KEITHLEY

Models 2635/2636

System SourceMeter® Specifications

Keithley Instruments, Inc.
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1. SPECIFICATION CONDITIONS

This document contains specifications and supplemental information for the Models 2635 and 2636 System SourceMeters®. Specifications are the standards against which the Models 2635 and 2636 are tested. Upon leaving the factory the 2635 and 2636 meet these specifications. Supplemental and typical values are non-warranted, apply at 23°C, and are provided solely as useful information.

The source and measurement accuracies are specified at the SourceMeters® CHANNEL A (2635 and 2636) or SourceMeters® B (2636) terminals under the following conditions:

1. 23°C ± 5°C, < 70% relative humidity.
2. After two-hour warm-up.
3. Speed normal (1 NPLC).
4. A/D auto-zero enabled.
5. Remote sense operation or properly zeroed local operation.
6. Calibration period: one year.

2. SOURCE SPECIFICATIONS

VOLTAGE SOURCE SPECIFICATIONS

Specifications Category	Specifications			
Voltage Programming Accuracy[1]	**RANGE**	**PROGRAMMING RESOLUTION**	**ACCURACY (1 Year) 23°C ± 5°C ± (% rdg. + volts)**	**TYPICAL NOISE (peak-peak) 0.1 Hz–10 Hz**
	200.000 mV	5 µV	0.02% + 375 µV	20 µV
	2.00000 V	50 µV	0.02% + 600 µV	50 µV
	20.0000 V	500 µV	0.02% + 5 mV	300 µV
	200.000 V	5 mV	0.02% + 50 mV	2 mV
Temperature Coefficient	± (0.15 × accuracy specification)/°C • For temperatures (0°–18°C & 28°–50°C)			
Maximum Output Power and Source/Sink Limits[2]	30.3 W per channel maximum. • ± 20.2 V @ ± 1.5 A • ± 202 V @ ± 100 mA • Four-quadrant source or sink operation.			
Voltage Regulation	Line: 0.01% of range Load: ± (0.01% of range + 100 µV).			
Noise 10 Hz – 20 MHz	< 20 mV peak-peak (typical), < 3 mV RMS (typical) • 20 V range			
Current Limit/Compliance[3]	Bipolar current limit (compliance) set with single value. Minimum value is 100 pA. Accuracy is the same as current source.			

[1] Add 50 µV to source accuracy specifications per volt of HI lead drop.
[2] Full power source operation regardless of load to 30°C ambient. Above 30°C and/or power sink operation, refer to Section 8 – "Operating Boundaries" in the Series 2600 Reference Manual for additional power derating information.

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Specifications Category	Specifications
Overshoot	< ± (0.1% + 10 mV) (typical) • Step size = 10% to 90% of range, resistive load, maximum - current limit/compliance.
Guard Offset Voltage	< 4 mV • Current < 10 mA

CURRENT SOURCE SPECIFICATIONS

Specifications Category	Specifications			
	RANGE	**PROGRAMMING RESOLUTION**	**ACCURACY (1 Year) 23°C ± 5°C ± (% rdg. + amps)**	**TYPICAL NOISE (peak-peak) 0.1 Hz–10 Hz**
Current Programming Accuracy	1.00000 nA	20 fA	0.15% + 2 pA	800 fA
	10.0000 nA	200 fA	0.15% + 5 pA	2 pA
	100.000 nA	2 pA	0.06% + 50 pA	5 pA
	1.00000 øA	20 pA	0.03% + 700 pA	25 pA
	10.0000 øA	200 pA	0.03% + 5 nA	60 pA
	100.000 øA	2 nA	0.03% + 60 nA	3 nA
	1.00000 mA	20 nA	0.03% + 300 nA	6 nA
	10.0000 mA	200 nA	0.03% + 6 øA	200 nA
	100.000 mA	2 øA	0.03% + 30 øA	600 nA
	1.00000 A[4]	20 øA	0.05% + 1.8 mA	70 øA
	1.50000 A[4]	50 øA	0.06% + 4 mA	150 øA
Temperature Coefficient	± (0.15 × accuracy specification)/°C • For temperatures (0° – 18°C & 28° – 50°C)			
Maximum Output Power and Source/Sink Limits[4]	30.3 W per channel maximum. • ± 1.515 A @ ± 20 V • ± 101 mA @ ± 200 V • Four-quadrant source or sink operation.			
Current Regulation	Line: 0.01% of range Load: ± (0.01% of range + 100µV).			
Voltage Limit/Compliance[5]	Bipolar voltage limit (compliance) set with single value. Minimum value is 10 mV. Accuracy is the same as current source.			

