2600B 시스템 소스미터 SMU 계측기

데이터 시트

KEITHLEY
A Tektronix Company

2600B 시리즈 시스템 소스미터 SMU 계측기는 업계 최고의 전류/전압 소스 및 측정 솔루션으로, 키슬리의 3세대 SMU 기술을 기반으로 구축되었습니다. 2600B 시리즈는 정밀 전원 공급 장치, 실제 전류 소스, 6½ 자릿수 DMM, 임의 파형 발생기, 펄스 발생기, 전자 부하 등의 기능을 모두 하나의 긴밀하게 통합된 계측기로 결합한 단일 채널 및 듀얼 채널 모델을 제공합니다. 벤치탑 I-V 특성화부터 고도로 자동화된 생산 테스트까지 다양한 애플리케이션의 생산성을 대폭 끌어올리는 강력한 솔루션이다. 내장된 웹 브라우저 기반 소프트웨어로 전 세계 어느 곳에서나 컴퓨터를 통해 I-V 테스트를 할 수 있습니다. 또는 Android 스마트 기기를 사용하여 키슬리 IVy 어플리케이션으로 손가락 끝으로 I-V 테스트를 하십시오.
자동화된 시스템 어플리케이션의 경우, 2600B 시리즈의 TSP®(Test Script Processor)는 업계 최고의 처리량을 위해 기기 내부에서 완전한 테스트 프로그램을 실행합니다. 더 큰 다채널 어플리케이션에서 키슬리의 TSP-Link® Technology는 TSP Technology와 함께 작동하여 고속 SMU-per-PIN 병렬 테스트를 가능하게 합니다. 2600B 시리즈 SourceMeter SMU 계측기는 메인프레임이 필요 없는 완전히 격리된 채널을 가지고 있기 때문에 테스트 애플리케이션이 발전함에 따라 쉽게 재구성하고 다시 전개할 수 있습니다.

주요 특징

- 긴밀하게 통합된 4사분원 전압/전류 소스 및 측정 기기는 6½ 인치 분해능으로 동급 최고의 성능을 제공.
- 업계에서 가장 광범위한 동적 범위를 제공하는 모델 제품군: 10A ~ 0.1fA, 200V ~ 100nV
- 내장된 웹 브라우저 기반 소프트웨어로 전 세계 어디에서나 브라우저, 컴퓨터, 모든 컴퓨터에서 원격 제어 가능
- Keithley IVy 모바일 앱과의 호환성을 통해 모든 Android 기기를 통해 진정한 플러그 앤 플레이 I/V 특성 확인 및 테스트 가능
- TSP(Test Script Processing) 기술은 동급 최고의 시스템 수준의 처리량을 위해 기기 내부에 완전한 테스트 프로그램을 내장하고 있음
- 메인프레임 없이 다채널 병렬 테스트를 위한 TSP-Link 확장 기술
- 키슬리의 2400 소스미터 SMU 계측기용 소프트웨어 에뮬레이션
- USB 2.0, LXI-C, GPIB, RS-232 및 디지털 I/O 인터페이스
- 무료 소프트웨어 드라이버 및 개발/디버그 도구
- ACS-기본 반도체 부품 특성화 소프트웨어(옵션)

Android™ 기기로 빠른 I-V 특성화 수행

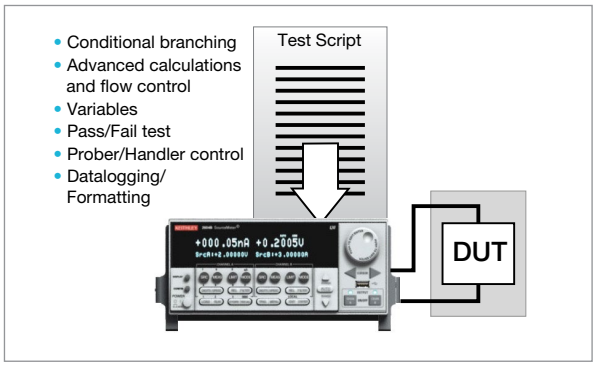
2600B 시리즈는 키슬리 IVY 애플리케이션과 호환되며, 가장 빠르고 쉬운 방법으로 전류 전압(I-V) 특성화를 수행하고, 테스트 대상 장치(DUT)의 문제를 해결하고, 측정 결과를 다른 사용자와 공유할 수 있습니다.

손가락 끝 컨트롤로 I-V 특성을 빠르게 구현하여 DUT에 대한 통찰력을 얻으십시오.

프로그래밍 없이 측정 결과를 시각화, 상호작용 및 공유할 수 있는 동시에 DUT에 대한 깊은 이해를 얻을 수 있습니다. 이러한 고유한 기능은 R&D, 교육, QA/FA 등 다양한 분야에 걸쳐 생산성을 높입니다.

TSP 기술을 사용한 자동 테스트에서 비교할 수 없는 처리량

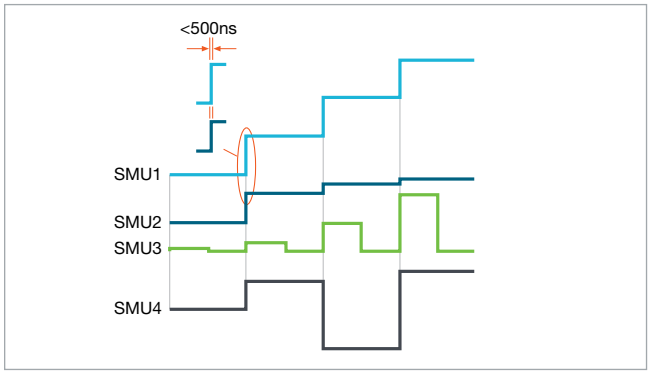
2600B의 TSP 기술은 최고 수준의 자동화 및 처리량을 요구하는 테스트 애플리케이션에 업계 최고의 성능입니다. TSP 기술은 전통적인 테스트 명령 시퀀서를 훨씬 능가합니다. 즉, SMU 기기 자체 내에서 완전한 테스트 프로그램을 구현합니다. 이를 통해 PC 컨트롤러와 주고받는 모든 시간 소모적인 버스 통신이 사실상 제거되고, 따라서 전체적인 테스트 시간이 획기적으로 개선됩니다.



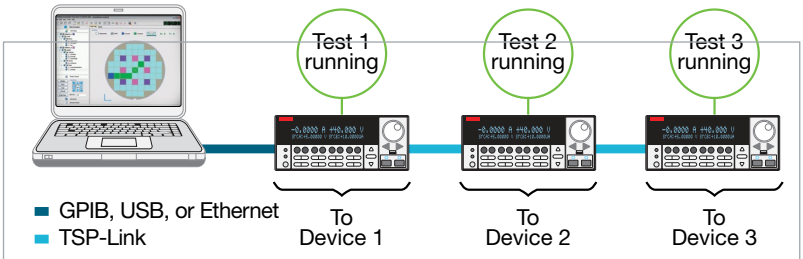
TSP 기술은 2600B의 비휘발성 메모리에서 완전한 테스트 프로그램을 실행합니다.

TSP-Link 기술을 이용한 SMU-Per-PIN 병렬 테스트

TSP-Link는 다중 시리즈 2600B를 상호 접속할 수 있는 채널 확장 버스로, 긴밀하게 동기화된 단일 멀티채널 시스템으로 기능합니다. 2600B의 TSP-Link Technology는 TSP 기술과 함께 작동하여 고속 SMU-per-pin 병렬 테스트를 가능하게 합니다. 2600B는 대형 AT 시스템과 같은 다른 고속 솔루션과 달리 메인프레임의 비용이나 부담 없이 병렬 테스트 성능을 구현합니다. 또한 TSP-Link 기반 시스템은 뛰어난 유연성을 가능하게 하여 시험 요구사항의 변화에 따라 빠르고 쉬운 시스템 재구성을 가능하게 합니다.



