

- Bias voltage for germanium and silicon detectors
- 0–5 kV or 0–500 V at 0–100  $\mu$ A
- Remote shutdown feature compatible with ORTEC and TTL outputs from warmup sensors on germanium detectors
- Reset safety feature on remote shutdown minimizes risk of preamplifier FET damage
- Selected output polarity indicated before bias voltage is turned on
- Automatic overload protection and overload indicator

The ORTEC Model 659 5-kV Detector Bias Supply furnishes bias voltage for germanium detectors, silicon detectors, or ionization chambers. It can be used with any detector that draws less than 100  $\mu$ A of current, and whose gain is insensitive to the applied voltage. The output voltage is continuously adjustable from zero to full scale with a calibrated and locking 5-turn dial. Separate outputs are provided for the 0–5 kV and the 0–500 V ranges. A 10-segment bar-graph indicator verifies that the selected voltage is being supplied at the output.

Security against accidentally changing the output polarity to the wrong state is ensured by two features. The selected output polarity is indicated by front-panel LEDs whenever the NIM bin power is turned on. Thus, the correct polarity can be verified before the HV ON/OFF switch is used to turn on the bias voltage to the detector. In addition, the side panel must be removed in order to alter the output polarity. This discourages unintentional changes.

The Model 659 includes a remote shutdown feature to protect the preamplifier FET against damage when a cooled germanium or Si(Li) detector warms up. A BIAS SHUTDOWN input that is compatible with the standard warmup sensor output on ORTEC preamplifiers is provided. When the preamplifier signals a warmup condition, the Model 659 shuts off the bias voltage and turns on a SHUT-DOWN indicator light. The bias voltage remains off, independent of the signal from the preamplifier warmup sensor, until the shutdown mode is manually cancelled by pressing the RESET pushbutton. This protects the preamplifier FET if the detector is cooling down with the HV ON/OFF switch accidentally left on. For further protection against operator error in the ORTEC shutdown mode, the bias shutdown input interprets a disconnected cable or a shorted cable as a warm detector, and responds by turning off the bias voltage. Some detector manufacturers provide a TTL logic level output from their detector warmup sensor. A board-mounted jumper in the Model 659 can be moved to the TTL position to make the bias shutdown input compatible with detectors supplying a TTL output. It is also possible to disable the bias shutdown feature by moving the board jumper to the BYPASS position. The Model 659 is shipped from the factory in the ORTEC mode.

Both high voltage outputs are protected against overload. When the bias supply senses an excessive output current demand, it turns on the overload light and reduces the output voltage until the output current is within tolerable limits. Recovery from overload is automatic when the excessive current demand is eliminated.

## Specifications

### PERFORMANCE

**BIAS VOLTAGE RANGES** 0–5 kV, or 0–500 V, on separate outputs, with each output controlled by a common, 5-turn, direct-reading, precision potentiometer located on the front panel.

**BIAS VOLTAGE POLARITY** Positive or negative. Internally selectable. Polarity indicated by front-panel LEDs whenever bin power is on.

**RATED OUTPUT CURRENT** 0–100  $\mu$ A.

**OUTPUT LINEARITY** Within  $\pm 3\%$  of dial setting from 10% to 100% of full range.

**TEMPERATURE SENSITIVITY OF OUTPUT VOLTAGE**  $\leq \pm 0.08\%/^{\circ}\text{C}$  through 10° to 50°C operating range.

**VOLTAGE STABILITY**  $\leq \pm 0.1\%/h$  variation in output voltage with constant temperature, constant load, and constant input voltages from the bin supply.

**NOISE AND RIPPLE**  $< 10$  mV peak-to-peak from 5 Hz to 50 MHz.

**OUTPUT VOLTAGE RISE TIME** Nominally 500 ms.

### INDICATORS

**0 kV–5 kV** Front-panel, 10-segment, bar-graph display indicates actual output voltage at the 0–5 kV output. Each segment corresponds to a 0.5-kV increment in output voltage, starting with 0.5 kV to turn on the first segment, and ending with 5 kV to turn on the tenth segment.

**POS** Front-panel LED is lit when the bin power is on, if the positive output polarity has been selected.

**NEG** Front-panel LED is lit when the bin power is on, if the negative output polarity has been selected.

**ON** Front-panel LED indicates when the output bias voltage is turned on. This LED turns off when the HV ON/OFF switch is turned off, the bin power is off, or the shutdown mode has been activated.

