WARNING

Voltages as high as 4000 volts exist within this equipment, contact with such voltage may prove fatal. Avoid accidental contact with any of the metallic 85A2 tube retainers which carry high voltage when the Power Supply is energized. EXTREME CAUTION should be exercised if the equipment is operated without protective cover screens. All high-voltage oil capacitors should be discharged prior to working on interior parts of this unit.

I. GENERAL DESCRIPTION

The Model 312 High Voltage Power Supply was developed to provide a highly stable d-c voltage source which is generally required for precision scintillation counting. Voltage drift has been reduced to an absolute minimum; it is possible to start an experiment a second time with virtually unchanged voltage conditions.

The Model 312 Power Supply consists of an input regulating transformer followed by a conventional high voltage transformer, rectifier, and R-C filter network. The filtered d-c voltage is applied to a bank of 17 cold cathode tubes from which the regulated output voltage is obtained.

In physical layout, the Model 312 Power Supply consists of a modular double-chassis assembly, panel mounted in a bottom-and-top ventilated cabinet. The front panel carries the voltage indicating meter and all necessary operating controls. The entire assembly may be removed from its own cabinet and mounted in a standard 19-inch relay rack or cabinet. Figures 1 and 4, giving outline drawings with dimensions, will aid in

planning an installation. The principal electrical characteristics of the unit are summarized in Table 1.

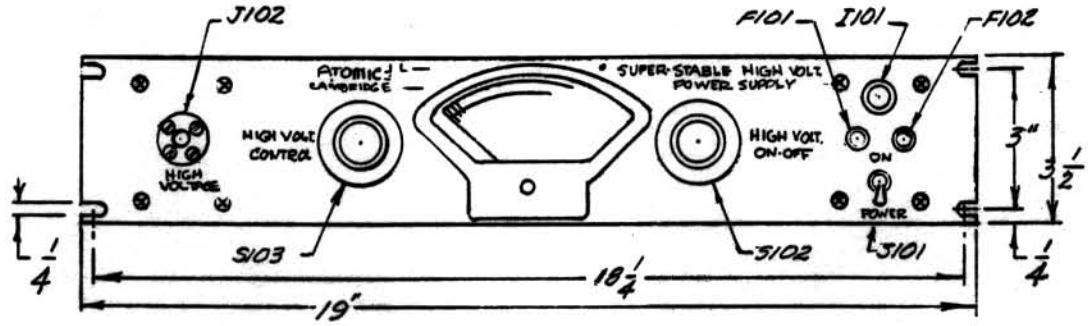

Figure 1. Front Panel

Table 1

Operating Specifications

AC 60-Cycle Transformer Type.

Range: From less than 100 V to greater than 1400 V in 17 steps.

Maximum load current: 1 milliamp.

Load regulation: Output voltage changes less than 0.35% for current increase from zero to maximum load.

Line regulation: Output voltage changes less than 0.00035% per volt change of line from 100-130 V.

Stability: Approximately 0.02% per day.

Ripple: Less than 0.01% of output voltage.

Power requirements: 30 watts.

Positive or negative output controlled by front panel switch.

II. OPERATION

The equipment is energized by throwing the POWER Switch to the ON position which also lights an indicator lamp.

Voltage adjustment is effected by means of the HIGH VOLTAGE CONTROL, a 17-position switch which increases the output high voltage with

clockwise rotation in 17 equal steps. The HIGH VOLTAGE CONTROL step positions are lettered from A to Q to correspond with similarly marked positions on the front panel meter scale. This not only indicates the operating voltage but also serves to check correct functioning of the Power Supply.

The HIGH VOLTAGE ON-OFF control consists of a 5-position switch. The output voltage appearing at the HIGH VOLTAGE Connector is positive or negative with respect to chassis ground depending on whether the HIGH VOLTAGE ON-OFF control is turned to the +H.V. or -H.V. position. Turning this control to any one of the 3 OFF positions removes output voltage from the HIGH VOLTAGE Connector and meter circuit without shutting off line power. Thus this control functions as a stand-by switch. As a safety feature, 3 detents are provided for the OFF positions to avoid any possibility of accidentally switching directly from one output voltage polarity to the opposite polarity. Application of reverse polarity can permanently damage some radiation detectors.

For maximum voltage stability, at least 1 hour - preferably 2 - should be allowed for warm-up. It is recommended that operation of this Power Supply take place at an ambient temperature which is maintained at a reasonably constant level.

For quiet operation of the Power Supply, it is essential that all screws used to fasten down chassis cover screens be tightened securely to prevent transmission of audible 60 cycle vibration from the voltage stabilizing transformer.

It is possible that some drift will be noted in the front panel meter reading, but this will be limited to the 2% full-scale tolerance

set by the meter manufacturer and drift in the meter circuit resistors. Such drift does not imply instability in the output voltage of the Model 312 Power Supply. The mechanical zero of the meter can be checked occasionally by turning the HIGH VOLTAGE ON-OFF Switch to the OFF position.

III. THEORY OF OPERATION

Block diagram, Figure 2, outlines the circuit in simplified form. Input regulating transformer T101 stabilizes against line voltage fluctuations. T101 in turn energizes high-voltage transformer T102 which, with V101, forms a conventional half-wave rectifier circuit. This is followed by a condenser input R-C filter arrangement. The filtered d-c voltage is dropped by limiting resistors R111 and R112 to supply ignition voltage to high-stability voltage reference tubes V102 to V118 inclusive. The regulating action of these gas-filled diodes derives from the fact that the voltage across such tubes is practically independent of the current through them when the current range is restricted within certain specified limits. The entire d-c system is essentially balanced with respect to ground, depending upon the setting of S103.

