

KEITHLEY

228A

The Keithley 228A is a programmable bipolar voltage and current source and sink, designed to deliver up to 100W of power. Operating in all four quadrants, the 228A can function as a high-precision constant voltage or constant current source, as well as an active electronic load. It features standard GPIB connectivity, dual 4.5-digit LED displays for simultaneous output readback, remote 4-wire sensing, and an internal 100-step program memory for sequencing.

SPECIFICATIONS

General

Interfaces	GPIB (IEEE-488)
Display	Dual 4.5-digit red LED displays for voltage and current
Maximum Common Mode Voltage	100 V peak (chassis to output common)
Warm-up Time	1 hour to rated accuracy

Physical

Power Supply	100V / 120V / 220V / 240V AC (switch-selectable), 50/60 Hz, 350 VA max
Operating Temperature	0°C to 50°C °C
Dimensions (W×H×D)	133 mm × 435 mm × 448 mm mm
Weight	9.8 kg

Voltage Source Specifications

Voltage Output Ranges	±1.0100 V, ±10.100 V, ±101.00 V
Voltage Programming Resolution	100 µV (1 V range), 1 mV (10 V range), 10 mV (100 V range)

Current Source Specifications

Current Output Ranges	±101.00 mA, ±1.0100 A, ±10.100 A
Current Programming Resolution	10 µA (100 mA range), 100 µA (1 A range), 1 mA (10 A range)

System & Channel Configuration

Operating Modes	Constant Voltage (CV) or Constant Current (CC)
Four-Quadrant Operation	Full 4-quadrant sourcing and sinking up to 100 W
Number of Channels	1
Sensing Modes	2-wire local or 4-wire remote sensing
Output Terminals	Rear panel quick-disconnect terminal block

Measurement Specifications

Readback Monitor	Simultaneous measurement and display of actual output voltage and current
Readback Display Resolution	4.5 digits

Triggering and Memory Buffer

Memory Capacity	100-step internal program memory
External Modulation Input	Rear panel input for external analog programming/modulation

Control and Connectivity

GPIB Interface	Standard IEEE-488 compliance
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Power Specifications

AC Input Voltage Options	100V, 120V, 220V, or 240V AC (rear-panel switch selectable)
AC Input Line Frequency	50 Hz or 60 Hz
Maximum Power Consumption	350 VA

Physical and Environmental

Form Factor	Full-rack width, 3U height
Storage Temperature Range	-25°C to 65°C
Operating Humidity Range	0% to 80% RH up to 35°C (non-condensing)

Performance

Maximum Output Power	100 W (source or sink)
Voltage Programming Accuracy	$\pm(0.05\% + 10 \text{ mV})$ on 10V range, $\pm(0.05\% + 100 \text{ mV})$ on 100V range
Current Programming Accuracy	$\pm(0.1\% + 1 \text{ mA})$ on 1A range, $\pm(0.1\% + 10 \text{ mA})$ on 10A range
Voltage Load Regulation	$\pm(0.01\% + 1 \text{ mV})$ for 0 to full load change
Current Load Regulation	$\pm(0.01\% + 100 \text{ }\mu\text{A})$ on 1A range, $\pm(0.01\% + 1 \text{ mA})$ on 10A range for 0 to max voltage change
Voltage Line Regulation	$\pm(0.01\% + 1 \text{ mV})$ for 10% line voltage change
Current Line Regulation	$\pm(0.01\% + 100 \text{ }\mu\text{A})$ on 1A range, $\pm(0.01\% + 1 \text{ mA})$ on 10A range for 10% line voltage change
Voltage Ripple and Noise	<10 mV RMS, <50 mV peak-to-peak (0.1 Hz to 20 MHz)
Current Ripple and Noise	<500 μA RMS on 1A range, <5 mA RMS on 10A range
Voltage Slew Rate (100V Range)	0.01 V/ms to 100 V/ms (in 1-2-5 sequence)
Voltage Slew Rate (10V Range)	0.001 V/ms to 10 V/ms (in 1-2-5 sequence)
Current Slew Rate (10A Range)	0.001 A/ms to 10 A/ms (in 1-2-5 sequence)
Current Slew Rate (1A Range)	0.0001 A/ms to 1 A/ms (in 1-2-5 sequence)
Temperature Coefficient	$\pm(0.1 \times \text{specified accuracy})$ per °C (0°C to 18°C & 28°C to 50°C)
Maximum Sink Power	100 W
Load Transient Recovery Time	< 1 ms to settle within 100 mV (or 10 mA) of programmed value for a step change of 50% to 100% of full scale load

Modulation Input

Modulation Input Impedance	10 kΩ
Modulation Sensitivity	10 V for 100% modulation of range
Modulation Bandwidth	DC to 1.2 kHz (3 dB bandwidth)

External Trigger

Trigger Input Level	TTL compatible, active on negative-going edge
Minimum Trigger Input Pulse Width	10 μs
Trigger Output Level	TTL compatible, negative-going pulse
Trigger Output Pulse Width	20 μs

Remote Sensing

Maximum Sense Lead Resistance	10 Ω per lead
Maximum Voltage Drop in Output Leads	0.5 V

Output Characteristics

Voltage Source Mode Output Resistance	< 20 mΩ
Common Mode Impedance	> 10 ⁹ Ω in parallel with < 0.05 μF

GPIB Interface

GPIB Interface Functions	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1
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TECHNOLOGY

Linear Power Supply / Source Measure Unit (SMU) precursor

APPLICATIONS

Precision semiconductor testing, battery charging/discharging simulation, and active load testing

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