

2440 5A SourceMeter® Instrument



- Designed for production testing of high power pump lasers and other high current electronic components
- 50W continuous capacity to 5A
- 0.012% basic accuracy with 5½-digit resolution
- Built-in comparator for fast pass/fail testing
- Digital I/O handler interface
- 1000 readings/second at 4½ digits
- Optional contact check function

The Model 2440 5A SourceMeter Instrument further broadens the capabilities offered by the popular SourceMeter line. The dynamic range and functionality of the Model 2440 makes it ideal for applications such as testing high power pump lasers for use in optical amplifiers, laser bar tests, and testing other higher power components. The Model 2440's 5A source and measure capability also extends the range of Keithley's L-I-V Test System. Manufacturers of pump laser modules, optical amplifiers, and computer, automotive, and consumer electronics products will find it invaluable for a wide range of design and production test applications.

The Model 2440 provides a complete, economical, high-throughput solution for high-power component production testing, all in one compact, half-rack box. It combines source, measure, and control capabilities in a form factor that's unique to the industry. The Model 2440 is also suitable for making a wide range of low power DC measurements, including resistance at a specified current or voltage, breakdown voltage, leakage current, and insulation resistance. The DC and pulse modes can be used interchangeably in a test suite for full evaluation of a component's key parameters.

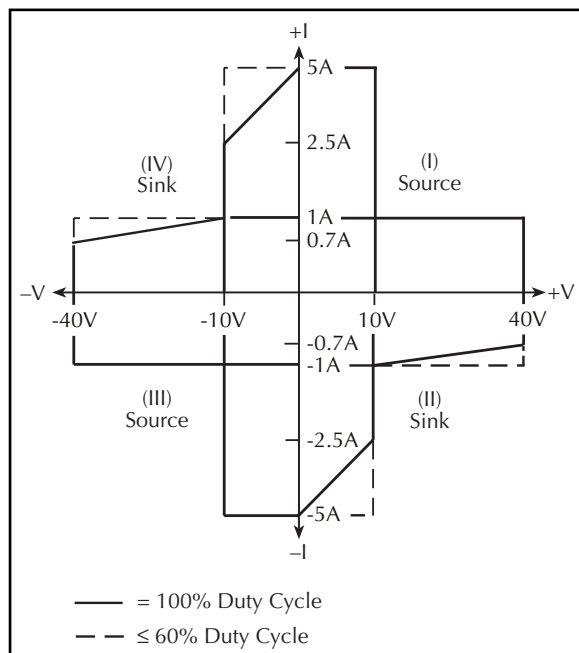
ORDERING INFORMATION

Model 2440 5A SourceMeter
Model 2440-C 5A SourceMeter with Contact Check

These products are available with an **Extended Warranty**.

Single Box Solution

By linking source and measurement circuitry in a single unit, the Model 2440 offers a variety of advantages over systems configured with separate source and measurement instruments. For example, its compact half-rack size conserves precious "real estate" in the test rack or bench. It also minimizes the test station development, set-up, and maintenance time required, while lowering the overall cost of system ownership. In addition, the Model 2440 simplifies the test process itself by eliminating many of the complex synchronization and connection issues associated with using multiple instruments.



Model 2440 Dynamic Range

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High Throughput to Meet Demanding Production Test Schedules

The Model 2440's highly integrated architecture offers significant throughput advantages. Many features of the Model 2440 enable it to "take control" of the test process, eliminating additional system bus traffic and maximizing total throughput. Built-in features that make this possible include:

- Source Memory List test sequencer with conditional branching
- Handler/prober interface
- Trigger-Link compatibility with switching hardware and other instruments from Keithley
- High-speed comparator, pass/fail limits, mathematical scaling
- Deep memory buffer

The Model 2440 also offers standard RS-232 and GPIB interfaces for integration with a PC. Adding one of Keithley's versatile switch systems enables fast, synchronized multipoint testing.

Optional Contact Check

The Contact Check option available on all SourceMeter instruments allows quick verification of a good connection to the DUT before functional testing proceeds. This feature helps prevent the loss of precious test time due to damaged, corroded, or otherwise faulty contacts in a test fixture. The innovative contact check design completes the verification and notification process in less than 350µs; comparable capabilities in other test equipment can require up to 5ms to perform the same function. Contact check failure is indicated on the instrument's front panel and over the GPIB bus. The Model 2440's digital I/O interface can also be used to communicate contact failure to the component handler in automated applications.

