODEL 3102

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Section 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

The Canberra Model 3102 is a single width NIM bin compatible high voltage power supply designed for operation with a wide variety of detectors. Its noise and ripple characteristics make it suitable for surface barrier detectors, while the 2mA current capability permits operation with scintillation detectors. By design, the Model 3102 will accommodate all types of detectors requiring 2kV or less.

The Model 3102 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 by means of the two calibrated front panel voltage controls over the full range from 0 to ± 2000 volts. The output voltage can also be turned on or off through the INHIBIT BNC shutdown 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 ± 2000 VDC, continuously adjustable; 0 to 2mA 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	Two front panel controls to set output amplitude: 0 to 1000 volts in 500 volt steps with the course control and 0 to 1000 volts via a 10-turn precision potentiometer. The nominal output is the sum of the two settings.

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	< 2mV peak to peak.
OUTPUT STABILITY	Long term drift of output voltage is $< 0.01\%$/hr. and $< 0.02\%$/8 hr. at a constant input line voltage, load, and ambient temperature after a 30 minute warmup.

	REGULATION	< 0.001% variation in output voltages for line and load changes within the operating range at constant ambient temperature.
	TEMPERATURE COEFFICIENT	< ± 50 ppm/°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 volt.
	OUTPUT LOAD CAPACITY	0 to 2mA.
	OUTPUT RANGE	0 to ± 2000 VDC.
2.6	CONNECTORS	
	OUTPUT VOLTAGE	Rear Panel SHV.
	INHIBIT	Rear Panel BNC, UG 1094/U.
2.7	POWER REQUIREMENTS	
		Provided by Model 2000 BIN/power supply as required: +12V – 50mA - 12V – 50mA +24V – 83mA - 24V – 83mA
2.8	PHYSICAL	
	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	3 lbs. (1.35 kg)
	SHIPPING WEIGHT	8 lbs. (3.6 kg)

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 3102, and it is recommended that this section be read before proceeding with the operation of the instrument.