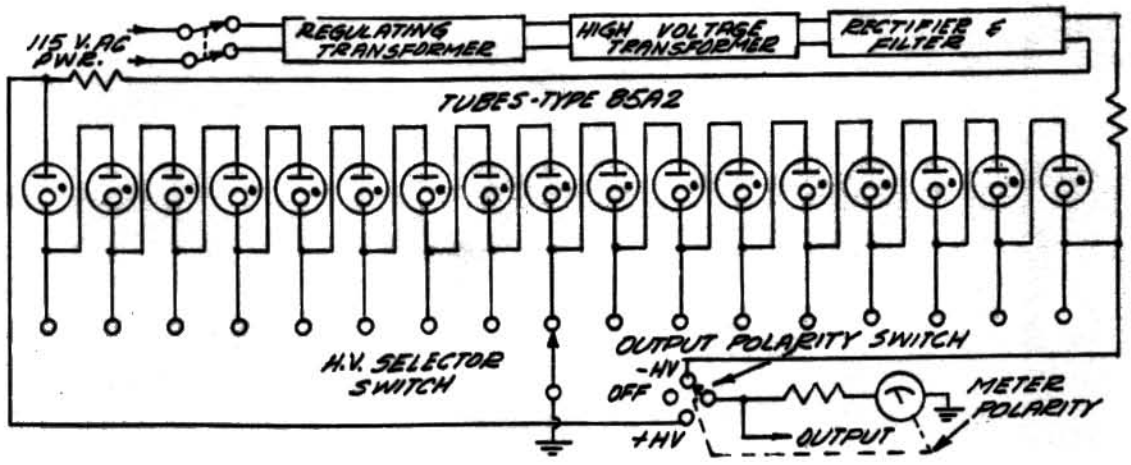

Figure 2. Block Diagram

Voltage output is adjustable in 17 steps of approximately 85 volts each by means of HIGH VOLTAGE CONTROL Switch S103 which varies the number of voltage reference tubes connected between the high-voltage jack and chassis ground. Achievement of day-to-day voltage reproducibility is aided by this fixed setting arrangement.

Output voltage polarity is controlled by the 5-position HIGH VOLTAGE ON-OFF Switch S102. This switch reverses terminal connections on meter M101 to indicate correct voltage regardless of polarity and, in the OFF positions, serves as a stand-by switch as explained in section II.

Output voltage is indicated by M101, a 200-microampere meter paralleled for calibration purposes by Rx.

IV. MAINTENANCE

The most likely source of malfunctioning in this equipment is found in the series-connected bank of cold cathode tubes, V102 thru V118. Failure of the 85A2 regulator tubes to ignite will be evidenced by a tendency for the front panel meter to read off-scale at the high end due to loss of regulation. In this case, turn the HIGH VOLTAGE ON-OFF Switch to the OFF position to prevent meter damage. Locate the defective tube by shorting out one tube at a time, until the entire string of regulator tubes lights up. This can be done by using a screwdriver with an insulated handle, shorting out each tube between base pins #1 and #7. Replace the defective tube in the socket which was shorted out.

If more than one tube is defective, it may be necessary to short out small groups of regulator tubes using a technique similar to that outlined above. It is possible for a defective regulator tube to ignite

and show an abnormally high anode-to-cathode voltage drop. Locate this type of defect by indexing the HIGH VOLTAGE CONTROL through steps "A" to "Q" and noting on the front panel meter whether each step increases the output by approximately 85 volts. For example, if the HIGH VOLTAGE ON-OFF Switch is set at +H.V., and all HIGH VOLTAGE CONTROL positions preceding "K" show normal voltages increments, then, an abnormal voltage increase at position "K" would indicate that V112 is defective.

A spare 85A2 tube is provided with each unit. In an emergency, type 5651 voltage reference tubes may be used in place of the 85A2 tubes -- at some sacrifice in voltage stability.

Table 2, Voltage and Resistance Measurements, and a Schematic Diagram are included to assist in isolating circuit faults and making repairs. All electrical components are identified by symbol numbers in Figures 1, 3 and 4 for easy location. These components are described in the Parts List where the figure in which the part is located and identified is listed.

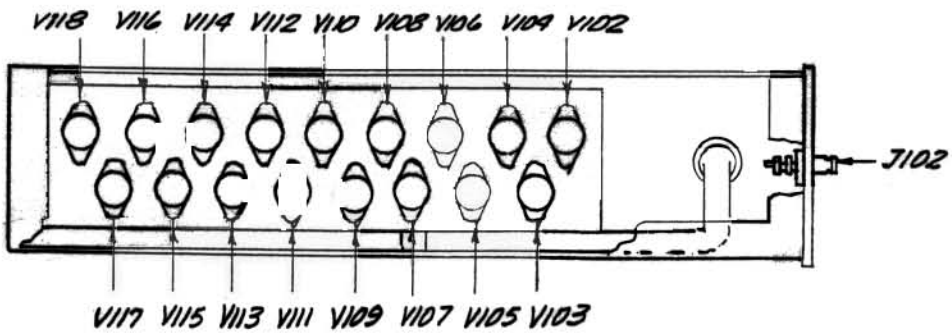

Figure 3. Component Tube Layout