ACCESSORIES AVAILABLE

SWITCHING HARDWARE		RACK MOUNT KITS	
7001	Two-Slot Switch System	4288-1	Single Fixed Rack Mount Kit
7002	Ten-Slot Switch System	4288-2	Dual Fixed Rack Mount Kit
7053	High-Current Switch Card	OTHER	
TEST LEADS AND PROBES		1050	Padded Carrying Case
5806	Kelvin Clip Lead Set	2440-EW	1-Year Warranty Extension
CABLES/ADAPTERS		KPC-488.2AT	GPIB/IEEE-488 Interface Card for IBM PC/AT (full slot)
2499-DIGIO	Digital I/O Expansion Assembly	KPC-TM	Trigger Master Interface
7007-1	Shielded GPIB Cable, 1m (3.3 ft)	KPCI-488	IEEE-488 Interface/Controller for the PCI Bus
7007-2	Shielded GPIB Cable, 2m (6.6 ft)	TestPoint™	Test Development Software
7009-5	RS-232 Cable	¹ Cold-switching only.	
8501-1	Trigger Link Cable, 1m (3.3 ft)		
8501-2	Trigger Link Cable, 2m (6.6 ft)		
8502	Trigger Link Adapter Box		

SOURCE SPECIFICATIONS

VOLTAGE PROGRAMMING ACCURACY (Local or Remote Sense)

RANGE	PROGRAMMING RESOLUTION	ACCURACY (1 Year)	NOISE
		23°C ±5°C ±(% rdg. + volts)	(peak-peak) 0.1Hz – 10Hz
200.000 mV	5 µV	0.02% + 600 µV	10µV
2.00000 V	50 µV	0.02% + 600 µV	50µV
10.0000 V	250 µV	0.02% + 1.2 mV	250µV
40.0000 V	1 mV	0.02% + 4.8 mV	1mV

TEMPERATURE COEFFICIENT (0°–18°C & 28°–50°C): ±(0.15 × accuracy specification)/°C.

MAX. OUTPUT POWER: 55W, four quadrant source or sink operation.

SOURCE/SINK LIMITS: ±10.5V @ ±5.25A, ±42V @ ±1.05A.

VOLTAGE REGULATION: Line: 0.01% of range. **Load:** 0.01% of range + 100µV.

NOISE 10Hz–1MHz (p-p): 50mV typical.

OVER VOLTAGE PROTECTION: User selectable values, 5% tolerance. Factory default = none.

CURRENT LIMIT: Bipolar current limit (compliance) set with single value. Min. 0.1% of range.

OVERSHOOT: <0.1% typical (full scale step, resistive load, 10mA range).

CURRENT PROGRAMMING ACCURACY (Local or Remote Sense)

RANGE	PROGRAMMING RESOLUTION	ACCURACY (1 Year)	NOISE
		23°C ±5°C ±(% rdg. + amps)	(peak-peak) 0.1Hz ~ 10Hz
10.0000 µA	500 pA	0.033% + 2 nA	5 nA
100.000 µA	5 nA	0.031% + 20 nA	50 nA
1.00000 mA	50 nA	0.034% + 200 nA	500 nA
10.0000 mA	500 nA	0.045% + 2 µA	50 µA
100.000 mA	5 µA	0.066% + 20 µA	1 µA
1.00000 A	50 µA	0.067% + 900 µA	50 µA
5.00000 A	250 µA	0.10 % + 5.4 mA	500 µA

TEMPERATURE COEFFICIENT (0°–18°C & 28°–50°C): ±(0.15 × accuracy specification)/°C.

MAX. OUTPUT POWER: 66W, four quadrant source or sink operation.

SOURCE/SINK LIMITS: ±5.25A @ ±10.5V, ±1.05A @ ±42V.

CURRENT REGULATION: Line: 0.01% of range. **Load:** 0.01% of range + 100pA.

VOLTAGE LIMIT: Bipolar voltage limit (compliance) set with single value. Min. 0.1% of range.

