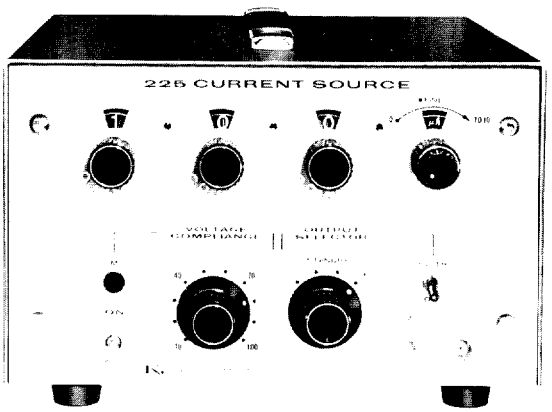
MODELS 225,227
CURRENT SOURCES



- *1 nanoampere to 100 milliamperes*
- *0.005% line and load regulation*
- *0.02% stability*
- *ac modulation capability*
- *10 to 100 volts compliance voltage*
- *500 volts off-ground floating capability*
- *true bi-polar output*

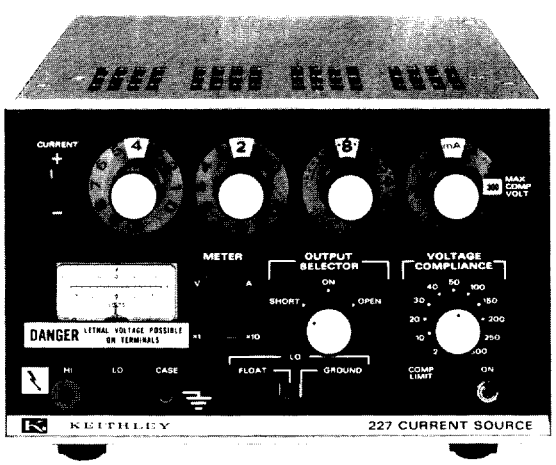
MODEL 225

The Keithley Model 225 is a true current source with full scale ranges of 10^{-7} to 10^{-1} ampere with 0.02% resolution and stability to within 0.02%. For ranges of 10^{-1} through 10^{-6} ampere, the output is regulated to within ±0.005% of full-range from no load to full load and to within ±0.05% on the 10^{-7} ampere range. This regulation can be maintained over the ±10-to ±100-volt compliance limits. Noise less than 0.01% of full range reduces the possibility of extraneous signal generation.

The precise regulation of the Model 225 can eliminate the uncertainties involved in using voltage sources for testing and sorting resistors, relays, meters, and similar devices. Accidents are eliminated because it supplies only the voltage needed to pass the desired current through the device under test, and never goes above the maximum set on the compliance voltage control.

Accurate to within 0.5%, the Model 225 current source offers design and convenience features such as 4-digit in-line readout and variable unipolar voltage limiting, selectable over a range from 10 to 100 volts. The setting of the compliance control and output polarity determines the maximum compliance voltage at that polarity permitted at the output. As the compliance voltage is exceeded, automatic crossover from the current mode to a voltage mode protects voltage sensitive loads. A light on the front panel indicates operation in the voltage-limiting mode.

Output current is adjusted using three calibrated in-line switches. A fourth in-line dial provides continuous adjustment with 0.02% resolution on each current range except 10^{-7}. When necessary, the 225 can be floated up to 500 volts off-ground.



- *excellent regulation, stability, and low noise assure high resolution.*
- *true bipolar current output can be modulated, programmed, monitored, and even floated up to 500 volts off ground.*
- *adaptable to systems use with Model 2271 Programming Option.*

MODEL 227

The programmable Model 227 Current Source is designed for high-performance applications requiring an accurate, stable, high-power constant current over full-scale ranges of 1 milliampere to 1000 milliamperes with adjustable compliance voltage. The 3-digit in-line readout of the Model 227 enables the current output to be set to within 0.005% of range, with a full-range accuracy of 0.62%.