TSP-Link 시스템의 모든 채널은 500ns 미만으로 동기화됩니다.



TSP와 TSP-Link를 사용한 SMU-Per-Pin 병렬 테스트는 테스트 처리량을 향상시키고 테스트 비용을 절감합니다.

2400 소프트웨어 에뮬레이션

시리즈 2600B는 키슬리의 2400 소스미터 SMU 기기용으로 개발된 테스트 코드와 호환됩니다. 이를 통해 2400 기반 테스트 시스템에서 Series 2600B로 보다 쉽게 업그레이드할 수 있으며 테스트 속도를 80%까지 향상시킬 수 있습니다. 또한 SCPI 프로그래밍에서 Keithley의 TSP 기술로의 마이그레이션 경로를 제공하며, 구현 시 테스트 시간을 더욱 향상시킬 수 있습니다. 레거시 테스트 시스템의 완전한 지원을 위해 2400의 소스-메모리-목록 테스트 시퀀서도 이 모드에서 완전히 지원됩니다.

3세대 SMU 기기 설계로 테스트 시간 단축

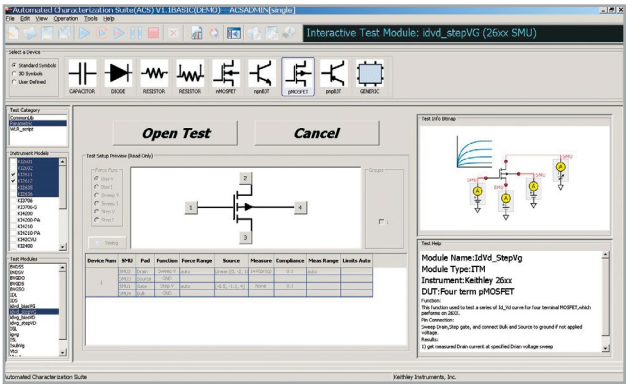
이전 시리즈 2600 계측기의 입증된 아키텍처를 기반으로 시리즈 2600B의 SMU 계측기 설계는 여러 가지 방법으로 테스트 속도를 향상시킵니다. 예를 들어, 이전 설계에서는 병렬 전류 범위 지정 토폴로지를 사용했지만, Series 2600B는 특허 받은 직렬 범위 지정 토폴로지를 사용하며, 이는 더 빠르고 부드러운 범위 변경 및 출력을 제공하여 더 빨리 정착되도록 합니다. 2600B 시리즈 SMU 기기 설계는 다양한 부하와 함께 사용할 수 있는 두 가지 작동 모드를 지원합니다. 정상 모드에서 SMU 계측기는 최대 처리량을 위해 높은 대역폭 성능을 제공합니다. 높은 커패시턴스 (high-C) 모드에서 SMU 계측기는 더 느린 대역폭을 사용하여 더 높은 용량성 부하로 강력한 성능을 제공합니다.

반도체 구성 요소 테스트, 검증 및 분석 단순화

옵션인 ACS Basic Edition 소프트웨어는 개발, 품질 검증 또는 고장 분석 중에 패키지 부품 특성화를 수행하는 고객의 생산성을 극대화합니다. 주요 기능은 다음과 같습니다:

- 접근이 용이한 다양한 테스트 라이브러리 세트
- 기존 테스트의 신속한 사용자 지정을 위한 스크립트 편집기
- 신속한 결과 비교를 위한 데이터 도구
- 캡처된 곡선을 분석하고 다양한 연산 기능을 제공하는 포뮬레이터 도구

ACS Basic Edition 소프트웨어에 대한 자세한 내용은 ACS Basic Edition 데이터 시트를 참조하십시오.



ACS Basic Edition의 마법사 기반 사용자 인터페이스를 통해 패키지 부품에 대한 데이터를 신속하게 획득해야 하는 경우 일반적인 FET 곡선 추적 테스트처럼 원하는 테스트를 쉽게 찾아 실행할 수 있습니다.

ACS Basic Edition의 유연한 소프트웨어 아키텍처를 통해 다양한 컨트롤러와 테스트 고정장치를 갖춘 시스템뿐 아니라 애플리케이션에 필요한 소스미터 SMU 계측기기의 정확한 개수를 구성할 수 있습니다.

강력한 소프트웨어 도구

Keithley IVy 스마트 장치 앱, 내장 웹 브라우저 기반 소프트웨어 및 옵션 ACS Basic Edition 소프트웨어와의 호환성 외에도 사용자가 TSP 테스트 스크립트를 작성, 수정, 디버그 및 저장할 수 있도록 무료 Test Script Builder 소프트웨어 도구가 제공됩니다. 표 1은 Series 2600B 소프트웨어 툴의 주요 기능을 설명합니다.

Feature/ Functionality	Keithley IVy Mobile App	Built-in Web Browser Based App	Test Script Builder (TSB)	ACS Basic Edition
Description	Quick I-V characterization tool for bench and lab users to visualize, interact and share measurement data via Android devices.	Built-in web browser based software for I-V characterization	Custom script writing tool for TSP instruments	Semiconductor characterization software for component test, verification, and analysis
Capability	Basic	General	Advanced	High Performance
Supported Hardware	Series 2600B	Series 2600B	Series 2600B, Series 3700	Series 2400, Series 2600B, 4200-SCS
Supported Buses	Not Applicable	LAN/LXI	GPIB, RS-232, LAN/LXI, USB	GPIB, LAN/LXI
Functionality	Visualize data in time mode, two terminal I-V mode and family of curves mode. Analyze collected data interactively with smart device's built-in capabilities. Share data instantly via mobile networks/Wi-Fi	Linear/Log Sweeps, Pulsing, Custom sweeps, Single point source-measures. **Note:** Uses new 2600B's new API's for precision timing and channel synchronization	Custom scripts with total flexibility, full featured debugger	Intuitive, wizard-based GUI, Rich set of test libraries, curve trace capability
Data Management	.csv and graphic data export	.csv export	User defined	Formulator tool with wide range of math functions
Installation	Free download from app stores	Not necessary. Embedded in the instrument.	Free Download or CD Install on PC.	Optional purchase

Table 1. Series 2600B software tools

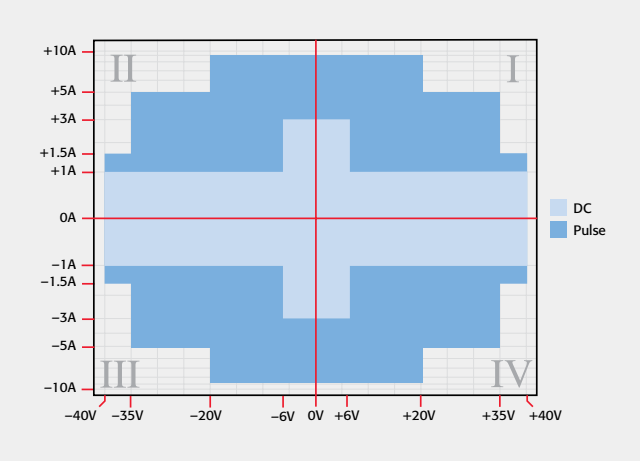
2600B 시리즈의 3 가지 새로운 듀얼 채널 벤치 탑 모델로 업계 최고의 가치와 성능 제공

최첨단 시스템 수준의 자동화 기능이 필요 없는 애플리케이션을 위해 키슬리는 2600B시리즈를 확장하여 3 가지의 새로운“벤치 탑”모델 2604B, 2614B 및 2634B를 포함 시켰습니다. 이 모델은 각각 모델 2602B, 2612B 및 2636B와 유사한 성능을 제공하지만 TSP-Link, Contact Check 및 Digital I / O 기능은 포함하지 않습니다.

