CANBERRA

Model 3106D
HV Power Supply
User's Manual

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1. Introduction

The Canberra Model 3106D 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 3106D will accommodate all types of detectors requiring up to 6 kV bias and up to 300 μA of current.

The output voltage is continuously adjustable from ±30 V dc to ±6000 V dc. For low voltage detectors, a secondary output having a range of ±3 V to ±600 V is available. A three-digit voltmeter measures and displays the output voltage with a resolution of 10 volts on the normal output and 1 volt on the secondary output. Polarity is selected internally.

The Model 3106D will withstand any overload or short circuit condition for an indefinite period of time. An inhibit input is available for remote shut down of the 3106D. The unit can be programmed by an internal jumper either to resume normal operation after removal of the fault or the inhibit or to require a manual reset.

The 3106D's output rise time of five seconds protects preamplifiers and detectors from excessive surge currents while charging.

2. Controls and Connectors

This is a brief description of the front panel controls and connectors. For more detailed information, refer to Appendix A, Specifications.

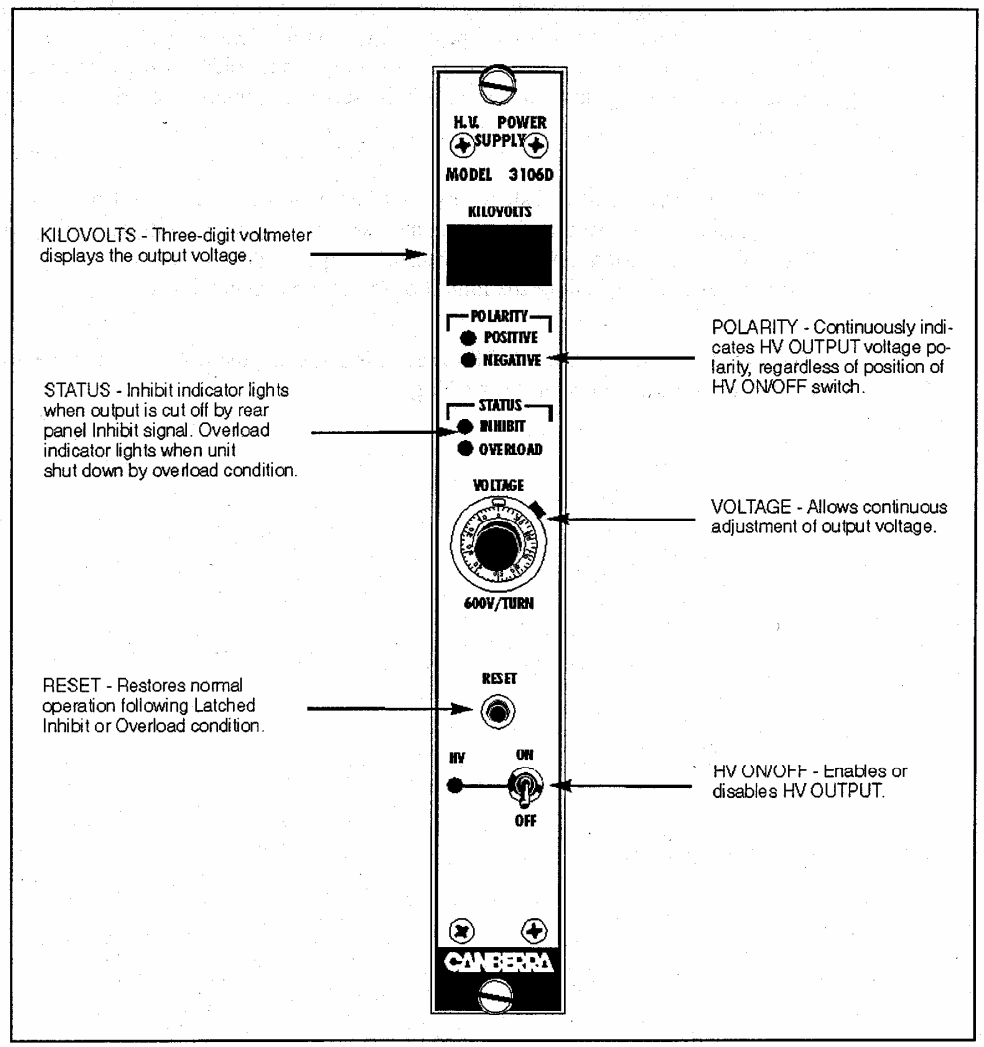

Figure 1 Front Panel Controls

This is a brief description of the rear panel connectors. For more detailed information, refer to Appendix A, Specifications.