OVERSHOOT: <0.1% typical (1mA step, RL = 10kΩ, 10V range).

¹ For sink mode, 1µA to 100mA range, accuracy is ±(0.5% + offset*3). For 1A range, accuracy is ±(1.5% + offset*3).

2440 5A SourceMeter® Instrument

ADDITIONAL SOURCE SPECIFICATIONS

TRANSIENT RESPONSE TIME: 30µs minimum for the output to recover to its spec. following a step change in load.

COMMAND PROCESSING TIME: Maximum time required for the output to begin to change following the receipt of :SOURce:VOLTage|CURRENT <nrf> command. **Autorange On:** 10ms. **Autorange Off:** 7ms.

OUTPUT SETTLING TIME: Time required to reach 0.1% of final value after command is processed. 100µs typical. Resistive load. 10µA to 100mA range.

OUTPUT SLEW RATE: 0.25V/µs, 40V range, 100mA compliance. 0.08V/µs, 10V range, 100mA compliance.

DC FLOATING VOLTAGE: Output can be floated up to ±250V DC from chassis ground.

REMOTE SENSE: Up to 1V drop per load lead.

COMPLIANCE ACCURACY: Add 0.1% of range to base specification.

OVER TEMPERATURE PROTECTION: Internally sensed temperature overload puts unit in standby mode.

RANGE CHANGE OVERSHOOT: Overshoot into a fully resistive 100kΩ load, 10Hz to 1MHz BW, adjacent ranges, Smooth Mode: 10V/40V range boundary.

MINIMUM COMPLIANCE VALUE: 0.1% of range.

CONTACT CHECK SPECIFICATIONS

(Full SourceMeter specifications are published separately.)

SPEED: 350µs for verification and notification.

CONTACT CHECK:	2Ω	15Ω	50Ω
No contact check failure	<1.00Ω	<13.5Ω	<47.5Ω
Always contact check failure	>3.00Ω	>16.5Ω	>52.5Ω

MEASURE SPECIFICATIONS^{1, 2, 7}

VOLTAGE MEASUREMENT ACCURACY (Local or Remote Sense)

RANGE	MAXIMUM RESOLUTION	INPUT RESISTANCE	ACCURACY (1 Year) 23°C ±5°C
			±(% rdg. + volts)
200.000 mV	1 µV	>10 GΩ	0.012% + 300 µV
2.00000 V	10 µV	>10 GΩ	0.012% + 300 µV
10.0000 V	50 µV	>10 GΩ	0.015% + 750 µV
40.0000 V	200 µV	>10 GΩ	0.015% + 3 mV

TEMPERATURE COEFFICIENT (0°–18°C & 28°–50°C): ±(0.15 × accuracy specification)/°C.

CURRENT MEASUREMENT ACCURACY (Local or Remote Sense)

RANGE	MAXIMUM RESOLUTION	VOLTAGE BURDEN ³	ACCURACY (1 Year) 23°C ±5°C
			±(% rdg. + amps)
10.0000 µA	100 pA	< 1 mV	0.027% + 700 pA
100.000 µA	1 nA	< 1 mV	0.025% + 6 nA
1.00000 mA	10 nA	< 1 mV	0.027% + 60 nA
10.0000 mA	100 nA	< 1 mV	0.035% + 600 nA
100.000 mA	1 µA	< 1 mV	0.055% + 6 µA
1.00000 A	10 µA	< 1 mV	0.060% + 570 µA
5.0000 A ⁶	25 µA	< 1 mV	0.10 % + 3.42 mA

TEMPERATURE COEFFICIENT (0°–18°C & 28°–50°C): ±(0.10 × accuracy specification)/°C.

