

# Model 610E

## High-Voltage Supply/Amplifier/Controller



The Trek Model 610E is a high-voltage supply/amplifier/controller that is used in many applications including closed-loop charge control, electrophotographic research, insulation testing, dielectric material evaluation, and as an amplifier for AC or DC calibrators and supplies. The Model 610E has an output voltage range of 0 V to  $\pm 10$  kV with an output current range of 0 to  $\pm 2000$   $\mu$ A, and can be operated in any of the six modes.

As a high-voltage amplifier, the Model 610E amplifies an externally applied signal with a switch selectable between 100 V/V or 1000 V/V. As a high-voltage reference supply, a front panel dial commands the output voltage.

As a transconductance amplifier, an externally applied voltage signal produces a proportional output current. The transconductance gain is switch selectable between 20  $\mu$ A/V or 200  $\mu$ A/V. As a current supply, a front panel dial commands the output current.

As a high-voltage controller, the high-voltage amplifier mode is maintained, but the amplifier input and feedback elements are uncommitted and available for configuration by the user. As a transconductance controller, the transconductance amplifier mode is maintained, but the amplifier input and feedback elements are uncommitted and available for configuration by the user.

The Model 610E features a compliance limit function. When in a CURRENT command mode, the compliance function is voltage. When in a VOLTAGE command mode, the compliance function is current. The current compliance limit function can be based upon either the total current or a specific load current path.

The Model 610E features a four-quadrant, active output stage that sinks or sources current into reactive or resistive loads throughout the output voltage range. This is essential for achieving the accurate output response and high slew rates demanded by reactive loads. The Model 610E is protected against overvoltage and overcurrent conditions that may be generated by active loads or by output short circuits to ground.

Precision voltage and current monitors provide low-voltage representations of the high-voltage output and load current for monitoring purposes, or for use as feedback signals in a closed-loop system. The current control loop provide a means for close regulation of either the total load current,  $I(t)$ , or a specific current path,  $I(r)$ . When the load includes several current paths, one may be chosen,  $I(r)$ , to be closely regulated.

- Six modes of high-voltage operation include VOLTAGE supply/amplifier/controller and CURRENT supply/amplifier/controller

- Selectable full scale high-voltage ranges of 0 to  $\pm 1$  kV or 0 to  $\pm 10$  kV

- Selectable full scale current ranges of 0 to  $\pm 200$   $\mu$ A or 0 to  $\pm 2000$   $\mu$ A

- Voltage and current compliance functions and controls

- Precise voltage & current monitors provide low-voltage representations of the output voltage and load current

- Remote high-voltage ON/OFF capability

- Rack mountable

- CE Compliant



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# Model 610E Primary Specifications

All specifications are with no load unless otherwise noted.

## Features

### Amplifier Input Configuration Programming

The 610E can be configured as a noninverting amplifier, an inverting amplifier, or a differential amplifier.

### External Control Connector

High-Voltage can be turned ON or OFF remotely.

### Digital Enable

An input providing a connection for a TTL compatible signal to drive the high-voltage output toward zero or allow normal high-voltage operation.

### Compliance Features

#### Compliance Level Selection

A precision potentiometer with a calibrated dial is used to set the current limit when operating in the voltage mode, or set a voltage limit when operating in the current mode.

#### Compliance Indicator

A LED will illuminate when the instrument is in a compliance limit condition.

#### Compliance Limit

Current mode is adjustable to within 20 V of the output voltage.  
Voltage mode is adjustable to within 0.5  $\mu$ A of the output current.

### High-Voltage Control Switch

A three-position switch to select ON, OFF or REMOTE.

### Mode Control Switch

A three position switch to select either the Supply, Amplifier, or Controller mode of operation.

### Supply Mode Voltage Control

#### Range Selection

A two-position switch to select 0 to  $\pm 1$  kV or 0 to  $\pm 10$  kV.

#### Output Level Selection

A precision potentiometer with a graduated dial.

#### Polarity Selection

A three-position switch to select positive (+), negative (-), or OFF.

### Front Panel Display

A 3½ digit LED display can be selected to indicate the voltage output or the current output.

#### Voltage Range

0 to  $\pm 1$  kV or 0 to  $\pm 10$  kV (switch selectable).

#### Current Range

0 to  $\pm 199.9$   $\mu$ A or 0 to  $\pm 1999$   $\mu$ A (switch selectable).

#### Voltage Resolution

1 kV Range is 1.0 volt.  
10 kV Range is 10 volts.