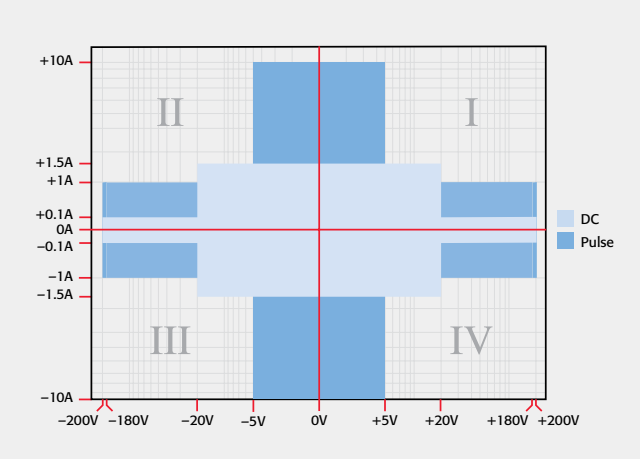
완벽한 자동화 시스템 솔루션

키슬리의 S500 통합 테스트 시스템은 장치, 웨이퍼 또는 카세트 레벨에서 반도체 특성 분석을 위해 고도로 구성 가능한 계측기 기반 시스템입니다. 입증된 2600B 시리즈 시스템 소스 미터 SMU 계측기를 기반으로 하는 S500 통합 테스트 시스템은 혁신적인 측정 기능과 시스템 유연성을 제공하며 사용자의 요구에 맞게 확장 할 수 있습니다. 독창적인 측정 기능은 강력하고 유연한 ACS (Automated Characterization Suite) 소프트웨어와 결합되어 시중의 다른 유사한 시스템에서는 제공되지 않는 광범위한 애플리케이션 및 기능을 제공합니다.

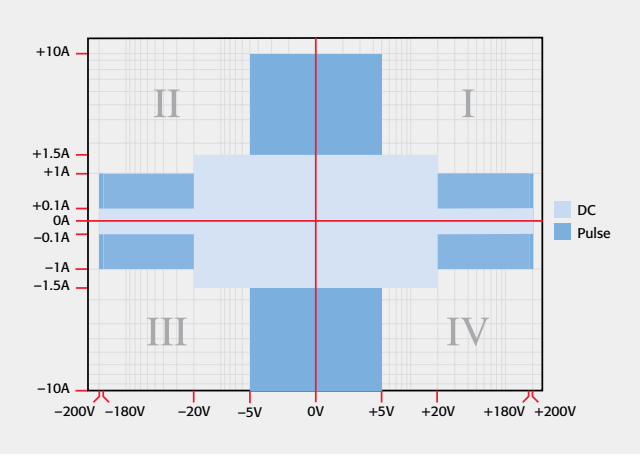
1 사분면과 3 사분면에서 Series 2600B SMU 기기는 소스로 작동하여 부하에 전력을 공급합니다. 2 사분면과 4 사분면에서는 싱크로 작동하여 내부적으로 전력을 소비합니다.



모델 2601B, 2602B 및 2604B I-V 기능.

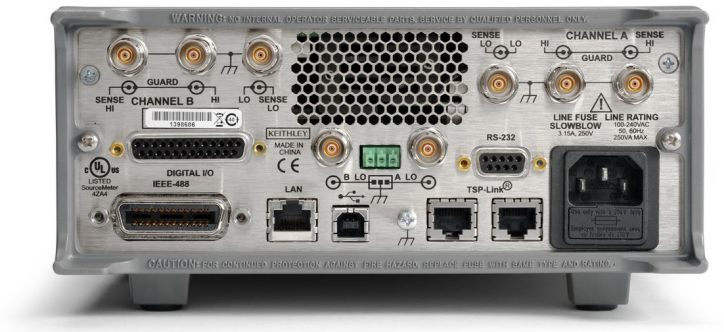


모델 2611B, 2612B 및 2614B I-V 기능.



모델 2634B, 2635B 및 2636B I-V 기능.

2604B / 2614B 후면 패널 (단일 채널 2601B, 2611B, 2635B는 표시되지 않음)



2636B 후면 패널

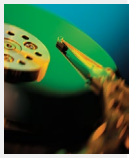
전형적인 응용분야

다음을 포함한 광범위한 장치의 I-V 기능 테스트 및 특성 분석에 쓰입니다:

- **개별 및 수동 부품**
  - 2 리드 – 센서, 디스크 드라이브 헤드, 금속 산화물 배리스터 (MOV), 다이오드, 제너 다이오드, 센서, 커패시터, 서미스터
  - 3 리드 – 소 신호 양극 접합 트랜지스터 (BJT), 전계 효과 트랜지스터 (FET) 등

- 간단한 IC – 옵토, 드라이버, 스위치, 센서, 컨버터, 레귤레이터
- 통합 장치 – 소규모 통합 (SSI) 및 대규모 통합(LSI)
  - 아날로그 IC
  - 무선 주파수 집적 회로 (RFIC)
  - 주문형 집적 회로 (ASIC)
  - 시스템 온 칩 (SOC) 장치

- 발광 다이오드 (LED)와 같은 광전자 장치, 레이저 다이오드, 고휘도 LED (HBLED), 수직 공동 표면 방출 레이저 (VCSEL), 디스플레이
- 웨이퍼 레벨 신뢰성
  - NBTI, TDDB, HCI, 일렉트로 마이그레이션



- 태양 전지
- 배터리
- 기타

사양 조건 (2601B, 2602B, 2604B)

이 문서에는 2601B, 2602B 및 2604B 시스템 소스미터 SMU 계측기의 사양 및 보충 정보가 포함되어 있습니다. 사양은 2601B, 2602B 및 2604B가 테스트되는 표준입니다. 출고시 2601B, 2602B 및 2604B는 이러한 사양을 충족합니다.
보충 및 일반적인 값은 보증되지 않으며 23°C에서 적용되며 유용한 정보로만 제공됩니다. 정확도 사양은 일반 및 고 정전 용량 모드 모두에 적용됩니다. 소스 및 측정 정확도는 다음 조건에서 SourceMeter CHANNEL A (2601B, 2602B 및 2604B) 또는 SourceMeter CHANNEL B (2602B 및 2604B) 터미널에서 지정됩니다.

1. 23 °C ± 5 °C, <70% relative humidity
2. After 2 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 = 1 year

Source Specifications (2601B, 2602B, 2604B)

Voltage Source 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
100 mV	5 µV	0.02% + 250 µV	20 µV
1 V	50 µV	0.02% + 400 µV	50 µV
6 V	50 µV	0.02% + 1.8 mV	100 µV
40 V	500 µV	0.02% + 12 mV	500 µV

Temperature Coefficient (0°–18 °C and 28°–50 °C)[2]
±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Maximum Output Power and Source/Sink Limits[3]
40.4 W per channel maximum. ±40.4 V @ ±1.0 A, ±6.06 V @ ±3.0 A, 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), 6 V range.

Current Limit/Compliance[4] — Bipolar current limit (compliance) set with single value. Minimum value is 10 nA. Accuracy same as current source.

Overshoot — <±(0.1% + 10 mV) typical. Step size = 10% to 90% of range, resistive load, maximum current limit/compliance.

Guard Offset Voltage — <4 mV typical. Current <10 mA.

NOTES

1. Add 50 µV to source accuracy specifications per volt of HI lead drop.
2. High Capacitance Mode accuracy is applicable at 23 °C ±5 °C only.
3. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B Reference Manual for additional power derating information.
4. For sink mode operation (quadrants II and IV), add 0.06% of limit range to the corresponding current limit accuracy specifications. Specifications apply with sink mode operation enabled.