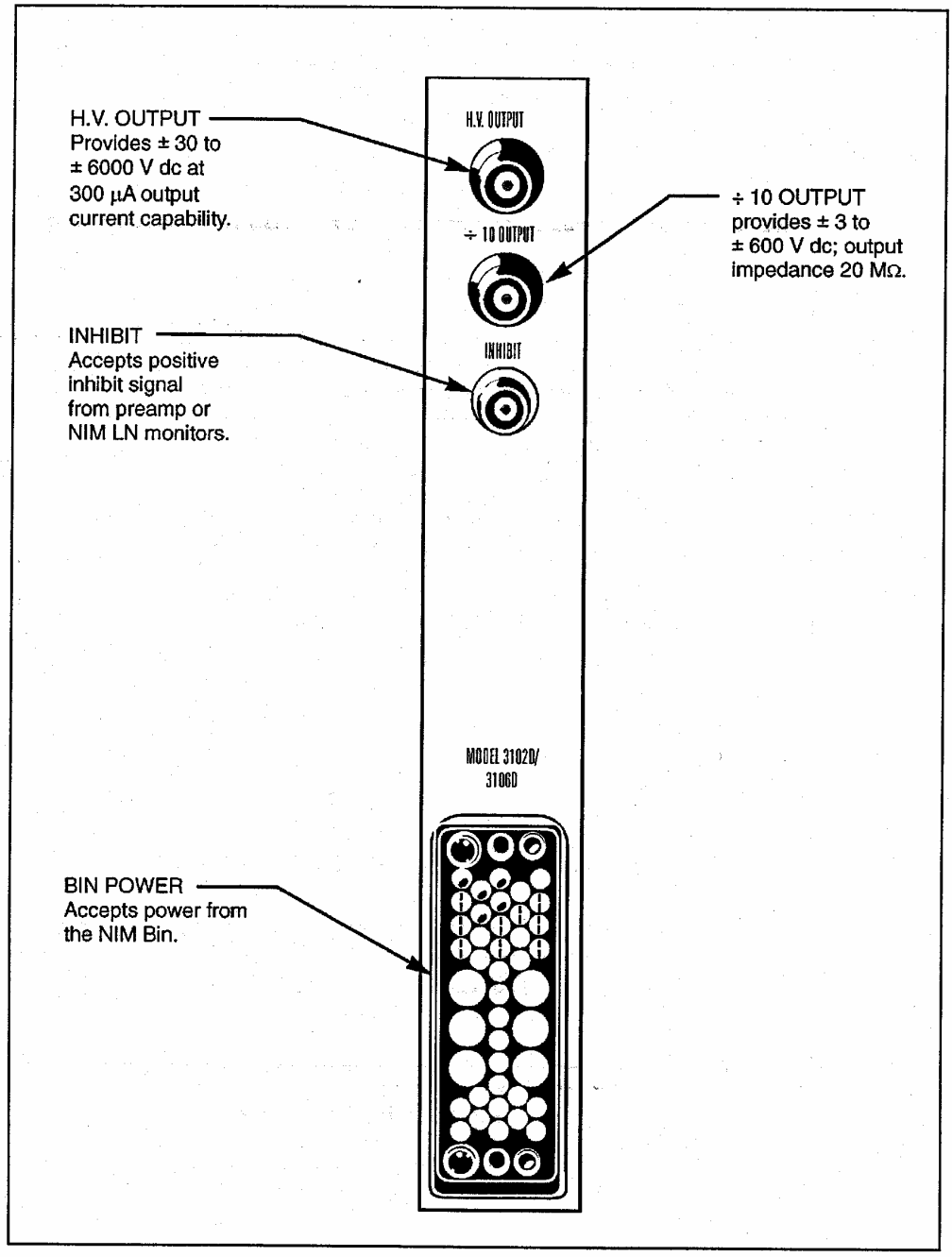

Figure 2 Rear Panel Controls

This is a brief description of the internal controls. For more detailed information, refer to Appendix A, Specifications.