The 227 has a continuously adjustable compliance voltage limit, which can be easily set from approximately 3 volts to 300 volts on the 100 milliampere range and lower. The 100 milliampere range compliance is similarly adjustable from approximately 3 volts to 50 volts. This compliance voltage limit can be preset using the convenient front panel meter as a guide. This meter is also used as an indicator of current and voltage output levels under load.

Other features include excellent output current regulation, low output noise, low output capacitance (with correspondingly high output impedance at high frequencies), fast programming ability, and a buffered voltage-monitor output on the rear panel. The 227 has significantly better load and line regulation and 3 to 15 times lower noise, when compared to many supplies presently in use as current sources.

The Model 227 has a true bipolar current output that can be modulated. This capability means that the 227 can be operated as a true ac constant current source. The output can be floated up to ±500 volts off chassis ground with less than 5 ppm of full-range change in output current per volt off ground.

OUTPUT:
DC Current: 10^{-7} ampere full range to 10^{-1} ampere in seven decade ranges, 3-digit in-line readout.
Voltage: 100 volts maximum. Compliance limit continuously variable from 10 to 100 volts.
Polarity: Positive or negative.
Floating: ±500 volts maximum off chassis ground, less than 5 ppm of full range change in output current per volt.
RESOLUTION: Three significant figures from 10^{-7} to 10^{-1} ampere. "Trim" potentiometer permits 0.02% of full range or better resolution.
ACCURACY: ±0.5% of reading, ±0.05% of full range.
STABILITY: ±0.02% of reading, ±0.005% of full range on the 10^{-1} to 10^{-6} ampere range, (±0.1% of reading, ±0.02% of range on the 10^{-7} ampere range) the first hour or in subsequent 8-hour periods after a 1-hour warm-up and at reasonably constant ambient temperature.
NOISE: Less than 0.01% rms of full range above 5 Hz.
LOAD REGULATION: ±0.005% of full range from no load to full load on the 10^{-1} to 10^{-6} ampere range, ±0.05% on the 10^{-7} ampere range (with FILTER "OFF").
LINE REGULATION: ±0.005% of full range for 10% change in line voltage.
OVERLOAD PROTECTION: Voltage limited to compliance voltage setting of polarity selected. Automatic recovery from overload.
MODULATION: Transformer input permits modulation of current from 50 Hz to 500 Hz. Input Z approximately 500 ohms.
FILTER: For operation with inductive loads up to 100 millihenries having greater than 10^{-6} L/R ratio. Limits shunt output impedance to 1 microfarad shunted by greater than 10^{10} ohms.
ENVIRONMENT: 50% relative humidity limit at 25°C.
CONNECTORS: Output (front and rear panels), BNC.
POWER: 105-125, 210-250 volts (switch selected), 50-60 Hz; 25 watts.
DIMENSIONS, WEIGHT: 133 mm (5¼ in.) half-rack, overall bench size 155 mm high x 225 mm wide x 310 mm deep (6¼ in. x 9 in. x 12¼ in.). Net weight, 4,2 kg (10 lbs.).
ACCESSORIES AVAILABLE:
Model 1004 Single Rack Mounting Kit (See page 63) ..... $ 35
PRICE: (For export pricing see inside front cover.)
Model 225 Current Source (bench) $875

AS A DC CONSTANT CURRENT SOURCE

OUTPUT:
Current: ±1 microampere (1000 μA full range) to ±1000 milliamperes in four decade ranges; 3-digit in-line readout; 11% overrange to 1110.
Voltage Compliance: ±300 volts on 100 milliampere range and lower; ±50 volts on 1000 milliampere range. Compliance limit continuously adjustable from approximately 3 volts to full voltage compliance.
Floating: ±500 volts maximum off chassis ground.
RESOLUTION: 0.005% of range, 3-digit readout.
ACCURACY ±(0.5% of setting + 0.12% of range).