Current Source Specifications

Current Programming Accuracy

Range	Programming Resolution	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + amps)	Typical Noise (peak-peak) 0.1Hz–10Hz
100 nA	2 pA	0.06% + 100 pA	5 pA
1 µA	20 pA	0.03% + 800 pA	25 pA
10 µA	200 pA	0.03% + 5 nA	60 pA
100 µA	2 nA	0.03% + 60 nA	3 nA
1 mA	20 nA	0.03% + 300 nA	6 nA
10 mA	200 nA	0.03% + 6 µA	200 nA
100 mA	2 µA	0.03% + 30 µA	600 nA
1 A [1]	20 µA	0.05% + 1.8 mA	70 µA
3 A [1]	20 µA	0.06% + 4 mA	150 µA
10 A [1, 2]	200 µA	0.5% + 40 mA (typical)	

Temperature Coefficient (0°–18 °C and 28°–50 °C) [3]
±(0.15 × accuracy specification)/°C.

Maximum Output Power and Source/Sink Limits [4]
40.4 W per channel maximum. ±1.01 A @ ±40.0 V, ±3.03 A @ ±6.0 V, four quadrant source or sink operation.

Current Regulation
Line: 0.01% of range. **Load:** ±(0.01% of range + 100 pA).

Voltage Limit/Compliance [5]
Bipolar voltage limit (compliance) set with a single value. Minimum value is 10 mV. Accuracy is the same as voltage source.

Overshoot
<±0.1% typical (step size = 10% to 90% of range, resistive load; see Current Source Output Settling Time for additional test conditions).

NOTES

1. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B Reference Manual for additional power derating information.
2. 10 A range accessible only in pulse mode.
3. High Capacitance Mode accuracy is applicable at 23 °C ±5 °C only.
4. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B 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 100 mV range add an additional 60 mV of uncertainty.

Additional Source Specifications

Transient Response Time
<70 µs for the output to recover to within 0.1% for a 10% to 90% step change in load.

Voltage Source Output Settling Time
Time required to reach within 0.1% of final value after source level command is processed on a fixed range.

100 mV, 1 V Ranges	<50 µs typical.
6 V Range	<100 µs typical.
40 V Range [1]	<150 µs typical.

NOTES

1. Add 150 µs when measuring on the 1 A range.

Current Source Output Settling Time	Time required to reach within 0.1% of final value after source level command is processed on a fixed range. Values below for $I_{out} \times R_{load}$ = 1 V unless noted.
3 A Range	<80 µs typical (current less than 2.5 A, R_{load} >2 Ω).
1 A–10 mA Ranges	<80 µs typical (R_{load} >6 Ω).
1 mA Range	<100 µs typical.
100 µA Range	<150 µs typical.
10 µA Range	<500 µs typical.
1 µA Range	<2.5 ms typical.
100 nA Range	<25 ms typical.
DC Floating Voltage	Output can be floated up to ±250 VDC from chassis ground.
Remote Sense Operating Range[1]	Maximum voltage between HI and SENSE HI = 3 V. Maximum voltage between LO and SENSE LO = 3 V.
Voltage Output Headroom	
40 V Range	Max. output voltage = 42 V – total voltage drop across source leads (maximum 1 Ω per source lead).
6 V Range	Max. output voltage = 8 V – total voltage drop across source leads (maximum 1 Ω per source lead).
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 an 100 kΩ load, 20 MHz BW.
Current Source Range Change Overshoot	<5% of larger range + 300 mV/R_{load} (typical with source settling set to SETTLE_SMOOTH_100NA). See Current Source Output Settling Time for additional test conditions.

NOTES

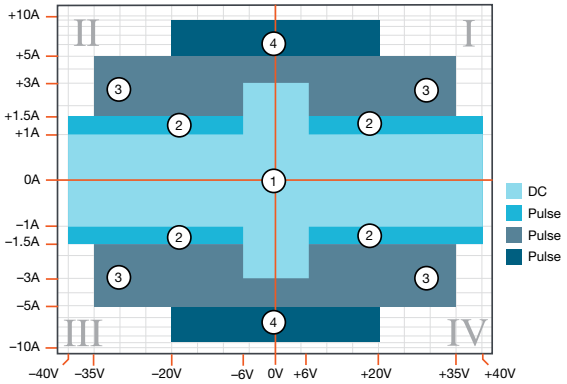
1. Add 50 µV to source accuracy specifications per volt of HI lead drop.

Pulse Specifications

Region	Maximum Current Limit	Maximum Pulse Width [1]	Maximum Duty Cycle [2]
1	1 A @ 40 V	DC, no limit	100%
1	3 A @ 6 V	DC, no limit	100%
2	1.5 A @ 40 V	100 ms	25%
3	5 A @ 35 V	4 ms	4%
4	10 A @ 20 V	1.8 ms	1%

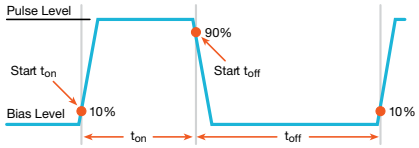
Minimum Programmable Pulse Width [3, 4]	100 µs. **Note:** Minimum pulse width for settled source at a given I/V output and load can be longer than 100 µs.
Pulse Width Programming Resolution	1 µs.
Pulse Width Programming Accuracy [4]	±5 µs.
Pulse Width Jitter	2 µs (typical).

Quadrant Diagram



NOTES

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

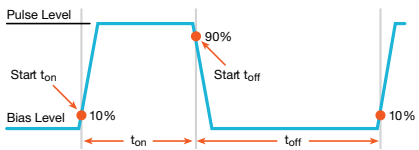


2. Thermally limited in sink mode (quadrants II and IV) and ambient temperatures above 30 °C. See power equations in the reference manual for more information.
3. Typical performance for minimum settled pulse widths:

Source Value	Load	Source Settling (% of range)	Min. Pulse Width
6 V	2 Ω	0.2%	150 µs
20 V	2 Ω	1%	200 µs
35 V	7 Ω	0.5%	500 µs
40 V	27 Ω	0.1%	400 µs
1.5 A	27 Ω	0.1%	1.5 ms
3 A	2 Ω	0.2%	150 µs
5 A	7 Ω	0.5%	500 µs
10 A	2 Ω	0.5%	200 µs

Typical tests were performed using remote operation, 4W sense, and best, fixed measurement range. For more information on pulse scripts, see the Series 2600B Reference Manual.

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



Meter Specifications (2601B, 2602B, 2604B)

Voltage Measurement Accuracy [1, 2]

Range	Default Display Resolution [3]	Input Resistance	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + volts)
100 mV	100 nV	>10 GΩ	0.015% + 150 µV
1 V	1 µV	>10 GΩ	0.015% + 200 µV
6 V	10 µV	>10 GΩ	0.015% + 1 mV
40 V	10 µV	>10 GΩ	0.015% + 8 mV

Temperature Coefficient (0°–18 °C and 28°–50 °C) [4]

±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Current Measurement Accuracy [2]

Range	Default Display Resolution [5]	Voltage Burden [6]	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + amps)
100 nA	100 fA	<1 mV	0.05% + 100 pA
1 µA	1 pA	<1 mV	0.025% + 500 pA
10 µA	10 pA	<1 mV	0.025% + 1.5 nA
100 µA	100 pA	<1 mV	0.02% + 25 nA
1 mA	1 nA	<1 mV	0.02% + 200 nA
10 mA	10 nA	<1 mV	0.02% + 2.5 µA
100 mA	100 nA	<1 mV	0.02% + 20 µA
1 A	1 µA	<1 mV	0.03% + 1.5 mA
3 A	1 µA	<1 mV	0.05% + 3.5 mA
10 A [7]	10 µA	<1 mV	0.4% + 25 mA (typical)

Current Measure Settling Time (time for measurement to settle after a V_{step}) [8]

Time required to reach within 0.1% of final value after source level command is processed on a fixed range. Values for V_{out} = 1 V unless noted.