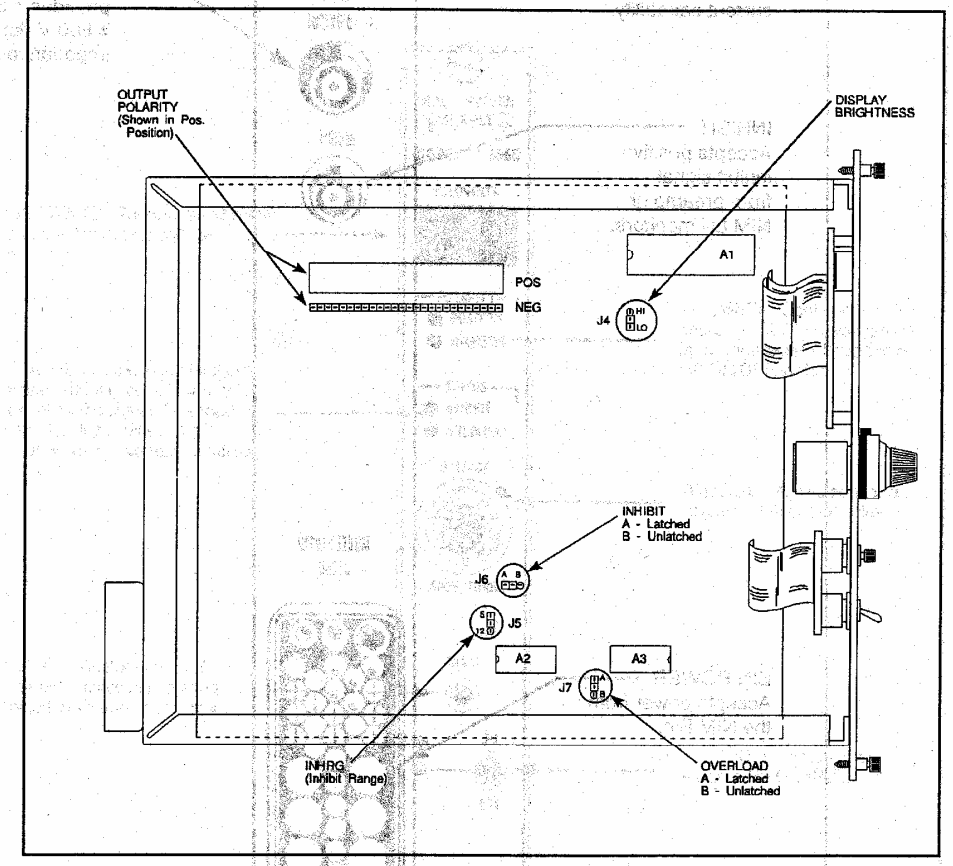

Figure 3 Internal Controls

3. Operating Instructions

The Model 3106D is factory set for positive output polarity. If negative polarity is required, change the internal polarity board before installing the unit in the NIM bin (refer to the Internal Conrols section, below, for instructions).

Installation

The Canberra Model 2000 NIM bin and Power Supply or equivalent power supply conforming to DOE/ER-00457T will accommodate the Model 3106D. The right side cover of the unit acts as a guide for insertion of the unit. 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 any module is installed or removed.

The Model 3106D can be safely operated where the ambient air temperature is between 0 °C and +50 °C. Perforations in the top and bottom of the unit's frame permit cooling air to circulate through the module. When rack mounted along with other heat generating equipment, be sure to provide adequate clearance for a flow of cooling air through the NIM bin.compliant grounding and safety precautions for any internal power distribution

Internal Controls

Remove the unit's left side cover to change the internal controls. Figure 3 shows the position of the internal controls.

