

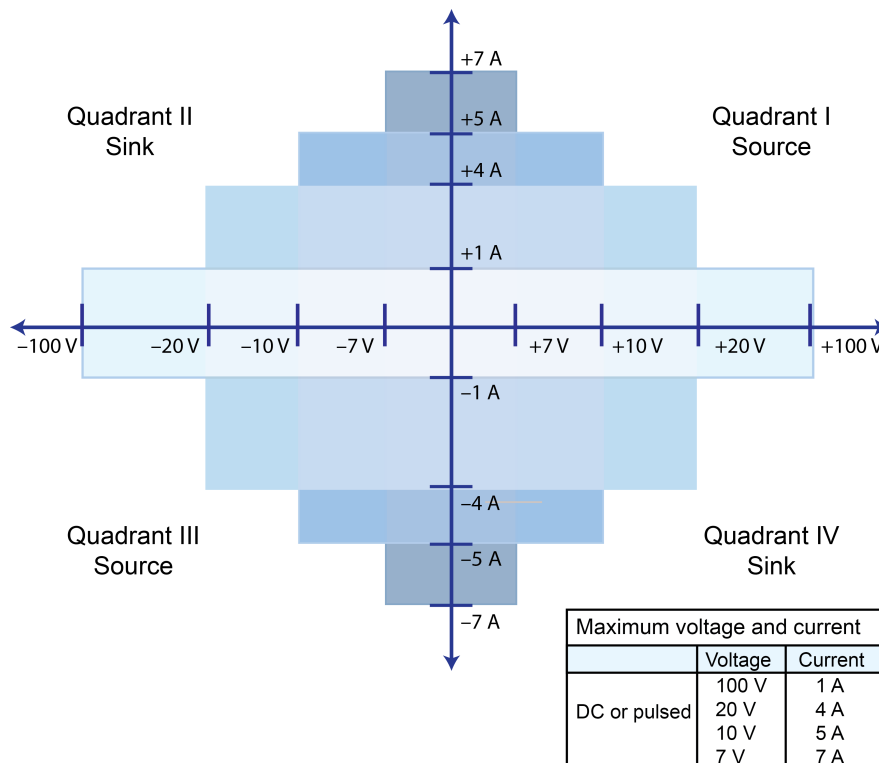
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SPECIFICATION CONDITIONS

This document contains specifications and supplemental information for the Model 2460 Interactive SourceMeter® Instrument. Specifications are the standards against which the Model 2460 is tested. Upon leaving the factory, the Model 2460 meets these specifications. Supplemental and typical values are nonwarranted, apply at 23 °C, and are provided solely as useful information.

DC POWER SPECIFICATIONS

	Voltage	Current
Maximum output power and source limits	105 W maximum ± 105 V (≤ 1 A range) - Four-quadrant source or sink operation	105 W maximum ± 1.05 A (≤ 100 V range) - Four-quadrant source or sink operation
Maximum DC voltage and current ratings	105 V	1.05 A
	21 V	4.2 A
	10.5 V	5.25 A
	7.35 V	7.35 A



VOLTAGE SPECIFICATIONS^{1,2}

Source					Measure ³		
Range	Max. current	Resolution	Accuracy 23 °C ± 5 °C 1 year ± (% setting + volts)	Noise (RMS) <10Hz	Resolution ⁴	Input resistance	Accuracy 23 °C ± 5 °C 1 year ± (% reading + volts)
200.0000 mV	7.35 A	5 µV	0.015 % + 200 µV	1 µV	100 nV	> 10 GΩ	0.012 % + 200 µV
2.000000 V	7.35 A	50 µV	0.015 % + 300 µV	10 µV	1 µV	> 10 GΩ	0.012 % + 300 µV
7.000000 V	7.35 A	250 µV	0.015 % + 2.4 mV	100 µV	1 µV	> 10 GΩ	0.015 % + 1 mV
10.00000 V	5.25 A	500 µV	0.015 % + 2.4 mV	100 µV	10 µV	> 10 GΩ	0.015 % + 1 mV
20.00000 V	4.2 A	500 µV	0.015 % + 2.4 mV	100 µV	10 µV	> 10 GΩ	0.015 % + 1 mV
100.0000 V	1.05 A	2.5 mV	0.015 % + 15 mV	1 mV	100 µV	> 10 GΩ	0.015 % + 5 mV
Temperature coefficient: ± (0.10 × accuracy specification)/°C 0 °C to 18 °C and 28 °C to 50 °C							