Current Range	1 mA.
Settling Time	<100 µs (typical).

Temperature Coefficient (0°–18 °C and 28°–50 °C) [9]

±(0.15 × accuracy specification/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

NOTES

1. Add 50µV to source accuracy specifications per volt of HI lead drop.
2. e-rate accuracy specifications for NPLC setting <1 by increasing error term. Add appropriate % of range term using table below.

NPLC Setting	100 mV Range	1 V–40 V Ranges	100 nA Range	1 µA–100 mA Ranges	1 A–3 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 %

3. Applies when in single channel display mode.
4. High Capacitance Mode accuracy is applicable for 23 °C ±5 °C only.
5. Applies when in single channel display mode.
6. Four-wire remote sense only with current meter mode selected. Voltage measure set to 100mV or 1V range only.
7. 10 A range accessible only in pulse mode.
8. Compliance equal to 100mA.
9. High Capacitance Mode accuracy is applicable for 23 °C ±5 °C only.

Contact Check[1] (not available on Model 2604B)

Speed	Maximum Measurement Time To Memory For 60Hz (50Hz)	Accuracy (1 Year), 23 °C ±5 °C ±(%rdg. + ohms)
FAST	1 (1.2) ms	5% + 10 Ω
MEDIUM	4 (5) ms	5% + 1 Ω
SLOW	36 (42) ms	5% + 0.3 Ω

NOTES

1. Includes measurement of SENSE HI to HI and SENSE LO to LO contact resistances.

Additional Meter Specifications

Maximum Load Impedance	**Normal Mode:** 10 nF (typical). **High Capacitance Mode:** 50 µF (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.

High Capacitance Mode[1, 2, 3]

Voltage Source Output Settling Time

Time required to reach 0.1% of final value after source level command is processed on a fixed range. Current limit = 1 A.

Voltage Source Range	Settling Time with C_{load} = 4.7 µF
100 mV	200 µs (typical)
1 V	200 µs (typical)
6 V	200 µs (typical)
40 V	7 ms (typical)

Current Measure Settling Time

Time required to reach 0.1% of final value after voltage source is stabilized on a fixed range. Values below for V_{out} = 1V unless noted.

Current Measure Range	Settling Time
3 A – 1 A	<120 µs (typical) (R_{load} > 2 Ω)
100 mA – 10 mA	<100 µs (typical)
1 mA	< 3 ms (typical)
100 µA	< 3 ms (typical)
10 µA	< 230 ms (typical)
1 µA	< 230 ms (typical)

Capacitor Leakage Performance Using HIGH-C Scripts[4]

Load = 5 µF||10 MΩ. **Test:** 5 V step and measure. 200 ms (typical) @ 50 nA.

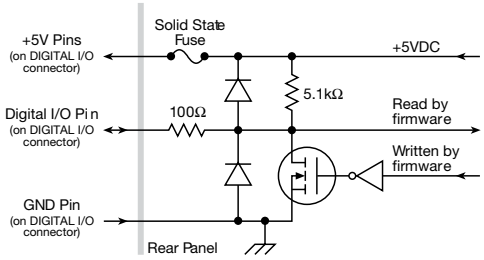
NOTES

1. High Capacitance Mode specifications are for DC measurements only.
2. 100 nA range is not available in High Capacitance Mode.
3. High Capacitance Mode utilizes locked ranges. Auto Range is disabled.
4. Part of KI Factory scripts. See reference manual for details.

Mode Change Delay	
100 µA Current Range and Above	Delay into High Capacitance Mode: 10 ms. Delay out of High Capacitance Mode: 10 ms.
1 µA and 10 µA Current Ranges	Delay into High Capacitance Mode: 230 ms. Delay out of High Capacitance Mode: 10 ms.
Voltmeter Input Impedance	10 GΩ in parallel with 3300 pF.
Noise, 10 Hz–20 MHz (6 V Range)	<30 mV peak-peak (typical).
Voltage Source Range Change Overshoot	<400 mV + 0.1% of larger range (typical). Overshoot into a 100 kΩ load, 20 MHz BW.

General (2601B, 2602B, 2604B)

IEEE-488	IEEE-488.1 compliant. Supports IEEE-488.2 common commands and status model topology.
USB Control (rear)	USB 2.0 device, TMC488 protocol.
RS-232	Baud rates from 300 bps to 115200 bps.
Ethernet	RJ-45 connector, LXI Class C, 10/100BT, no auto MDIX.
Expansion Interface	The TSP-Link expansion interface allows TSP enabled instruments to trigger and communicate with each other. (Not available on 2604B.)
Cable Type	Category 5e or higher LAN crossover cable.
Length	3 meters maximum between each TSP enabled instrument.
LXI Compliance	LXI Class C 1.4.
LXI Timing	**Total Output Trigger Response Time:** 245 µs min., 280 µs typ., (not specified) max. **Receive LAN[0-7] Event Delay:** Unknown. **Generate LAN[0-7] Event Delay:** Unknown.
Digital I/O Interface	(Not available on Model 2604B)



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	0.7 V, +850 µA max.
Minimum Logic High Input Voltage	2.1 V, +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 (not including 2604B).
5V Power Supply Pins	Limited to 250 mA total for all three pins, solid state fuse protected.
Output Enable	Active high input pulled down internally to ground with a 10 kΩ resistor; when the output enable input function has been activated, each SourceMeter channel will not turn on unless the output enable pin is driven to >2.1 V (nominal current = 2.1 V/10 kΩ = 210 µA).
USB File System (Front)	**USB 2.0 Host:** Mass storage class device.
Power Supply	100 V to 250 VAC, 50–60 Hz (auto sensing), 240 VA max.
Cooling	Forced air. Side intake and rear exhaust. One side must be unobstructed when rack mounted.
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 and feet):** 104mm high × 238mm wide × 460mm deep (4⅛ in × 9⅜ in × 17½ in).
Weight	**2601B:** 4.75 kg (10.4 lbs). **2602B, 2604B:** 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.

See pages 30 and 31 for measurement speeds and other specifications.

Specification Conditions (2611B, 2612B, 2614B)

This document contains specifications and supplemental information for the 2611B, 2612B, and 2614B System SourceMeter® SMU instruments. Specifications are the standards against which the 2611B, 2612B, and 2614B are tested. Upon leaving the factory the 2611B, 2612B, and 2614B meet these specifications. Supplemental and typical values are non-warranted, apply at 23 °C, and are provided solely as useful information.

Accuracy specifications are applicable for both normal and high capacitance modes.

The source and measurement accuracies are specified at the SourceMeter CHANNEL A (2611B, 2612B, and 2614B) or SourceMeter CHANNEL B (2612B, 2614B) terminals under the following conditions:

1. 23 °C ± 5 °C, <70% relative humidity
2. After 2 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 = 1 year

Source Specifications (2611B, 2612B, 2614B)

Voltage Source Specifications

Voltage Programming Accuracy[1]

Range	Programming Resolution	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + volts)	Typical Noise (peak-peak) 0.1Hz–10Hz
200 mV	5 µV	0.02% + 375 µV	20 µV
2 V	50 µV	0.02% + 600 µV	50 µV
20 V	500 µV	0.02% + 5 mV	300 µV
200 V	5 mV	0.02% + 50 mV	2 mV

Temperature Coefficient (0°–18 °C and 28°–50 °C)[2]
±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Maximum Output Power and Source/Sink Limits[3]
30.3W 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[4] — Bipolar current limit (compliance) set with single value. Minimum value is 10 nA. Accuracy same as current source.