WARNING The Model 3106D generates hazardous high voltage, which will be present for several minutes after the unit is switched off.

Before removing the unit from the NIM bin, set the VOLTAGE control to 0.00 volts and the HV ON/OFF switch to OFF.

Avoid the risk of injury. Leave the unit in the NIM bin until the voltage reduces to 0 volts, as indicated on the front panel digital display.

Polarity Selection

Output polarity can be changed by removing the unit's left side cover and changing the polarity selector board's location. The board is symmetrical by design. Polarity is not affected by orientation. When the unit's NIM bin power is turned on, the front panel POLARITY preview LEDs will indicate the current polarity selection. Canberra recommends that the polarity selection be verified before turning on the unit's NIM bin power. Factory set to POSitive.

J4, Brightness Control

Jumper J4 sets the display brightness to HIgh or LOw (factory set to low). In the HI position, the display is at its brightest, but the unit will draw significantly more current. See the Power Requirements specification in Appendix A for details.

Inhibit Control

The Inhibit Function, which is independent of the Voltage Control's setting, allows the output voltage to be conditionally turned off or latched off by grounding or by applying a logic 0 (≤0.7 V) to the rear panel INHIBIT connector. The front panel INHIBIT STATUS indicator lights when the output has been inhibited.

Jumper J5

The INHIBIT input is compatible with all Canberra preamps for either position of Jumper plug J5; it isn't necessary to set jumper plug J5 to match the HV INHIBIT logic high level of the associated Canberra preamp.

Jumper J5 selects the pull up/clamp voltage level of the INHIBIT input for compatibility with INHIBIT signals from instruments made by other manufacturers. With J5 in position 5 (factory setting), the pull up/clamp level is set to +5 volts. With J5 set to position 12 the pull up/clamp level is +12 volts. Please consult the manual provided with your instrument for its requirements.

Jumper J6

Jumper J6 selects the Latched Inhibit Mode or the Conditional Inhibit Mode.

In the Latched Mode (jumper position A; factory setting), pressing the front panel RESET button when a logic 1 or open circuit is present at the INHIBIT connector will restore the output voltage. In the Conditional Mode (jumper position B), an INHIBIT input of ≥2 V or an open circuit enables the output.

Automatic Overload Shutdown

One of the 3106D's circuits monitors the output load current and automatically disables the outputs for an overload or a fault condition.

A short duration arc-over or turn-on charging transient will not cause shut down. The front panel OVERLOAD STATUS indicator lights when the unit has been shut down.

The unit can be programmed to either automatically resume operation when the fault is removed or to require a manual reset.

Jumper J7

With Jumper J7 in position A (factory setting), the front panel RESET button must be pressed to resume normal operation after the fault is removed. With Jumper J7 set to position B, the output will automatically resume when the fault condition is removed.

Setup

After setting the internal controls, install the Model 3106D in the NIM bin. Connect the load to the appropriate rear panel SHV connector, set the HV ON/OFF switch to OFF, and set the VOLTAGE control to zero. Set the NIM bin power to ON; the appropriate polarity LED should light, indicating the polarity selected.

Set the HV ON/OFF switch to ON and the VOLTAGE control to the desired setting. The front panel digital display will indicate the HV OUTPUT voltage in kilovolts (kV).

Divide By 10 Output

The 3106D has two rear panel output connectors: HV OUTPUT and ÷10 OUTPUT. Canberra recommends that *only one* of these outputs be used at a time.

For detectors operating at relatively low bias voltages and requiring little current, the ÷10 output should be used. This output is provided by means of a simple voltage divider network, which has an impedance of 20 megohms. Therefore, loading effects have to be taken into account if there is a significant current drain.

The advantage of the ÷10 output is that the zero offset and the control are better by a factor of 10 over that of the HV OUTPUT. Most detectors (for example, Canberra PIPS detectors, Si(Li) detectors, and Low Energy (LEGe) detectors), take very little current and are thus compatible with the ÷10 output. The ÷10 output should never be used with scintillation detectors which draw relatively large currents.

Preventive Maintenance

Preventive maintenance is not required for this unit.