AS A BIPOLAR PROGRAMMABLE CONSTANT-CURRENT SOURCE/AMPLIFIER

VOLTAGE PROGRAMMING (INPUT): DC-coupled 0 to ±11 volts. Input resistance 10 kilohms. Input must be isolated from output load by greater than 10^6 ohms.
TRANSFER FUNCTION: ±10 volts dc for ± full-range current output. Accuracy ±0.5% Zero offset less than 0.1% of range.
BANDWIDTH (—3dB): 600 Hz minimum.
OPTIONAL PROGRAMMING: Model 2271 option permits remote programming of Range, Magnitude, Polarity and Compliance Limit (see Model 2271).

GENERAL

STABILITY: ±(0.005% of setting + 0.005% of range)/°C. Short-term stability up to 30 days is masked by this temperature coefficient.
LOAD REGULATION: ±0.005% of range from no load to full load.
LINE REGULATION: ±0.005% of range from 10% change in line voltage.
NOISE: Wideband noise less than (0.03% of range + 2 mV) rms above 5 Hz.
ENVIRONMENT:
Operating: 0°C to 50°C. 0% to 80% relative humidity up to 35°C. Requires approximately 50 mm (2 in.) top and 150 mm (6 in.) rear panel clearances for air movement.
Storage: -25°C to 70°C.
CONNECTORS: Output (front and rear), Voltage Programming Input (rear); Banana Jacks.
POWER: 90-110, 105-125, 195-235, 210-250 volts (switch selected), 50-60 Hz; 145 watts.
DIMENSIONS, WEIGHT: Style N, 133 mm (5¼ in.) half-rack, overall bench size 145 mm high x 220 mm wide x 385 mm deep (5¾ in. x 8¾ in. x 15¼ in.). Net weight, 10,9 kg (24 lbs.).
ACCESSORIES AVAILABLE: (See ACCESSORIES, pages 60 through 63.)
Model 1008 Single Rack Mounting Kit ..... $ 29
Model 1009 Dual Rack Mounting Kit ..... $ 29
Model 2272 Rack Panel: 44 mm x 483 mm (1¾ in. x 19 in.) filler panel with air grill for rack mounting above Model 227 ..... $ 7
PRICE: (For export pricing see inside front cover.)
Model 227 Current Source (bench) $1095

MODEL 2271 PROGRAMMING OPTION

RANGE SELECT: Closure* on one of four lines selects range.
CURRENT SET:
Voltage Programming: Standard feature of Model 227. See Specifications of 227.
Resistance Programming: Transfer function: 10% of full range per kilohm (± 0.5%). Zero at approximately 11 kilohms. Stability: adds ±(0.01% of setting + 0.01% of range)/°C to Model 227 specification. Resistance must be isolated and shielded.
COMPLIANCE LIMIT:
External Operate: Closure* enables external control of both span and limit. Open enables 227 front-panel control.
Span Select: Closure* enables compliance limit to be set from 10 to 300 volts, open makes span 4 to 50 volts.
Compliance Limit Set: Resistance programmed, non-linear transfer function. 0 Ω yields high end of span, 25 kΩ yields approximately mid span, open circuit yields low end. Resistance must be isolated and shielded.
Flag (Output): Logic "0" (≡<0.4 V drop while sinking 16 mA to external power supply Lo) appears when 227 is in compliance limit. Logic "1" (≡>2.4 V at up to 400 μA referenced to supply Lo) appears when 227 is not in compliance limit.
REQUIRED CONTROL LEVELS:
*CLOSURE ≡ Closure to external power supply Lo within 0.5 volt while sinking 50 mA (range-select for 1-ampere range requires sinking 100mA)
OPEN ≡>2 kilohms referenced to external power supply Lo.
EXTERNAL POWER SUPPLY: Control requires external power supply of 5 to 6 volts at 200 milliamps.
CONNECTOR: DAM-15S type mounts on 227 rear panel.
ACCESSORIES SUPPLIED: Mating connector.
PRICE: (For export pricing see inside front cover.)
Model 227/2271 Current Source with Programming Option Installed (bench) $1395