[3] For sink mode operation (quadrants II and IV), add 12% of limit range and ±0.02% of limit setting to corresponding current limit accuracy specifications. For 1A range add an additional 40mA of uncertainty.
[4] Full power source operation regardless of load to 30°C ambient. Above 30°C and/or power sink operation, refer to Section 8 – "Operating Boundaries" in the Series 2600 Reference Manual for additional power derating information
[5] For sink mode operation (quadrants II and IV), add 10% of compliance range and ±0.02% of limit setting to corresponding voltage source specification. For 200mV range add an additional 120mV of uncertainty.

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Specifications Category	Specifications
Overshoot	< ± 0.1% (typical) • step size = 10% to 90% of range, resistive load, maximum - current limit/compliance • See CURRENT SOURCE OUTPUT SETTLING TIME for additional test conditions

ADDITIONAL SOURCE SPECIFICATIONS

Specifications Category	Specifications	
Transient Response Time	< 70 µs for the output to recover to 0.1% for a 10% to 90% step change in load.	
Voltage Source Output Settling Time	Time required to reach 0.1% of final value after source level command is processed on a fixed range.	
	Range	**Settling Time**
	200 mV	< 50 µs (typical)
	2 V	< 50 µs (typical)
	20 V	< 110 µs (typical)
	200 V	< 700 µs (typical)
Current Source Output Settling Time	Time required to reach 0.1% of final value after source level command is processed on a fixed range. • Values below for Iout × Rload = 2 V unless noted	
	Current Range	**Settling Time**
	1.5 A – 1 A	< 120 µs (typical) (Rload > 6 Ω)
	100 mA – 10 mA	< 80 µs (typical)
	1 mA	< 100 µs (typical)
	100 µA	< 150 µs (typical)
	10 µA	< 500 µs (typical)
	1 µA	< 2 ms (typical)
	100 nA	< 20 ms (typical)
	10 nA	< 40 ms (typical)
	1 nA	< 150 ms (typical)
DC Floating Voltage	Output can be floated up to ± 250 VDC	
Remote Sense Operating Range[6]	Maximum voltage between HI and SENSE HI = 3 V Maximum voltage between LO and SENSE LO = 3V	
Voltage Output Headroom	200 V Range • Maximum output voltage = 202.3 V – total voltage drop across source leads. (maximum 1 Ω per source lead) 20 V Range • Maximum output voltage = 23.3 V – total voltage drop across source leads. (maximum 1 Ω per source lead)	

[6] Add 50 µV to source accuracy specifications per volt of HI lead drop.

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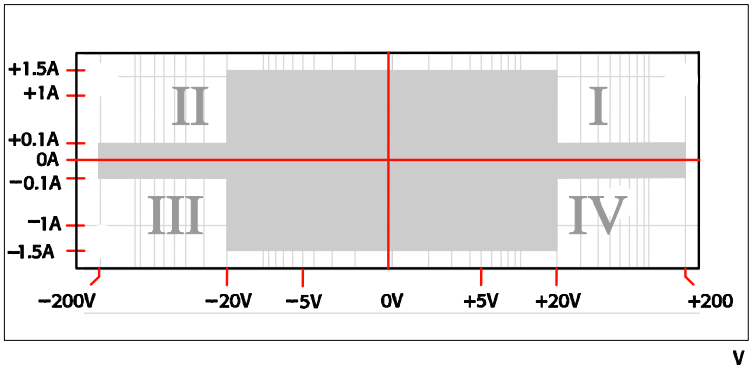
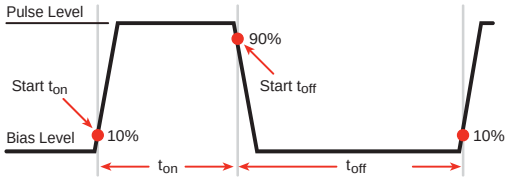
Specifications Category	Specifications
Over Temperature Protection	Internally sensed temperature overload puts unit in standby mode.
Voltage Source Range Change Overshoot	300 mV + 0.1% of larger range (typical) • Overshoot into a 200 KΩ load, 20 MHz BW
Current Source Range Change Overshoot	< 5% of larger range + 300 mV/Rload + 60 nA (typical) • See CURRENT SOURCE OUTPUT SETTLING TIME for additional test conditions.