When needed, the front panel of the unit may be cleaned. Remove power from the unit before cleaning. Use only a soft cloth dampened with warm water and make sure the unit is fully dry before restoring power. Because of access holes in the NIM wrap, DO NOT use any liquids to clean the wrap, side or rear panels.

4. Circuit Description

A functional schematic of the Model 3106D can be ordered from Canberra. 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 VOLTAGE control. The input to the high voltage dc to dc converter is obtained from a conventional NIM power supply and uses ±12 V dc and ±24 V dc.

An oscillator determines a high frequency (≈37 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.

A. Specifications

Inputs

INPUT POWER – The Model 3106D is powered from a standard NIM Bin and power supply, such as the Model 2100, 2000 or 1000.

INHIBIT – Logic low or ground inhibits the HV outputs; max logic low ≤0.7 V; logic high ≥2.0 V or open circuit enables.

Outputs

HV OUTPUT – ±30 to ±6000 V dc, continuously adjustable; 300 µA output current capability; rear panel SHV connector.

÷10 OUTPUT – ±3 to ±600 V dc, continuously adjustable; Z_{out} = 20 MΩ; rear panel SHV connector.

Controls

ON/OFF – Front panel toggle switch to enable or disable output.

RESET – Restores normal operation following a latched Inhibit and/or Overload fault condition.

VOLTAGE – Front panel 10-turn control permits continuous adjustment of the output voltage.

POLARITY – Internal polarity board sets output polarity.

Indicators

HV OUTPUT – 3-digit panel meter; 0 to 6.00 kV.

POLARITY – Front panel LEDs indicate polarity status continuously.

INHIBIT – LED to indicate Inhibit status.

OVERLOAD – LED to indicate Overload status.

Performance

RIPPLE AND NOISE – ≤3 mV peak to peak at 300 µA.

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

TEMPERATURE COEFFICIENT – ≤±50 ppm/°C after 30 minute warmup.

REGULATION – ≤0.001% variation in output voltage over the load range and ≤0.001% for ±0.1% input voltage change within the operating range at constant ambient temperature.

OVERLOAD PROTECTION – Power supply will withstand any overload, including a short circuit for an indefinite period.

CURRENT LIMIT – 450 µA maximum.

DIAL ACCURACY – ±1% of full scale.

METER ACCURACY – ±0.6% of full scale plus 10 volts.

Connectors

HV OUTPUT – Rear panel SHV.

÷10 OUTPUT – Rear panel SHV.

INHIBIT – Rear panel BNC.

Power Requirements

+24 V – 70 mA +12 V – 160 mA*

–24 V – 10 mA –12 V – 150 mA

*With Brightness Control J4 set to HI, +12 V will draw 265 mA, which exceeds the normal Bin allotment of 167 mA for a single-width module.

Physical

SIZE – Standard single width NIM module 3.43 x 22.12 cm, (1.35 x 8.71 in.) per DOE/ER-0457T.

NET WEIGHT – 1.4 kg (3.1 lb).

SHIPPING WEIGHT – 2.4 kg (5.3 lb).

Environmental

OPERATING TEMPERATURE – 0 to 50 °C.

OPERATING HUMIDITY – 0-80% relative, non-condensing.

Tested to the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.

B. Installation Considerations

This unit complies with all applicable European Union requirements.

Compliance testing was performed with application configurations commonly used for this module; i.e. a CE compliant NIM Bin and Power Supply with additional CE compliant application-specific NIM were racked in a floor cabinet to support the module under test.

During the design and assembly of the module, reasonable precautions were taken by the manufacturer to minimize the effects of RFI and EMC on the system. However, care should be taken to maintain full compliance. These considerations include:

- A rack or tabletop enclosure fully closed on all sides with rear door access
- Single point external cable access
- Blank panels to cover open front panel Bin area
- Compliant grounding and safety precautions for any internal power distribution
- The use of CE compliant accessories such as fans, UPS, etc.

Any repairs or maintenance should be performed by a qualified Canberra service representative. Failure to use exact replacement components, or failure to reassemble the unit as delivered, may affect the unit's compliance with the specified EU requirements.