

High Voltage Power Supply Development for INGA Facility at IUAC

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Introduction

The upcoming INGA facility requires a large number of high voltage supplies to bias detectors. Two types of NIM based high voltage supplies have been developed with unique functional facilities, which makes the biasing of large arrays very comfortable (5 kV / 50 μ A programmable power supplies for Germanium Detectors and 3 kV/ 10 mA power supplies for BGO Detectors). High Power multioutput Preamplifier supplies have been developed for for INGA facility.

5 kV/ 50 μ A Programmable Bias Supply for Germanium Detector

Germanium Clover Detectors are biased using stable high voltage power supplies (upto 5kV). While biasing these detectors the applied bias voltage should ramp up slowly to prevent damage due to sudden voltage changes. Presently the detectors are biased manually using front panel potentiometer, which takes around 15 minutes. It is time consuming to bias multi-detector arrays consisting of large number of detectors. To get rid of this problem a high voltage power supply has been developed using switch mode technique and high voltage is generated by Cockroft Walton multiplier. The power supply have an automatic output ramping facility where output always starts at zero volt

and then ramp up to the value set by the front panel potentiometer at the chosen ramping rate. The commercially available bias supplies do not have this facility. Power Supplies are protected for over current and output short circuit. 30 power supplies have been assembled and tested.

Specifications

- Output Voltage range : 0 – 5kV
- Rated output current : 0 – 50 μ A
- Output stability : 0.1% (8hrs)
- Noise and ripple : < 8mVpp

Features

- Ready signal after set output achieved.
- Output can be ramped UP and Down.
- Output can be paused while ramping.

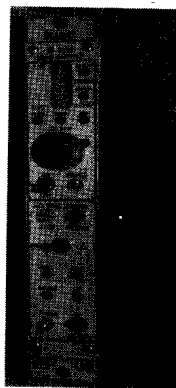


Figure-1: 5 kV / 50 μ A Germanium Clover Detector Bias Supply

3 kV/ 10 mA Bias Supply for BGO/ ACS Detector

These are medium power high voltage regulated supplies based on pulse amplitude modulation technique. These are AC powered (230 V_{AC}) supplies housed in double width NIM module. Power supply have two regulation loops to control power dissipation and to regulate output voltage. High grade insulating materials are used to avoid local discharge and EMI for achieving low ripple and noise. Power supplies are protected for over load and short circuit. 30 power supplies have been assembled and tested.

Specifications

- Output voltage range : 0 - 3kV
- Output current range : 0 - 10mA
- Load regulation : 0.003%
- Long term drift : 0.035%/ 8 Hrs
- Output ripple : ~ 20mVpp @ 50Hz
- Output noise : ± 10mV @ 25kHz

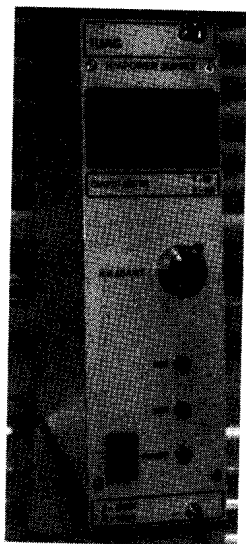


Figure-2: 3 kV/ 10 mA BGO / ACS Detector Bias Supply

Preamplifier Power Supply (±24 V/ 1 A, ±12V/1A)

High power preamplifier power supplies have been designed and assembled. It can provide power to six preamplifiers simultaneously. Separate ground technique and linear low noise regulators are used to achieve good regulation and low noise. These are highly protected power supplies with three fold protections. 10 power supplies have been assembled and tested.

Performance

- Load regulation : 0.005% (zero - full load)
- Stability : 0.01% per 12 Hrs
- Noise & Ripple : < 2 mVpp (full load)

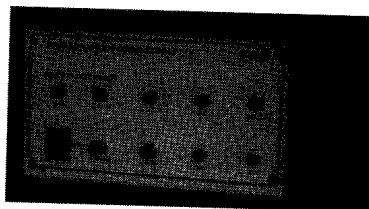


Figure-3 : Preamplifier Power Supply

References:

1. S. Muralithar et. al. Indian National Gamma Array in Beamhall -II at IUAC, DAE Symposium on Nuclear Physics, 2007