RESISTANCE MEASUREMENT ACCURACY (Local or Remote Sense)

RANGE	MAX. RESOLUTION	DEFAULT TEST CURRENT	ACCURACY (1 Year) 23°C ±5°C
			±(% rdg. + ohms)
<0.200000 Ω ⁴	1 µΩ	—	Source I _{ACC} + Meas. V _{ACC}
2.00000 Ω ⁴	10 µΩ	1 A	0.17% + 0.0003 Ω
20.0000 Ω	100 µΩ	100 mA	0.10% + 0.003 Ω
200.000 Ω	1 mΩ	10 mA	0.08% + 0.03 Ω
2.00000 kΩ	10 mΩ	1 mA	0.07% + 0.3 Ω
20.0000 kΩ	100 mΩ	100 µA	0.06% + 3 Ω
200.000 kΩ	1 Ω	10 µA	0.07% + 30 Ω
2.00000 MΩ	10 Ω	1 µA	0.11% + 300 Ω
20.0000 MΩ	100 Ω	1 µA	0.11% + 1 kΩ
200.000 MΩ ⁴	1 kΩ	—	Source I _{ACC} + Meas. V _{ACC}
>200.000 MΩ ⁴	1 MΩ	—	Source I _{ACC} + Meas. V _{ACC}

TEMPERATURE COEFFICIENT (0°–18°C & 28°–50°C): ±(0.15 × accuracy specification)/°C.

SOURCE I MODE, MANUAL OHMS: Total uncertainty = I source accuracy + V measure accuracy (4-wire remote sense).

SOURCE V MODE: Total uncertainty = I source accuracy + V measure accuracy (4-wire remote sense).

6-WIRE OHMS MODE: Available using active ohms guard and guard sense. Max. Guard Output Current: 50mA (except 1A range). Accuracy is load dependent. Refer to manual for calculation formula.

GUARD OUTPUT IMPEDANCE: 0.1Ω in ohms mode.

¹ Speed = Normal (1 PLC). For 0.1 PLC, add 0.005% of range to offset specifications, except 200mV, 1A, 10A ranges, add 0.05%. For 0.01 PLC, add 0.05% of range to offset specifications, except 200mV, 1A, 10A ranges, add 0.5%.

² Accuracies apply to 2- or 4-wire mode when properly zeroed.

³ 4-wire mode.

⁴ Manual ohms only – 2Ω range.

⁵ Source readback enabled, offset compensation ON.

⁶ 10A range only in pulse mode.

⁷ In pulse mode, limited to 0.1 PLC measurement.

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SYSTEM SPEEDS

MEASUREMENT¹

MAXIMUM RANGE CHANGE RATE: 75/second.

MAXIMUM MEASURE AUTORANGE TIME: 40ms (fixed source)².

SWEEP OPERATION³ READING RATES (rdg./second) for 60Hz (50Hz):

SPEED	NPLC/TRIGGER ORIGIN	MEASURE		SOURCE-MEASURE		SOURCE-MEASURE PASS/FAIL TEST ^{4,5}		SOURCE-MEMORY ⁴	
		TO MEM.	TO GPIB	TO MEM.	TO GPIB	TO MEM.	TO GPIB	TO MEM.	TO GPIB
Fast	0.01 / internal	2125 (2010)	1000 (1000)	1675 (1590)	900 (900)	1000 (990)	760 (760)	200 (185)	200 (185)
	0.01 / external	1275 (1220)	910 (920)	1080 (1045)	830 (835)	940 (910)	710 (710)	195 (180)	195 (180)
Medium	0.10 / internal	510 (435)	510 (485)	475 (410)	475 (410)	400 (355)	400 (355)	155 (140)	155 (140)
	0.10 / external	440 (380)	440 (380)	418 (365)	415 (365)	390 (345)	390 (345)	150 (135)	150 (135)
Slow	1.00 / internal	59 (49)	59 (49)	58 (48)	58 (48)	57 (48)	57 (48)	46 (39)	46 (39)
	1.00 / external	57 (48)	57 (48)	57 (47)	57 (47)	56 (47)	56 (47)	46 (39)	46 (39)

SINGLE READING OPERATION READING RATES (rdg./second) for 60Hz (50Hz):

SPEED	NPLC/TRIGGER ORIGIN	MEASURE		SOURCE-MEASURE ⁵		SOURCE-MEASURE PASS/FAIL TEST ^{4,5}	
		TO GPIB	TO GPIB	TO GPIB	TO GPIB	TO GPIB	TO GPIB
Fast	0.01 / internal	200 (200)		65 (65)		65 (65)	
Medium	0.10 / internal	160 (150)		60 (60)		60 (58)	
Slow	1.00 / internal	46 (40)		31 (28)		30 (28)	