CURRENT SPECIFICATIONS^{1,2,5}

Source					Measure ³		
Range	Max voltage	Resolution	Accuracy 23 °C ± 5 °C 1 year ± (% setting + amps)	Noise (RMS) <10Hz	Resolution ⁴	Voltage burden ⁶	Accuracy 23 °C ± 5 °C 1 year ± (% reading + amps)
1.000000 µA	105V	50 pA	0.025 % + 1 nA	40 pA	1 pA	< 100 µV	0.025 % + 700 pA
10.00000 µA	105V	500 pA	0.025 % + 1.5 nA	40 pA	10 pA	< 100 µV	0.025 % + 1 nA
100.0000 µA	105V	5 nA	0.020 % + 15 nA	100 pA	100 pA	< 100 µV	0.020 % + 10 nA
1.000000 mA	105V	50 nA	0.020 % + 150 nA	1 nA	1 nA	< 100 µV	0.020 % + 100 nA
10.00000 mA	105V	500 nA	0.020 % + 1.5 µA	10 nA	10 nA	< 100 µV	0.020 % + 1 µA
100.0000 mA	105V	5 µA	0.020 % + 15 µA	100 nA	100 nA	< 100 µV	0.020 % + 10 µA
1.000000 A	105V	50 µA	0.050 % + 750 µA	5 µA	1 µA	< 100 µV	0.050 % + 500 µA
4.000000 A	21V	250 µA	0.100 % + 3 mA	25 µA	1 µA	< 100 µV	0.100 % + 2.5 mA
5.000000 A	10.5V	250 µA	0.100 % + 3 mA	25 µA	1 µA	< 100 µV	0.100 % + 2.5 mA
7.000000 A	7.35V	500 µA	0.150 % + 6 mA	125 µA	1 µA	< 100 µV	0.150 % + 5 mA
Temperature coefficient: ± (0.10 × accuracy specification)/°C 0 °C to 18 °C and 28 °C to 50 °C							

¹ Speed = 1 PLC.² All specifications guaranteed with output ON.³ Accuracies apply to 2-wire and 4-wire modes when properly zeroed.⁴ Measure resolution 6.5 digits.⁵ Accuracy specifications guaranteed when using Model 2460-KIT screw terminal accessory.⁶ Four-wire mode.

RESISTANCE MEASUREMENT ACCURACY (LOCAL OR REMOTE SENSE)^{7,8,9}

Range	Resolution ¹⁰	Default test current	Normal accuracy 23 °C ± 5 °C 1 year ± (% reading + ohms)	Enhanced accuracy ¹¹ 23 °C ± 5 °C 1 year ± (% reading + ohms)
≤ 2.000000 Ω ¹²	1 μΩ	User-defined	Source I _{ACC} + Meas V _{ACC}	Meas I _{ACC} + Meas V _{ACC}
20.00000 Ω	10 μΩ	100 mA	0.05 % + 0.003 Ω	0.04 % + 0.001 Ω
200.0000 Ω	100 μΩ	10 mA	0.05 % + 0.03 Ω	0.04 % + 0.01 Ω
2.000000 kΩ	1 mΩ	1 mA	0.05 % + 0.3 Ω	0.04 % + 0.1 Ω
20.00000 kΩ	10 mΩ	100 μA	0.05 % + 3 Ω	0.04 % + 1 Ω
200.0000 kΩ	100 mΩ	10 μA	0.05 % + 30 Ω	0.05 % + 10 Ω
2.000000 MΩ	1 Ω	10 μA	0.06 % + 100 Ω	0.06 % + 50 Ω
20.00000 MΩ	10 Ω	1 μA	0.14 % + 1000 Ω	0.12 % + 500 Ω
> 20.00000 MΩ ¹²	-----	User-defined	Source I _{ACC} + Meas V _{ACC}	Meas I _{ACC} + Meas V _{ACC}
Temperature coefficient: ± (0.10 × accuracy specification)/°C 0 °C to 18 °C and 28 °C to 50 °C				
Source current, measure resistance mode		Total uncertainty = I source accuracy + V measure accuracy (4-wire remote sense)		
Source voltage, measure resistance mode		Total uncertainty = V source accuracy + I measure accuracy (4-wire remote sense)		