Overshoot — <±(0.1% + 10 mV) typical. Step size = 10% to 90% of range, resistive load, maximum current limit/compliance.

Guard Offset Voltage — <4 mV typical. Current <10 mA.

NOTES

1. Add 50 µV to source accuracy specifications per volt of HI lead drop.
2. High Capacitance Mode accuracy is applicable at 23 °C ±5 °C only.
3. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B Reference Manual for additional power derating information.
4. For sink mode operation (quadrants II and IV), add 0.06% of limit range to the corresponding current limit accuracy specifications. Specifications apply with sink mode operation enabled.

Current Source Specifications

Current Programming Accuracy [1]

Range	Programming Resolution	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + amps)	Typical Noise (peak-peak) 0.1Hz–10Hz
100 nA	2 pA	0.06% + 100 pA	5 pA
1 µA	20 pA	0.03% + 800 pA	25 pA
10 µA	200 pA	0.03% + 5 nA	60 pA
100 µA	2 nA	0.03% + 60 nA	3 nA
1 mA	20 nA	0.03% + 300 nA	6 nA
10 mA	200 nA	0.03% + 6 µA	200 nA
100 mA	2 µA	0.03% + 30 µA	600 nA
1 A [2]	20 µA	0.05% + 1.8 mA	70 µA
1.5 A [2]	20 µA	0.06% + 4 mA	150 µA
10 A [2, 3]	200 µA	0.5% + 40 mA (typical)	

Temperature Coefficient (0°–18 °C and 28°–50 °C) [4]
±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Maximum Output Power and Source/Sink Limits [5]
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 + 100 pA).

Voltage Limit/Compliance [6]
Bipolar voltage limit (compliance) set with a single value. Minimum value is 20 mV. Accuracy is the same as voltage source.

Overshoot
<±0.1% typical. Step size = 10% to 90% of range, resistive load; see Current Source Output Settling Time for additional test conditions).

Additional Source Specifications

Transient Response Time
<70 µs for the output to recover to within 0.1% for a 10% to 90% step change in load.

Voltage Source Output Settling Time
Time required to reach within 0.1% of final value after source level command is processed on a fixed range.

100 mV, 1 V Ranges	<50 µs typical.
6 V Range	<100 µs typical.
40 V Range [6]	<150 µs typical.

NOTES

1. Accuracy specifications do not include connector leakage. Derate accuracy by V_{out}/2E11 per °C when operating between 18°–28 °C. Derate accuracy by V_{out}/2E11 + (0.15 · V_{out}/2E11) per °C when operating <18 °C and >28 °C.
2. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B Reference Manual for additional power derating information.
3. 10 A range accessible only in pulse mode.
4. High Capacitance Mode accuracy is applicable at 23 °C ±5 °C only.
5. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B Reference Manual for additional power derating information.
6. 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 200 mV range add an additional 120 mV of uncertainty.

Current Source Output Settling Time	Time required to reach within 0.1% of final value after source level command is processed on a fixed range. Values below for $I_{out} \times R_{load}$ = 1 V unless noted.
3 A Range	<80 µs typical (current less than 2.5 A, R_{load} >2 Ω).
1 A–10 mA Ranges	<80 µs typical (R_{load} >6 Ω).
1 mA Range	<100 µs typical.
100 µA Range	<150 µs typical.
10 µA Range	<500 µs typical.
1 µA Range	<2.5 ms typical.
100 nA Range	<25 ms typical.
DC Floating Voltage	Output can be floated up to ±250 VDC from chassis ground.
Remote Sense Operating Range [1]	Maximum voltage between HI and SENSE HI = 3 V. Maximum voltage between LO and SENSE LO = 3 V.
Voltage Output Headroom	
40 V Range	Max. output voltage = 42 V – total voltage drop across source leads (maximum 1 Ω per source lead).
6 V Range	Max. output voltage = 8 V – total voltage drop across source leads (maximum 1 Ω per source lead).
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 an 100 kΩ load, 20 MHz BW.
Current Source Range Change Overshoot	<5% of larger range + 300 mV/R_{load} (typical with source settling set to SETTLE_SMOOTH_100NA). See Current Source Output Settling Time for additional test conditions.

NOTES

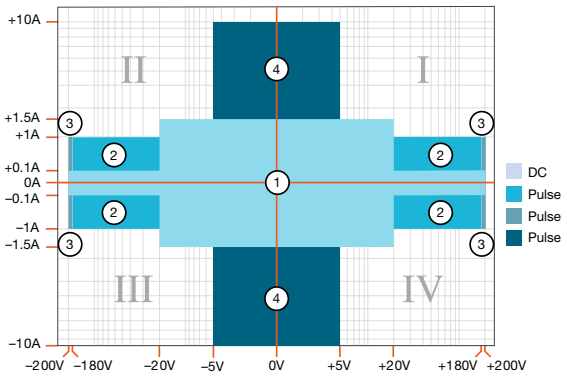
1. Add 50 µV to source accuracy specifications per volt of HI lead drop.

Pulse Specifications

Region	Maximum Current Limit	Maximum Pulse Width [1]	Maximum Duty Cycle [2]
1	100 mA @ 200 V	DC, no limit	100%
1	1.5 A @ 20 V	DC, no limit	100%
2	1 A @ 180 V	8.5 ms	1%
3 [3]	1 A @ 200 V	2.2 ms	1%
4	10 A @ 5 V	1 ms	2.2%

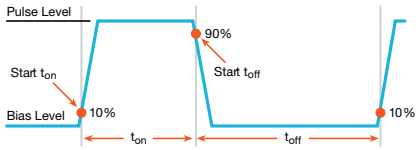
Minimum Programmable Pulse Width [4, 5]	100 µs. **Note:** Minimum pulse width for settled source at a given I/V output and load can be longer than 100 µs.
Pulse Width Programming Resolution	1 µs.
Pulse Width Programming Accuracy [5]	±5 µs.
Pulse Width Jitter	2 µs (typical).

Quadrant Diagram



NOTES

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

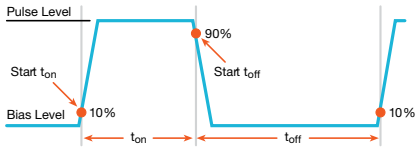


2. Thermally limited in sink mode (quadrants II and IV) and ambient temperatures above 30 °C. See power equations in the reference manual for more information.
3. Voltage source operation with 1.5 A current limit.
4. Typical performance for minimum settled pulse widths:

Source Value	Load	Source Settling (% of range)	Min. Pulse Width
5 V	0.5 Ω	1%	300 µs
20 V	200 Ω	0.2%	200 µs
180 V	180 Ω	0.2%	5 ms
200 V (1.5 A Limit)	200 Ω	0.2%	1.5 ms
100 mA	200 Ω	1%	200 µs
1 A	200 Ω	1%	500 µs
1 A	180 Ω	0.2%	5 ms
10 A	0.5 Ω	0.5%	300 µs

Typical tests were performed using remote operation, 4W sense, and best, fixed measurement range. For more information on pulse scripts, see the Series 2600B Reference Manual.

