

- Bias voltage for solid-state, charged-particle detectors
- Four supplies, with independently selectable polarity and voltage from 0 to  $\pm 100$  V and from 0 to  $\pm 1$  kV
- Automatic shutdown if the detector current exceeds 20  $\mu$ A
- Detector protection in case of vacuum failure
- Alarm output for stopping data collection if a detector or vacuum failure occurs
- LED display for convenient digital readout of the current or voltage of any supply



The Model 710 Quad 1-kV Bias Supply contains four high-voltage power supplies that have independently selectable output voltages and polarities. Each supply can deliver an output voltage that is continuously adjustable over the range from 0 to  $\pm 100$  V or from 0 to  $\pm 1$  kV, with a maximum output current of 20  $\mu$ A. The Model 710 is ideal for providing the bias voltage for solid-state, charged-particle detectors. It can also be used with ionization chambers and proportional counters that operate within the range of voltage and current delivered by the Model 710.

On each supply, a 10-turn, locking dial adjusts the output voltage with a control resolution of 0.05% of full scale. Feedback regulation ensures an output voltage accuracy within  $\pm 0.25\%$  of full scale. The output voltage or output current of any of the four supplies can be selected for monitoring on the 3-1/2-digit LED display. This is useful when initially determining the correct bias voltage for a solid-state detector. Detector bias currents from 0.01 to 19.99  $\mu$ A can be measured with a 0.01- $\mu$ A resolution.

On each supply, a three-position, locking toggle switch selects the 1-kV or the 100-V range of output voltage, or disables operation of that supply. The outputs of all active supplies are also controlled by the MASTER ON/OFF switch. A red LED on each supply indicates when its bias voltage is turned on.

Several features are incorporated to protect the detectors served by the Model 710, and to ensure the integrity of the data they are collecting. Green LEDs indicate the polarity of the output voltage for each supply whenever the bin power is on, and the output polarity selection jumpers are mounted on the printed circuit board. If the detector current exceeds 20  $\mu$ A, the bias voltage for that detector turns off, and the yellow overload LED turns on to indicate a shutdown condition. That particular channel remains shut down until the fault is cleared and the OVERLOAD RESET button is pushed. To protect the detectors and their associated preamplifiers against discharges in a partial vacuum, the vacuum shutdown feature can be utilized. A relay closure to ground, or a low TTL signal from a trip level on a vacuum gauge can be applied to the VACUUM SHUTDOWN input to turn off all bias supplies in the case of a vacuum failure in the detector vacuum chamber. A yellow, front-panel LED turns on to indicate that the vacuum shutdown has been activated.

The rear-panel overload/shutdown alarm output generates a low TTL level whenever an overload or vacuum shutdown has occurred in the Model 710. This output can be connected to a computer, or other suitable alarm, to stop the measurement

and prevent the collection of faulty data. The overload/shutdown alarm outputs from a number of Model 710 modules can be connected together to generate a common alarm signal.

## Specifications

The Model 710 contains four identical bias supplies with independently adjustable voltage and polarity. The specifications apply to each of the four channels unless noted otherwise.

### PERFORMANCE

**POLARITY** Positive or negative polarity, independently selectable for each channel by printed circuit board jumpers.

**OUTPUT VOLTAGE RANGE** Front-panel switch selectable as 0 to 100 V, or 0 to 1 kV.

**OUTPUT CURRENT RANGE** Internally limited to 20  $\mu$ A on each output.

**OUTPUT VOLTAGE ACCURACY**  $\pm 0.25\%$  of full scale.

**VOLTAGE CONTROL RESOLUTION** 0.5 V on 1000-V range, 0.05 V on the 100-V range.

**OUTPUT VOLTAGE REGULATION**  $< 0.001\%$  or 1 mV (whichever is greater).

**OUTPUT VOLTAGE TEMPERATURE SENSITIVITY**  $< 30$  ppm/ $^{\circ}$ C for 0 to 50 $^{\circ}$ C.

**OUTPUT VOLTAGE LONG-TERM INSTABILITY**  $< 0.001\%$ /24 hours.

**OUTPUT RIPPLE**  $< 2$  mV peak-to-peak, 5 Hz to 100 MHz.

**OUTPUT RISE TIME** Nominally 100 ms.

**DISPLAY RANGES** 0 to 100 V in 0.1-V steps on the 100-V range, 0 to 1000 V in 1-V steps on the 1000-V range, and 0 to 19.99  $\mu$ A in 0.01- $\mu$ A steps for current.

**DISPLAY NONLINEARITY**  $\leq \pm 0.05\%$  of full scale for voltage from 0 to 100 V or from 0 to 1 kV, and current from 0 to 10  $\mu$ A.