⁷ Speed = 1 PLC.⁸ All specifications guaranteed with output ON.⁹ Accuracies apply to 2-wire and 4-wire modes when properly zeroed.¹⁰ Measure resolution 6.5 digits.¹¹ Source readback enabled; offset compensation on.¹² Source current, measure resistance or source voltage, measure resistance only.

SUPPLEMENTAL SPECIFICATIONS

Overrange	105 % of range, source and measure		
Regulation	Voltage - Line: 0.01 % of range - Load: 0.01 % of range + 100 μV Current - Line: 0.01 % of range - Load: 0.01 % of range + 100 pA		
Source limits	Voltage source current limit: - Bipolar current limit set with a single value - Minimum value is 10 % of range Current source voltage limit: - Bipolar voltage limit set with a single value - Minimum value is 10 % of range		
V-limit/I-limit accuracy	Add 0.3 % of setting and ± 0.02 % of reading to base specification		
Overshoot	Voltage source: < 0.1 % typical - Step size = Full scale, resistive load, 20 V range, 10 mA I-limit Current source: < 0.1 % typical - Step size = 1 mA, $R_{Load} = 10$ kΩ, 20 V range		
Range change overshoot	Overshoot into a fully resistive 100 k Ω load, 10 Hz to 20 MHz bandwidth, adjacent ranges: < 250 mV typical		
Output settling time	Time required to reach within 0.1 % of final value: 20 V range, 100 mA I-limit: < 200 μ s typical		
Maximum slew rate	1 V per μ s, 100 V range, 100 mA limit into a 20 k Ω load (typical) 0.6 V per μ s, 20 V range, 100 mA limit into a 20 k Ω load (typical)		
Overvoltage protection	User-selectable values, 5 % $\pm$ 0.5 V tolerance; factory default = none		
Voltage source noise	10 Hz to 20 MHz (RMS): < 4.5 mV typical into a resistive load		
Common mode voltage	250 V DC		
Common mode isolation	> 1 G Ω , < 1000 pF		
Noise rejection (typical)	NPLC	NMRR	CMRR
	0.01	-----	60 dB
	0.1	-----	60 dB
	1	60 dB	100 dB

Load impedance	Normal mode 20 nF typical	High-capacitance mode - Stable into 50 μF typical - High-capacitance mode valid for $\geq 100 \mu$A ranges
Maximum voltage drop between force and sense terminals	5 V	
Maximum force lead voltage drop	1 V	
Maximum sense lead resistance	1 M Ω for rated accuracy	
Sense input impedance	$> 10 \text{ G}\Omega$	
Guard offset voltage	$< 300 \mu$ V typical	

SYSTEM MEASUREMENT SPEEDS¹³

Reading rates (readings per second) typical for 60 Hz (50 Hz), script (TSP®) programmed

NPLC	Trigger origin	Measure to memory	Measure to GPIB/USB/LAN	Source measure to memory	Source measure to GPIB/USB/LAN
0.01 NPLC	Internal	3050 (2800)	2800 (2500)	1700 (1600)	1650 (1550)
0.01 NPLC	External	2300 (2100)	2150 (2000)	1650 (1550)	1600 (1450)
0.1 NPLC	Internal	540 (460)	530 (450)	470 (410)	470 (400)
0.1 NPLC	External	500 (420)	500 (420)	460 (390)	450 (350)
1 NPLC	Internal	59 (49)	59 (49)	58 (48)	58 (48)
1 NPLC	External	58 (48)	58 (48)	57 (48)	57 (46)