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



Meter Specifications (2611B, 2612B, 2614B)

Voltage Measurement Accuracy [1, 2]

Range	Default Display Resolution [3]	Input Resistance	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + volts)
200 mV	100 nV	>10 GΩ	0.015% + 225 µV
2 V	1 µV	>10 GΩ	0.02% + 350 µV
20 V	10 µV	>10 GΩ	0.015% + 5 mV
200 V	100 µV	>10 GΩ	0.015% + 50 mV

Temperature Coefficient (0°–18 °C and 28°–50 °C) [4]
±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Current Measurement Accuracy [2, 5]

Range	Default Display Resolution [6]	Voltage Burden [7]	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + amps)
100 nA	100 fA	<1 mV	0.06% + 100 pA
1 µA	1 pA	<1 mV	0.025% + 500 pA
10 µA	10 pA	<1 mV	0.025% + 1.5 nA
100 µA	100 pA	<1 mV	0.02% + 25 nA
1 mA	1 nA	<1 mV	0.02% + 200 nA
10 mA	10 nA	<1 mV	0.02% + 2.5 µA
100 mA	100 nA	<1 mV	0.02% + 20 µA
1 A	1 µA	<1 mV	0.03% + 1.5 mA
1.5 A	1 µA	<1 mV	0.05% + 3.5 mA
10 A [8]	10 µA	<1 mV	0.4% + 25 mA (typical)

Current Measure Settling Time (time for measurement to settle after a V_{step}) [9]
Time required to reach within 0.1% of final value after source level command is processed on a fixed range. Values for V_{out} = 1 V unless noted.

Current Range	1 mA.
Settling Time	<100 µs (typical).

Temperature Coefficient (0°–18 °C and 28°–50 °C) [10]
±(0.15 × accuracy specification/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Additional Meter Specifications

Maximum Load Impedance	**Normal Mode:** 10 nF (typical). **High Capacitance Mode:** 50 µF (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.

Contact Check [11] (not available on 2614B)

Speed	Maximum Measurement Time to Memory For 60 Hz (50 Hz)	Accuracy (1 Year), 23 °C ±5 °C ±(%rdg. + ohms)
FAST	1 (1.2) ms	5% + 10 Ω
MEDIUM	4 (5) ms	5% + 1 Ω
SLOW	36 (42) ms	5% + 0.3 Ω

NOTES

1. Add 50 µV to source accuracy specifications per volt of HI lead drop.
2. Derate 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%

3. Applies when in single channel display mode.
4. High Capacitance Mode accuracy is applicable for 23 °C ±5 °C only.
5. Accuracy specifications do not include connector leakage. De-rate accuracy by V_{out}/2E11 per °C when operating between 18°–28 °C. Derate accuracy by V_{out}/2E11 + (0.15 · V_{out}/2E11) per °C when operating <18° and >28 °C
6. Applies when in single channel display mode.
7. Four-wire remote sense only with current meter mode selected. Voltage measure set to 200 mV or 2 V range only.
8. 10 A range accessible only in pulse mode.
9. Compliance equal to 100 mA.
10. High Capacitance Mode accuracy is applicable for 23 °C ±5 °C only.
11. Includes measurement of SENSE HI to HI and SENSE LO to LO contact resistances.

High Capacitance Mode [1, 2, 3]

Voltage Source Output Settling Time

Time required to reach 0.1% of final value after source level command is processed on a fixed range. Current limit = 1 A.

Voltage Source Range	Settling Time with C_{load} = 4.7 µF
200 mV	600 µs (typical)
2 V	600 µs (typical)
20 V	1.5 µs (typical)
200 V	20 ms (typical)

Current Measure Settling Time

Time required to reach 0.1% of final value after voltage source is stabilized on a fixed range. Values below for V_{out} = 2 V unless noted.

Current Measure Range	Settling Time
1.5 A – 1 A	<120 µs (typical) (R_{load} > 6 Ω)
100 mA – 10 mA	<100 µs (typical)
1 mA	< 3 ms (typical)
100 µA	< 3 ms (typical)
10 µA	< 230 ms (typical)
1 µA	< 230 ms (typical)

Capacitor Leakage Performance Using HIGH-C Scripts [4]

Load = 5 µF||10 MΩ. **Test:** 5 V step and measure. 200 ms (typical) @ 50 nA.

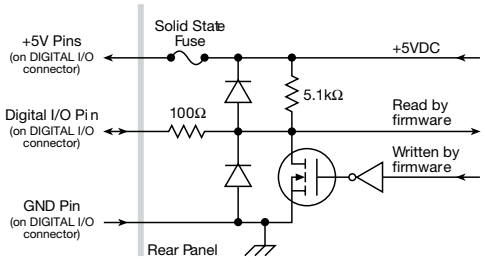
NOTES

1. High Capacitance Mode specifications are for DC measurements only.
2. 100 nA range is not available in High Capacitance Mode.
3. High Capacitance Mode utilizes locked ranges. Auto Range is disabled.
4. Part of KI Factory scripts. See reference manual for details.

Mode Change Delay	
100 µA Current Range and Above	Delay into High Capacitance Mode: 10 ms. Delay out of High Capacitance Mode: 10 ms.
1 µA and 10 µA Current Ranges	Delay into High Capacitance Mode: 230 ms. Delay out of High Capacitance Mode: 10 ms.
Voltmeter Input Impedance	30 GΩ in parallel with 3300 pF.
Noise, 10 Hz–20 MHz (20 V Range)	<30 mV peak-peak (typical).
Voltage Source Range Change Overshoot (for 20 V range and below)	<400 mV + 0.1% of larger range (typical). Overshoot into a 200 kΩ load, 20 MHz BW.

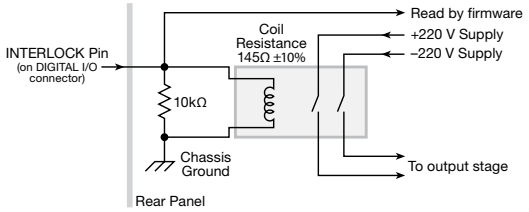
General (2611B, 2612B, 2614B)

IEEE-488	IEEE-488.1 compliant. Supports IEEE-488.2 common commands and status model topology.
USB Control (rear)	USB 2.0 device, TMC488 protocol.
RS-232	Baud rates from 300 bps to 115200 bps.
Ethernet	RJ-45 connector, LXI Class C, 10/100BT, no auto MDIX.
Expansion Interface	The TSP-Link expansion interface allows TSP enabled instruments to trigger and communicate with each other. (Not available on 2614B.)
Cable Type	Category 5e or higher LAN crossover cable.
Length	3 meters maximum between each TSP enabled instrument.
LXI Compliance	LXI Class C 1.4.
LXI Timing	**Total Output Trigger Response Time:** 245 µs min., 280 µs typ., (not specified) max. **Receive LAN[0-7] Event Delay:** Unknown. **Generate LAN[0-7] Event Delay:** Unknown.
Digital I/O Interface	(Not available on Model 2614B)



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	0.7 V, +850 µA max.
Minimum Logic High Input Voltage	2.1 V, +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.
5 V Power Supply Pins	Limited to 250 mA total for all three pins, 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 ensure 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:



USB File System (Front)	**USB 2.0 Host:** Mass storage class device.
Power Supply	100 V to 250 VAC, 50–60 Hz (auto sensing), 240 VA max.
Cooling	Forced air. Side intake and rear exhaust. One side must be unobstructed when rack mounted.
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 and feet):** 104mm high × 238mm wide × 460mm deep (4⅛ in × 9⅜ in × 17½ in).
Weight	**2611B:** 4.75 kg (10.4 lbs). **2612B, 2614B:** 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.

See pages 30 and 31 for measurement speeds and other specifications.

Specification Conditions (2634B, 2635B, 2636B)

This document contains specifications and supplemental information for the 2634B, 2635B, and 2636B System SourceMeter® SMU instruments. Specifications are the standards against which the 2634B, 2635B, and 2636B are tested. Upon leaving the factory, the 2634B, 2635B, and 2636B meet these specifications. Supplemental and typical values are non-warranted, apply at 23 °C, and are provided solely as useful information.

Accuracy specifications are applicable for both normal and high capacitance modes.