PULSE SPECIFICATIONS

Specifications Category	Specifications
Minimum Programmable Pulse Width[7]	200 µs • Note: Minimum pulse width for settled source at a given I/V output and load can be longer than 200 µs.
Pulse Width Programming Resolution	1 µs
Pulse Width Programming Accuracy	± 25 µs
Pulse Width Jitter	50 µs (typical)
Quadrant Diagram	

[7] Times measured from the start of pulse to the start off-time; see figure below.



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3. METER SPECIFICATIONS

VOLTAGE MEASUREMENT SPECIFICATIONS

Specifications Category	Specifications			
	RANGE	**DISPLAY RESOLUTION[9]**	**INPUT IMPEDENCE**	**ACCURACY (1 Year) 23°C ± 5°C ± (% rdg. + volts)**
Voltage Measurement Accuracy[8,9]	200.000 mV	1 µV	> 10 GΩ	0.015% + 225 µV
	2.00000 V	10 µV	> 10 GΩ	0.02% + 350 µV
	20.0000 V	100 µV	> 10 GΩ	0.015% + 5 mV
	200.000 V	1 mV	> 10 GΩ	0.015% + 50 mV
Temperature Coefficient	± (0.15 × accuracy specification)/°C • For temperatures (0°–18°C & 28°–50°C)			

CURRENT MEASUREMENT SPECIFICATIONS[9]

Specifications Category	Specifications			
	RANGE	**DISPLAY RESOLUTION[10]**	**VOLTAGE BURDEN[11]**	**ACCURACY (1 Year) 23°C ± 5°C ± (% rdg. + amps)**
Current Measurement Accuracy	100.000 pA[12,13]	1 fA	< 1 mV	0.15% + 120 fA
	1.00000 nA[12,14]	10 fA	< 1 mV	0.15% + 240 fA
	10.0000 nA	100 fA	< 1 mV	0.15% + 3 pA
	100.000 nA	1 pA	< 1 mV	0.06% + 40 pA
	1.00000 øA	10 pA	< 1 mV	0.025% + 400 pA
	10.0000 øA	100 pA	< 1 mV	0.025% +1.5 nA

[8] Add 50µV to source accuracy specifications per volt of HI lead drop

[9] De-rate accuracy specifications for NPLC setting < 1 by increasing error term. Add appropriate % of range term using table below

NPLC Setting	200 mV Range	2 V – 200 V Ranges	100 nA Range	1 µA – 100 mA Ranges	1 A – 1.5 A Ranges
0.1	0.01%	0.01%	0.01%	0.01%	0.01%
0.01	0.08 %	0.07%	0.1 %	0.05%	0.05%
0.001	0.8 %	0.6 %	1 %	0.5 %	1.1 %

[10] Applies when in single channel display mode.

[11] Four-wire remote sense only.

[12] 10-NPLC, 11-Point Median Filter, < 200V range, measurements made within 1 hour after zeroing. 23°C ± 1°C

[13] Under default specification conditions: ±(0.15% + 750 fA).

[14] Under default specification conditions: ±(0.15% + 1 pA).