Reading rates (readings per second) typical for 60 Hz (50 Hz), SCPI programmed

NPLC	Trigger origin	Measure to memory	Measure to GPIB/USB/LAN	Source measure to memory	Source measure to GPIB/USB/LAN
0.01 NPLC	Internal	3000 (2800)	3000 (2790)	1700 (1600)	1550 (1500)
0.01 NPLC	External	2330 (2150)	2330 (2150)	1650 (1550)	1500 (1450)
0.1 NPLC	Internal	540 (460)	540 (460)	470 (410)	460 (400)
0.1 NPLC	External	510 (430)	510 (430)	470 (400)	460 (390)
1 NPLC	Internal	59 (49)	59 (49)	58 (48)	58 (48)
1 NPLC	External	58 (49)	58 (49)	58 (48)	58 (48)

¹³ Reading rates applicable for voltage or current measurements, autozero off, autorange off, filter off, binary reading format, and source readback off.

GENERAL CHARACTERISTICS

(Default mode unless specified)

Factory default standard power-up setting	SCPI mode	
Source output modes	▪ Fixed DC level ▪ Memory/configuration list (mixed function) ▪ Sweep (linear and logarithmic) ▪ Sweep (Dual linear and dual logarithmic)	
Memory buffer	> 250,000 readings with selected measured values and timestamp	
Real-time clock	Lithium battery backup (3 years plus battery life)	
Remote interfaces	GPIO: IEEE Std 488.1 compliant; supports IEEE Std 488.2 common commands and status model topology USB device (rear panel, type B): 2.0 full-speed USBTMC USB host (front panel, type A): USB 2.0, support for flash drives, FAT32 Ethernet: RJ-45 connector, 10/100 BT	
IP configuration	Static or DHCP	
Expansion interface	The TSP-Link® expansion interface allows TSP-enabled instruments to trigger and communicate with each other	
LXI compliance	LXI version 1.4 Core 2011	
TSP mode	Embedded Test Script Processor (TSP®) accessible from any host interface	
Display	Five-inch capacitive touch, color TFT WVGA (800 × 480) with LED backlight	
Input signal connections	Front: Banana Rear: Mass termination screw terminal	
Programmability	SCPI or TSP command sets	
Interlock	Active high-input	
Digital I/O	Lines	Six input/output, user-defined, for digital I/O or triggering
	Connector	9-pin female D
	Input signal levels	0.7 V (maximum logic low) 3.7 V (minimum logic high)
	Input voltage limits	−0.25 V (absolute minimum) +5.25 V (absolute maximum)
	Maximum source current	+2.0 mA at > 2.7 V (per pin)
	Maximum sink current	−50 mA at 0.7 V (per pin, solid-state fuse protected)
	5 V power supply pin	Limited to 500 mA at > 4 V (solid-state fuse protected)
	Handler	User-definable start of test, end of test, four category bits

Cooling	Forced air, variable speed
Overtemperature protection	Internally sensed temperature overload puts instrument in standby mode
Power supply	100 V to 240 V RMS, 50 Hz to 60 Hz (automatically detected at power up)
VA rating	350 VA maximum
Altitude	Maximum 2000 meters (6562 feet) above sea level
EMC	Conforms to European Union EMC Directive
Safety	Compliance with CE and NRTL listed to UL61010-1 and UL61010-2-30 Conforms with European Union Low Voltage Directive
Vibration	MIL-PRF-28800F Class 3 Random
Warm up	One hour to rated accuracies
Dimensions	With handle and bumpers: 106 mm × 255 mm × 425 mm deep (4.18 in. high × 10.05 in. wide × 16.75 in.) Without handle and bumpers: 88 mm × 213 mm × 397 mm deep (3.46 in. high × 8.39 in. wide × 15.63 in.)
Weight	With handle and bumpers: 4.75 kg (10.5 lb) Without handle and bumpers: 4.35 kg (9.6 lb)
Environment	Operating: 0 °C to 50 °C, 70 % relative humidity up to 35 °C; derate 3 % relative humidity/°C, 35 °C to 50 °C, noncondensing Storage: -25 °C to 65 °C

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