

KEITHLEY

6221

The Keithley 6221 is a highly precise AC and DC current source designed for applications requiring extremely low current sourcing with low noise, such as nanotechnology, semiconductor characterization, and superconductivity research. It offers low-current sourcing ranges from picoamps to 100mA, high-speed pulsed output capability, and an integrated arbitrary waveform generator.

SPECIFICATIONS

General

Interfaces	GPIB, RS-232, Ethernet (LXI Class C), Trigger Link, Digital I/O, Dedicated RS-232 for Keithley 2182A connection
Display	12-character vacuum fluorescent display (VFD)
Cooling System	Forced air, internal fan

Physical

Power Supply	100 V to 240 V AC, 50 Hz to 60 Hz, 120 VA maximum
Operating Temperature	0°C to 50°C °C
Dimensions (W×H×D)	213 mm × 89 mm × 370 mm mm
Weight	4.75 kg kg

DC Current Source Specifications

Current Output Ranges	2 nA, 20 nA, 200 nA, 2 μA, 20 μA, 200 μA, 2 mA, 20 mA, 100 mA
Maximum Output Current	105 mA
Source Programming Resolution	100 fA (on 2 nA range) to 10 μA (on 100 mA range)
Compliance Voltage Range	0.1 V to 105 V, programmable in 10 mV steps
Output Resistance (2 nA range)	$> 10^{14} \Omega$
Output Resistance (20 nA range)	$> 10^{14} \Omega$
Output Resistance (200 nA range)	$> 10^{13} \Omega$
Output Resistance (2 μA range)	$> 10^{12} \Omega$
Output Resistance (20 μA range)	$> 10^{11} \Omega$
Output Resistance (200 μA range)	$> 10^{10} \Omega$
Output Resistance (2 mA range)	$> 10^9 \Omega$
Output Resistance (20 mA range)	$> 10^8 \Omega$
Output Resistance (100 mA range)	$> 10^7 \Omega$
Output Capacitance	$< 10 \text{ pF}$ (2 nA to 20 mA ranges), $< 20 \text{ pF}$ (100 mA range)
DC Noise (0.1 Hz to 10 Hz, p-p, 2 nA range)	80 fA
Settling Time to Rated Accuracy	$< 100 \mu\text{s}$ (to 0.1% of final value, resistive load, 2 μA to 100 mA ranges)

AC Current and Waveform Specifications

Frequency Range	1 mHz to 100 kHz
Frequency Accuracy	±100 ppm
Waveform Types	Sine, Square, Ramp, Arbitrary
Arbitrary Waveform Memory Depth	65,536 points
Waveform Sample Rate	10 MSps
Total Harmonic Distortion (THD)	< 0.1% (typical, 10 Hz to 20 kHz, resistive load)
Amplitude Flatness (10 Hz to 10 kHz)	±0.1% (typical)
Amplitude Flatness (10 kHz to 100 kHz)	±1.0% (typical)

Pulsed Current Specifications

Minimum Pulse Width	50 µs
Pulse Width Programming Resolution	1 µs
Pulse Jitter	< 2 µs

Guarding and Isolation

Maximum Guard Current	100 µA
Common Mode Isolation (Output Lo to Chassis)	> 10 ¹⁰ Ω, < 100 pF

Sweep and Buffer Capabilities

Maximum Sweep Points	65,536 (64k)
Buffer Memory Size	65,536 points

Connectivity and Control Interfaces

Output Connector Type	3-slot Triaxial (rear panel)
Emulation Modes	Keithley Model 220 Command Emulation

Power and Environmental Specifications

Storage Temperature Range	-25°C to 65°C
Warm-up Time	1 hour to rated accuracy

Physical and Regulatory Standards

Form Factor	Half-rack, 2U high
Safety Certifications	Conforms to European Union Directive 73/23/EEC, EN 61010-1
EMC Compliance	Conforms to European Union Directive 89/336/EEC, EN 61326-1

Accuracy (1 Year, 18°C–28°C)

Programming Accuracy (2 nA range)	$\pm(0.4\% \text{ of rdg} + 2 \text{ pA})$
Programming Accuracy (20 nA range)	$\pm(0.3\% \text{ of rdg} + 10 \text{ pA})$
Programming Accuracy (200 nA range)	$\pm(0.1\% \text{ of rdg} + 100 \text{ pA})$
Programming Accuracy (2 μA range)	$\pm(0.05\% \text{ of rdg} + 1 \text{ nA})$
Programming Accuracy (20 μA range)	$\pm(0.05\% \text{ of rdg} + 10 \text{ nA})$
Programming Accuracy (200 μA range)	$\pm(0.05\% \text{ of rdg} + 100 \text{ nA})$
Programming Accuracy (2 mA range)	$\pm(0.05\% \text{ of rdg} + 1 \text{ } \mu\text{A})$
Programming Accuracy (20 mA range)	$\pm(0.05\% \text{ of rdg} + 10 \text{ } \mu\text{A})$
Programming Accuracy (100 mA range)	$\pm(0.05\% \text{ of rdg} + 50 \text{ } \mu\text{A})$

Temperature Coefficient

Temperature Coefficient (0°C–18°C & 28°C–50°C)	$\pm(0.15 \times \text{accuracy specification}) \text{ per } ^\circ\text{C}$
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Compliance Voltage

Compliance Voltage Programming Resolution	10 mV
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Electrical & Power

Maximum Power Consumption	120 VA
Maximum Output Power	11 W
Maximum Common Mode Voltage	250 V peak

Interfaces & Connectivity

Digital I/O Port	4-bit, RJ-45, 5 V TTL
Trigger Link Connector	8-pin micro-DIN
Interlock Connector	3-pin micro-DIN
Phase Synchronization Connection	BNC (Input and Output, 0 to 5 V)

Power

AC Line Voltage	100 V to 240 V AC
AC Line Frequency	50 Hz to 60 Hz (automatic sensing)

Inputs & Outputs

Digital I/O Power Output Voltage	+5 V
Digital I/O Power Output Current Limit	250 mA

Performance

Delta Mode Compatibility	Keithley Model 2182 and 2182A Nanovoltmeters
Delta Mode Minimum Cycle Time	2.8 ms

Environmental

Maximum Operating Altitude	2000 m
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Compliance

Vibration Standard Compliance	MIL-PRF-28800F Class 3 Random
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TECHNOLOGY

Solid State Precision Current Sourcing

APPLICATIONS

Nanotechnology research, semiconductor characterization, superconductivity measurements, and low-resistance testing

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