3.2 FRONT PANEL (Refer to Figure 3-1)

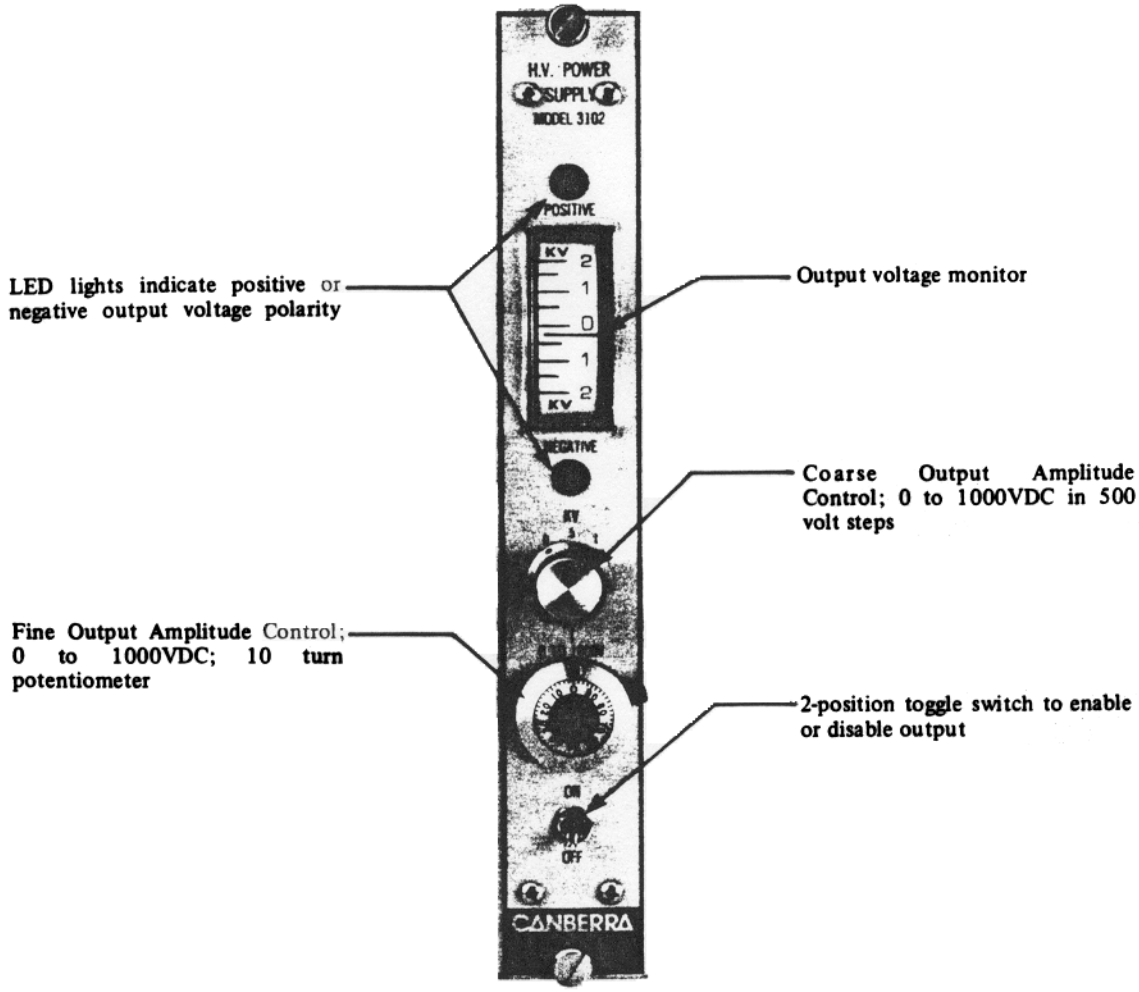

Figure 3-1. Front Panel Controls.

3.3 REAR PANEL (Refer to Figure 3-2)

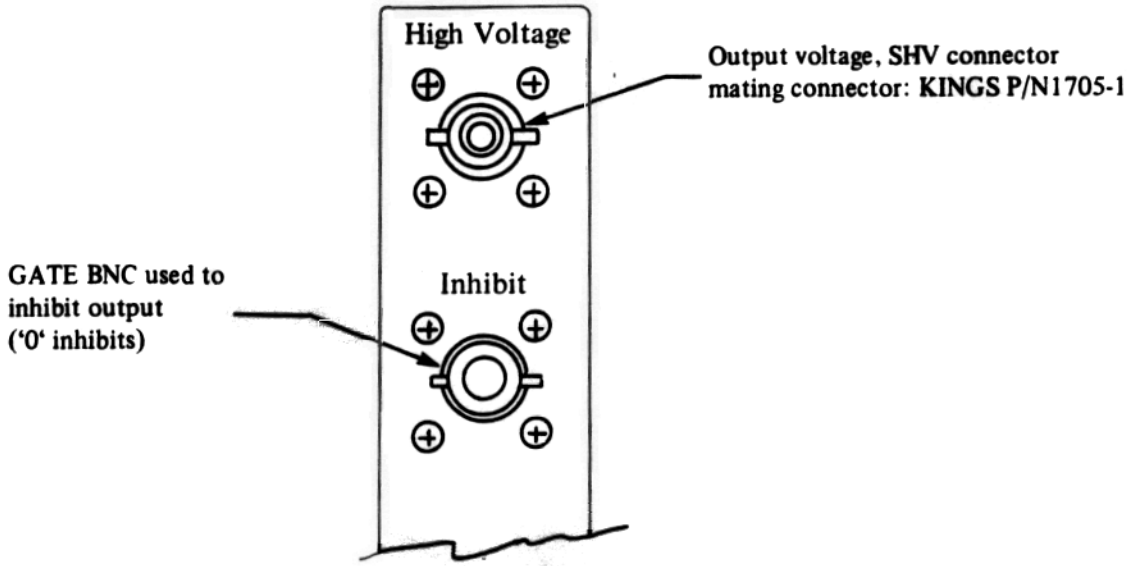

Figure 3-2 Rear Panel Connectors

3.4 INTERNAL (Refer to Figure 3-3)

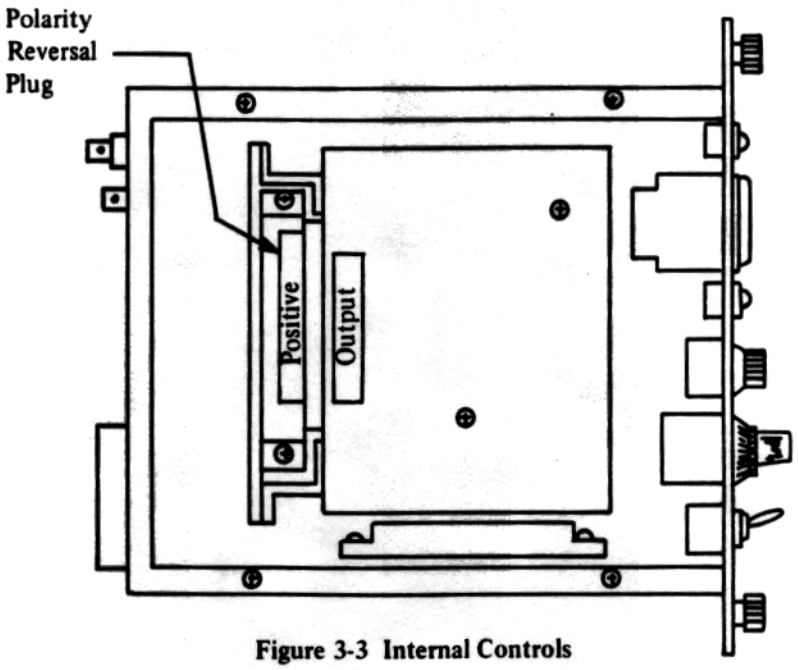

Figure 3-3 Internal Controls

Section 4
OPERATING INSTRUCTIONS

4.1 GENERAL

The purpose of this section is to familiarize the user with the operation of the Model 3102 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 3102. 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 3102 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 3102 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 visable 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 coarse/fine output amplitude controls to the desired settings, remembering the total output amplitude is equal to the sum of the coarse and fine controls. The meter will provide a coarse indication of 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 SHUT DOWN

The Model 3102 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

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, 1.0 meg ohms.
e) High Voltage shorting stick.