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Specifications Category	Specifications			
	RANGE	**DISPLAY RESOLUTION[15]**	**VOLTAGE BURDEN[16]**	**ACCURACY (1 Year) 23°C ± 5°C ± (% rdg. + amps)**
	100.000 µA	1 nA	< 1 mV	0.02% + 25 nA
	1.00000 mA	10 nA	< 1 mV	0.02% +200 nA
	10.0000 mA	100 nA	< 1 mV	0.02% + 2.5 µA
	100.000 mA	1 µA	< 1 mV	0.02% +20 µA
	1.00000 A	10 µA	< 1 mV	0.03% +1.5 mA
	1.50000 A	10 µA	< 1 mV	0.05% + 3.5 mA
Current Measure[17] Settling Time	Time required to reach 0.1% of final value.			
	Current Range		**Settling Time**	
	1 mA		< 100 µs (typical)	
Temperature Coefficient	± (0.15 × accuracy specification)/°C • For temperatures (0°–18°C & 28°–50°C)			

ADDITIONAL METER SPECIFICATIONS

Specifications Category	Specifications
Load Impedance	Stable into 10,000 pF (typical)
Common Mode Voltage	250 VDC
Common Mode Isolation	> 1 GΩ < 4500 pF
Overrange	101% of source range 102% of measure range
Maximum Sense Lead Resistance	1 KΩ for rated accuracy
Sense Input Impedance	> 10 GΩ

[15] Applies when in single channel display mode.
[16] Four-wire remote sense only.
[17] See series 2600 SourceMeter Reference Manual Section 8 for more information.

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4. GENERAL

Specifications Category	Specifications
Host Interfaces	Computer control interfaces
IEEE-488	IEEE-488.1 compliant. Supports IEEE-488.2 common commands and status model topology
RS-232	Baud rates from 300bps to 115200bps. Programmable number of data bits, parity type, and flow control (RTS/CTS hardware or none). When not programmed as the active host interface, the SourceMeter can use the RS-232 interface to control other – instrumentation
Expansion Interface	The TSP-Link expansion interface allows TSP enabled instruments to trigger and communicate with each other.
Cable Type	Category 5e or higher LAN crossover cable
Length	3 meters maximum between each TSP enabled instrument
Digital I/O Interface	See 2601/02 GENERAL specifications for circuit diagram
Connector	25-pin female D
Input/Output Pins	14 open drain I/O bits
Absolute Maximum Input Voltage	5.25 V
Absolute Minimum Input Voltage	– 0.25 V
Maximum Logic Low Input Voltage	0.7V, +850 µA max
Minimum Logic High Input Voltage	2.1V, + 570 µA
Maximum Source Current (flowing out of Digital I/O bit)	+ 960 µA
Maximum Sink Current @ Maximum Logic Low Voltage (0.7V	– 5.0 mA
Absolute Maximum Sink Current (flowing into Digital I/O pin	– 11 mA
5V Power Supply Pin	Limited to 600 mA, solid state fuse protected
Safety Interlock Pin	Active high input. > 3.4 V @ 24 mA (absolute maximum of 6 V) must be externally applied to this pin to insure 200 V operation. This signal is pulled down to chassis ground with a 10 KΩ resistor. 200 V operation will be blocked when the INTERLOCK signal is < 0.4 V (absolute minimum –0.4 V). See figure below:

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	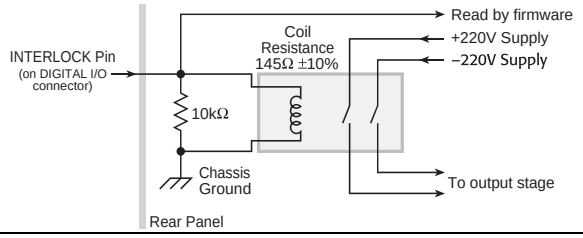
Power Supply	100 V to 250 VAC, 50 Hz – 60 Hz (auto sensing), 250 VA max
Cooling	Forced air. Side intake and rear exhaust. One side must be unobstructed when rack mounted
Warranty	1 year
EMC	Conforms to European Union Directive 2004/108/EEC, EN 61326-1
Safety	Conforms to European Union Directive 73/23/EEC, EN 61010-1, and UL 61010-1
Dimensions	89 mm high × 213 mm wide × 460 mm deep (3½ in × 8⅜ in × 17½ in). Bench Configuration (with handle & feet): 104 mm high × 238 mm wide × 460 mm deep (4⅛ in × 9⅜ in × 17½ in)
Weight	2635: 4.75 Kg (10.4 lbs). 2636: 5.50 Kg (12.0 lbs).
Environment	For indoor use only
Altitude	Maximum 2000 meters above sea level
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

SPEED SPECS