#### Current Resolution

200  $\mu$ A Range is 0.1  $\mu$ A.  
2000  $\mu$ A Range is 1  $\mu$ A.

#### Zero Offset

$\pm 1$  count, referred to the Voltage and Current monitors.

## Features (cont.)

### Voltage Monitor

#### Scale Factor

1/1000th of the output voltage.

#### DC Scale Accuracy

Better than 0.1% of full scale as referred to the high-voltage output.  
Offset Voltage is less than 5 mV.  
Noise is less than 20 mV p-p.  
Output Impedance is 47  $\Omega$ , nominal.

### Current Monitor

#### Scale Factor

1 V/200  $\mu$ A.  
Noise is less than 30 mV p-p.  
DC Scale Accuracy is better than 0.1% of full scale as referred to the high-voltage output.  
Offset Voltage is less than 10 mV.  
Output Impedance is 1 k $\Omega$ , nominal.

## As a High-Voltage Supply

### Output Voltage Range

0 to +1 kV, 0 to -1 kV, 0 to +10 kV, or 0 to -10 kV, switch selectable and adjustable using a precision dial potentiometer.

Resolution of the 1 kV range is 1 volt.

Resolution of the 10 kV range is 10 volts.

### Accuracy

Better than 0.1% of full scale, typical.

### Compliance Current Range (adjustable)

0 to  $\pm 2$  mA DC, using a precision dial potentiometer.

### Output Noise

Less than 700 mV rms (measured with a 20 kHz true rms meter).

Regulation of line is better than 0.01%.

Regulation of Load is better than 0.01% for a load change from 1  $\mu$ A to 1000  $\mu$ A.

## As a Current Supply

### Output Current Range

0 to  $\pm 200$   $\mu$ A, or 0 to  $\pm 2000$   $\mu$ A, switch selectable and adjustable using a precision dial potentiometer.

Resolution of the 200  $\mu$ A range is 0.2  $\mu$ A.

Regulation of the 2000  $\mu$ A range is 2  $\mu$ A.

### Compliance Voltage Range (adjustable)

0 to  $\pm 10$  kV DC using a precision potentiometer with a dial.

## As a High-Voltage Amplifier and Controller

### Output Voltage Range

0 to  $\pm 1$  kV or 0 to  $\pm 10$  kV DC or peak AC, switch selectable.

### Input Voltage Range

0 to  $\pm 10$  V DC or peak AC.

## As a High-Voltage Amplifier and Controller (cont.)

Voltage Gain of the 1 kV Range is 100 V/V.

Voltage Gain of the 10 kV Range is 1000 V/V.

### DC Voltage Gain Accuracy

Better than 0.3% of full scale (Controller mode Gain Accuracy is dependent on user-specified components).

### Compliance Current Range

0 to  $\pm 2$  mA DC or peak AC (adjustable using a precision dial potentiometer).

### Offset Voltage

Less than 2 volts.

### Output Noise

Less than 700 mV rms (measured with a 20 kHz true rms meter).

### Slew Rate (10% to 90%, typical)

Greater than 20 V/ $\mu$ s.

### Large Signal Bandwidth (-3dB)

DC to greater than 1.2 kHz.

### Large Signal Bandwidth (1% Distortion)

DC to greater than 600 Hz.

### Small Signal Bandwidth (-3dB)

DC to 10 kHz.

### Settling Time to 1%

Less than 1 ms for a 0 to 10 kV step.

## As a Transconductance Amplifier and Controller

### Output Current Range

0 to  $\pm 200$   $\mu$ A or 0 to  $\pm 2000$   $\mu$ A DC or peak AC, switch selectable.

### Input Voltage Range

0 to  $\pm 10$  V DC or peak AC.

### Transconductance Gain

200  $\mu$ A range is 20  $\mu$ A/V.  
2000  $\mu$ A range is 200  $\mu$ A/V.

### DC Current Gain Accuracy

Better than 0.3% of full scale, typical, and 1% of full scale, max (Controller mode Gain Accuracy is dependent on user-specified components).

### Compliance Voltage Range

0 to  $\pm 10$  kV DC or peak AC (adjustable using a precision dial potentiometer).

## General

Input voltage selectable: 100 V, 120 V, or 230 V AC, at 48 to 63 Hz (specify when ordering).

### Dimensions

140 mm H x 432 mm W x 374 mm D (5.5" H x 17" W x 15" D).

### Weight

10.6 kg (23.5 lb).

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All specifications are subject to change.  
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