**OVERLOAD** Front-panel LED turns on when the bias supply senses an excessive output current demanded by the external load. Under overload, the output voltage is reduced automatically until the output current is within a tolerable limit. Recovery from overload is automatic when the overload is eliminated.

**SHUTDOWN** Front-panel LED turns on when the shutdown mode has been activated to turn off the output voltage. The shutdown mode is activated by the appropriate signal level on the rear-panel, BIAS SHUTDOWN input, or whenever the bin power is turned off and on.

### CONTROLS

**0–5 kV** Front-panel, 5-turn, direct-reading, locking potentiometer with 500 dial divisions adjusts the output voltages simultaneously for the 0–500 V and the 0–5 kV outputs.

**HV ON/OFF** Front-panel toggle switch turns the 0–500 V and the 0–5 kV outputs on or off. For added safety, the RESET push button must be pressed after turning the HV ON/OFF switch to the ON position, in order to turn on the output voltage. The output voltage



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will not turn on if a shutdown condition is present at the BIAS SHUTDOWN input.

**RESET** Pressing this front-panel push-button switch enables the high voltage to turn on after the bin power has been turned on, the HV ON/OFF switch has been turned on, or the supply has been disabled by the BIAS SHUTDOWN input. If a shutdown condition is still present at the BIAS SHUTDOWN input, the RESET button will be ineffective.

**ORTEC/TTL/BYPASS** Internal printed wiring board jumper selects the operating mode of the BIAS SHUTDOWN input for compatibility with the warmup sensor in the associated Ge detector. The ORTEC position is used for ORTEC detectors. The TTL position is for detectors employing TTL levels. The BYPASS position disables the BIAS SHUTDOWN input, but does not alter the function of the RESET button. The Model 659 is shipped with this jumper in the ORTEC mode.

**OUTPUT VOLTAGE POLARITY** The output polarity is changed between positive and negative by changing the position of a daughter board in the module.

## INPUTS

**BIAS SHUTDOWN INPUT** Rear-panel BNC connector accepts signals from warmup sensors in cooled germanium detectors. When a warmup is signaled, this input turns off the detector bias voltage in order to protect the preamplifier FET input. The ORTEC/TTL/BYPASS jumper selects the operating mode of the BIAS SHUTDOWN input for compatibility with the warmup sensor in the associated Ge detector.

**ORTEC Mode** The input is compatible with the warmup sensor output on ORTEC germanium detectors. For added safety, an open or shorted coaxial cable on the BIAS SHUTDOWN input will also cause the supply to shut down.

**TTL Mode** A source supplying  $>+2$  V or an open circuit will allow the Model 659 to produce the full output voltage. A source supplying  $<+0.8$  V and capable of sinking 700  $\mu$ A will shut down the high voltage output.

**BYPASS Mode** The BIAS SHUTDOWN input is rendered inactive, and cannot trigger a bias shutdown.

## OUTPUTS

**0–5 kV** Rear-panel SHV connector furnishes the adjusted output voltage in the 0 to 5 kV range through an output impedance of approximately 2 M $\Omega$ . A voltage foldback circuit protects the output against demands for excessive output current. Recovery from overload is automatic when the overload is eliminated.

**0–500 V** Rear-panel SHV connector furnishes the adjusted output voltage in the 0 to 500 V range through an output impedance of approximately 700 k $\Omega$ . A voltage foldback circuit protects the output against demands for excessive output current. Recovery from overload is automatic when the overload is eliminated.

## ELECTRICAL AND MECHANICAL

**POWER REQUIREMENTS** The Model 659 derives its power from a NIM bin power supply. Required DC voltages and currents are +24 V, 80 mA; +12 V, 80 mA; –24 V, 35 mA; and –12 V, 65 mA.

### WEIGHT

**Net** 0.68 kg (1.5 lb).

**Shipping** 1.1 kg (2.5 lb).

**DIMENSIONS** Standard single-width NIM module, 3.43 X 22.13 cm (1.35 x 8.714 in.) front panel per DOE/ER-0457T.

## Ordering Information

Model	Description
659	5-kV Detector 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