**DISPLAY UNCERTAINTY**  $\pm 1/2$  least significant digit.

**DISPLAY TEMPERATURE SENSITIVITY**  $\leq 50$  ppm/ $^{\circ}$ C for 0 to 50 $^{\circ}$ C.

### CONTROLS AND INDICATORS

**MASTER ON/OFF (common to all channels)** Front-panel, two-position, toggle switch enables or disables all four supplies.

**OVERLOAD RESET (common to all channels)** Front-panel, momentary, push-button switch that clears the overload shutdown on any channel after a current overload. (See OVL LED.)

**VOLTS/CURRENT (common to all channels)** Front-panel, eight-position, rotary switch selects the parameter to be read from the display. Either the output voltage or the output current of each of the four supplies can be selected.

**DISPLAY (common to all channels)** Front-panel, 3-1/2-digit, LED display monitors either the voltage or current of the supply selected by the VOLTS/CURRENT rotary switch.

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## Quad 1-kV Bias Supply

**POLARITY JUMPER (1 per channel)** Internal, printed circuit board jumper selects either positive or negative output polarity.

**POS/NEG LEDs (2 per channel)** Front-panel, green LEDs indicate the polarity of the HV OUTPUT. POS is on for positive, or NEG is on for negative output polarity.

**RANGE (1 per channel)** Front-panel, three-position, locking toggle switch selects a full-range output voltage of 0 to 100 V or 0 to 1 kV, or disables the output.

**ON LED (1 per channel)** Front-panel, red LED is on if the supply is enabled and has not experienced a vacuum shutdown or current overload.

**VOLTAGE CONTROL (1 per channel)** Front-panel, 10-turn, precision potentiometer with locking, graduated dial provides a continuously variable output voltage from 0 to 100 V or from 0 to 1 kV, depending upon the VOLTAGE RANGE setting. (Also see VOLTAGE CONTROL JUMPER.)

**VOLTAGE CONTROL JUMPER (1 per channel)** Internal, printed circuit board jumper selects either the REMOTE INPUT or the front-panel VOLTAGE CONTROL potentiometer as the source that sets the output voltage. Normally set to the VOLTAGE CONTROL potentiometer position.

**OVL LED (1 per channel)** Front-panel, yellow LED is on if the supply has been shut down because the current demanded from the HV OUTPUT exceeded 20  $\mu$ A. (See OVERLOAD RESET.)

**VACUUM SHUTDOWN LED (common to all channels)** Front-panel, yellow LED is on if a vacuum shutdown has been triggered. (See VACUUM SHUTDOWN input.)

### INPUTS

**VACUUM SHUTDOWN (common to all channels)** Rear-panel, BNC connector disables all supplies and turns on the VACUUM SHUTDOWN LED if a low TTL signal or a resistance to ground less than 75  $\Omega$  is applied. The supplies are enabled and the VACUUM SHUTDOWN LED turns off when a high TTL signal or a resistance to ground greater than 5 k $\Omega$  is connected to this input. Used with the trip level on a vacuum gauge to turn off the detector bias voltage when vacuum is lost in the chamber containing the detectors.

**REMOTE INPUT (1 per channel)** Rear-panel, BNC connector accepts a 0 to +10-V input that controls the output voltage from 0 to full scale. Active only when the REMOTE INPUT is selected by the VOLTAGE CONTROL JUMPER.

### OUTPUTS

**HV OUTPUT (1 per channel)** Rear-panel, SHV connector supplies the 0 to  $\pm$ 100 V or 0 to  $\pm$ 1 kV bias voltage output.

**OVL/SHDN ALARM (common to all channels)** Rear-panel, BNC connector provides an open-collector, active-low, TTL-compatible signal if a vacuum shutdown or an overcurrent shutdown on any of the four channels has occurred. An external pull-up resistor to +5 V is required. OVL/SHDN ALARM outputs from other Model 710 modules can be connected in parallel to produce a common alarm to signal a detector failure or a vacuum failure in the experiment.

### ELECTRICAL AND MECHANICAL

**POWER REQUIRED** The Model 710 derives its power from a NIM bin supplying  $\pm$ 24 V and  $\pm$ 12 V, such as the ORTEC Model 4001A/ 4002A NIM Bin/Power Supply. The power required is +24 V at 90 mA, +12 V at 390 mA, -12 V at 360 mA, and -24 V at 90 mA.

### WEIGHT

**Net** 1.4 kg (3.2 lb).

**Shipping** 2.9 kg (6.4 lb)

**DIMENSIONS** Standard double-width NIM module, 6.90 X 22.13 cm (2.70 X 8.714 in.) front panel per DOE/ER-0457T.

### Ordering Information

Model	Description
710	Quad 1-kV Bias Supply

### OPTIONAL CABLE ACCESSORIES

Model	Description
C-24-12	RG-62A/U 93- $\Omega$ Cable with two BNC male plugs; 12-ft length
C-36-12	RG-59A/U 75- $\Omega$ Cable with two SHV female plugs; 12-ft length