COMPONENT INTERFACE HANDLER TIME for 60Hz (50Hz):

SPEED	NPLC/TRIGGER ORIGIN	MEASURE		SOURCE-MEASURE ⁵		SOURCE-MEASURE PASS/FAIL TEST ^{4,5}	
		TO GPIB	TO GPIB	TO GPIB	TO GPIB	TO GPIB	TO GPIB
Fast	0.01 / internal	1.07 ms	(0.95 ms)	0.5 ms	(0.5 ms)	4.0 ms	(4.0 ms)
Medium	0.10 / internal	2.8 ms	(2.75 ms)	0.5 ms	(0.5 ms)	5.5 ms	(5.75 ms)
Slow	1.00 / internal	20.85 ms	(20.75 ms)	0.5 ms	(0.5 ms)	20.5 ms	(24 ms)

¹ Reading rates applicable for voltage or current measurements. Auto zero off, autorange off, filter off, display off, trigger delay = 0, and binary reading format.

² Purely resistive load. 1µA and 10µA ranges <65ms.

³ 1000 point sweep was characterized with the source on a fixed range.

⁴ Pass/Fail test performed using one high limit and one low math limit.

⁵ Includes time to re-program source to a new level before making measurement.

⁶ Time from falling edge of START OF TEST signal to falling edge of END OF TEST signal.

⁷ Command processing time of: SOURce:VOLtagelCURRent:TRIGgered <nr> command not included.

GENERAL

NOISE REJECTION:

	NPLC	NMRR	CMRR
Fast	0.01	—	80 dB
Medium	0.1	—	80 dB
Slow	1	60 dB	120 dB ¹

¹ Except lowest 2 current ranges = 90dB.

LOAD IMPEDANCE: Stable into 20,000pF typical.

COMMON MODE VOLTAGE: 40V DC.

COMMON MODE ISOLATION: >10%Ω, <1000pF.

OVERRANGE: 105% of range, source and measure.

MAX. VOLTAGE DROP BETWEEN INPUT/OUTPUT AND SENSE TERMINALS: 5V.

MAX. SENSE LEAD RESISTANCE: 1MΩ for rated accuracy.

SENSE INPUT IMPEDANCE: >10¹⁰Ω.

GUARD OFFSET VOLTAGE: >150µV, typical (300µV for Models 2430, 2440).

SOURCE OUTPUT MODES: Fixed DC level, Memory List (mixed function), Stair (linear and log)

SOURCE MEMORY LIST: 100 points max.

MEMORY BUFFER: 5,000 readings @ 5 digits (two 2,500 point buffers). Includes selected measured value(s) and time stamp. Lithium battery backup (3 yr+ battery life).

PROGRAMMABILITY: IEEE-488 (SCPI-1995.0), RS-232, 5 user-definable power-up states plus factory default and *RST.

DIGITAL INTERFACE:

Interlock: Active low input.

Handler Interface: Start of test, end of test, 3 category bits. +5V@ 300mA supply.

Digital I/O: 1 trigger input, 4 TTL/Relay Drive outputs (33V @ 500mA, diode clamped).

POWER SUPPLY: 240VA.

COOLING: Forced air, variable speed.

WARRANTY: 1 year.

EMC: Conforms to European Union Directive 89/336/EEC, EN 61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC, EN61010-1.

VIBRATION: MIL-T-28800E Type III, Class 5.

WARM-UP: 1 hour to rated accuracies.

DIMENSIONS: 89mm high × 213mm wide × 370mm deep (3½ in × 8½ in × 14⅞ in).

Bench Configuration (with handle & feet): 104mm high × 238mm wide × 370mm deep (4⅞ in × 9⅞ in × 14⅞ in).

WEIGHT: 4.1kg (9.0 lbs).

ENVIRONMENT:

Operating: 0°–50°C, 70%R.H. up to 35°C. Derate 3% R.H./°C, 35°–50°C.

Storage: –25°C to 65°C.

ACCESSORIES SUPPLIED: Model 1754 Universal Test Lead Kit, User's Manual, Service Manual, LabVIEW and TestPoint Drivers.

Specifications are subject to change without notice.

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KEITHLEY

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