Connect the high voltage output of the Model 3102 to the 1000:1 DC voltage divider. Connect the low voltage of the divider to the DVM and the scope to the AC viewing 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 3102 High Voltage Power Supply.

5.2 CIRCUIT DESCRIPTION

A functional schematic of the Model 3102 is shown in Figure 5.1. 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 ± 12VDC and ± 24VDC.

An oscillator determines a high frequency (≈ 20kHz) 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.

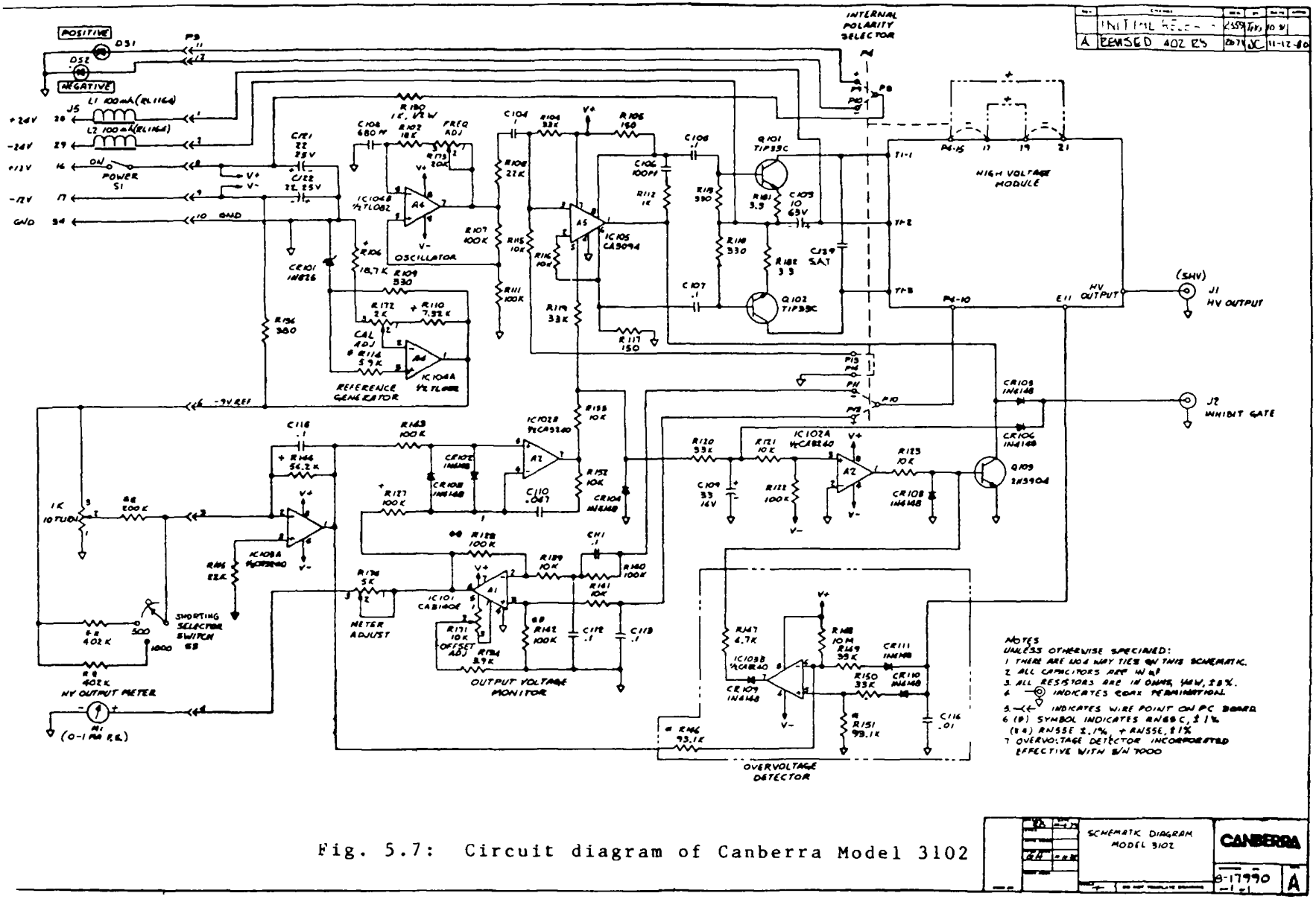

Fig. 5.7: Circuit diagram of Canberra Model 3102