The source and measurement accuracies are specified at the SourceMeter CHANNEL A (2634B, 2635B, and 2636B) or SourceMeter CHANNEL B (2634B, 2636B) terminals under the following conditions:

1. 23 °C ± 5 °C, <70% relative humidity
2. After 2 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 = 1 year

Source Specifications (2634B, 2635B, 2636B)

Voltage Source Specifications

Voltage Programming Accuracy[1]

Range	Programming Resolution	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + volts)	Typical Noise (peak-peak) 0.1Hz–10Hz
200 mV	5 µV	0.02% + 375 µV	20 µV
2 V	50 µV	0.02% + 600 µV	50 µV
20 V	500 µV	0.02% + 5 mV	300 µV
200 V	5 mV	0.02% + 50 mV	2 mV

Temperature Coefficient (0°–18 °C and 28°–50 °C)[2]
±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Maximum Output Power and Source/Sink Limits[3]
30.3W 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[4] — Bipolar current limit (compliance) set with single value. Minimum value is 100 pA. Accuracy is the same as current source.

Overshoot — <±(0.1% + 10 mV) typical. Step size = 10% to 90% of range, resistive load, maximum current limit/compliance.

Guard Offset Voltage — <4 mV typical. Current <10 mA.

NOTES

1. Add 50 µV to source accuracy specifications per volt of HI lead drop.
2. High Capacitance Mode accuracy is applicable at 23 °C ±5 °C only.
3. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B Reference Manual for additional power derating information.
4. For sink mode operation (quadrants II and IV), add 0.06% of limit range to the corresponding current limit accuracy specifications. Specifications apply with sink mode operation enabled.

Current Source Specifications

Current Programming Accuracy

Range	Programming Resolution	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + amps)	Typical Noise (peak-peak) 0.1Hz–10Hz
1 nA	20 fA	0.15% + 2 pA	800 fA
10 nA	200 fA	0.15% + 5 pA	2 pA
100 nA	2 pA	0.06% + 50 pA	5 pA
1 µA	20 pA	0.03% + 700 pA	25 pA
10 µA	200 pA	0.03% + 5 nA	60 pA
100 µA	2 nA	0.03% + 60 nA	3 nA
1 mA	20 nA	0.03% + 300 nA	6 nA
10 mA	200 nA	0.03% + 6 µA	200 nA
100 mA	2 µA	0.03% + 30 µA	600 nA
1 A [1]	20 µA	0.05% + 1.8 mA	70 µA
1.5 A [1]	50 µA	0.06% + 4 mA	150 µA
10 A [1, 2]	200 µA	0.5 % + 40 mA (typical)	

Temperature Coefficient (0°–18 °C and 28°–50 °C) [3]
±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

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 + 100 pA).

Voltage Limit/Compliance [5]
Bipolar voltage limit (compliance) set with a single value. Minimum value is 20 mV. Accuracy is the same as voltage source.

Overshoot
<±0.1% typical. Step size = 10% to 90% of range, resistive load; see Current Source Output Settling Time for additional test conditions).

Additional Source Specifications

Transient Response Time
<70 µs for the output to recover to within 0.1% for a 10% to 90% step change in load.

Voltage Source Output Settling Time
Time required to reach within 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)

NOTES

1. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B Reference Manual for additional power derating information.
2. 10 A range accessible only in pulse mode.
3. High Capacitance Mode accuracy is applicable at 23 °C ±5 °C only.
4. Full power source operation regardless of load to 30 °C ambient. Above 30 °C and/or power sink operation, refer to "Operating Boundaries" in the Series 2600B 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 200 mV range add an additional 120 mV of uncertainty.

Current Source Output Settling Time

Time required to reach within 0.1% of final value after source level command is processed on a fixed range. Values below for $I_{out} \times R_{load}$ = 1 V unless noted.

Range	Settling Time
1.5 A – 1 A	<120 µs (typical) (R_{load} > 6Ω)
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 from chassis ground.

Remote Sense Operating Range [1]

Maximum voltage between HI and SENSE HI = 3 V.
Maximum voltage between LO and SENSE LO = 3 V.

Voltage Output Headroom

200 V Range

Max. output voltage = 202.3 V – total voltage drop across source leads (maximum 1 Ω per source lead).

20 V Range

Max. output voltage = 23.3 V – total voltage drop across source leads (maximum 1 Ω per source lead).

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/R_{load} (typical with source settling set to SETTLE_SMOOTH_100NA). See Current Source Output Settling Time for additional test conditions.

NOTES

1. Add 50 µV to source accuracy specifications per volt of HI lead drop.

Pulse Specifications

Region	Maximum Current Limit	Maximum Pulse Width [1]	Maximum Duty Cycle [2]
1	100 mA @ 200 V	DC, no limit	100%
1	1.5 A @ 20 V	DC, no limit	100%
2	1 A @ 180 V	8.5 ms	1%
3 [3]	1 A @ 200 V	2.2 ms	1%
4	10 A @ 5 V	1 ms	2.2%

Minimum Programmable Pulse Width [4, 5]

100 µs.
Note: Minimum pulse width for settled source at a given I/V output and load can be longer than 100 µs.

Pulse Width Programming Resolution

1 µs.

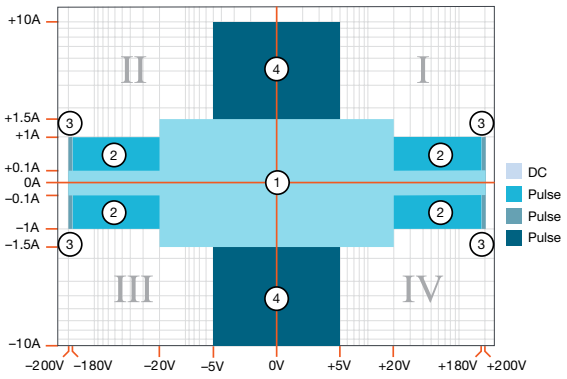
Pulse Width Programming Accuracy [5]

±5 µs.

Pulse Width Jitter

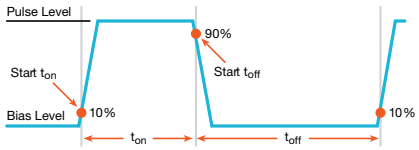
50 µs (typical).

Quadrant Diagram



NOTES

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

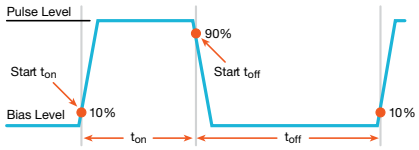


2. Thermally limited in sink mode (quadrants II and IV) and ambient temperatures above 30 °C. See power equations in the reference manual for more information.
3. Voltage source operation with 1.5 A current limit.
4. Typical performance for minimum settled pulse widths:

Source Value	Load	Source Settling (% of range)	Min. Pulse Width
5 V	0.5 Ω	1%	300 µs
20 V	200 Ω	0.2%	200 µs
180 V	180 Ω	0.2%	5 ms
200 V (1.5 A Limit)	200 Ω	0.2%	1.5 ms
100 mA	200 Ω	1%	200 µs
1 A	200 Ω	1%	500 µs
1 A	180 Ω	0.2%	5 ms
10 A	0.5 Ω	0.5%	300 µs

Typical tests were performed using remote operation, 4W sense, and best, fixed measurement range. For more information on pulse scripts, see the Series 2600B Reference Manual.

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



Meter Specifications (2634B, 2635B, 2636B)

Voltage Measurement Accuracy [1, 2]

Range	Default Display Resolution [3]	Input Resistance	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + volts)
200 mV	100 nV	>10^{14} Ω	0.015% + 225 µV
2 V	1 µV	>10^{14} Ω	0.02% + 350 µV
20 V	10 µV	>10^{14} Ω	0.015% + 5 mV
200 V	100 µV	>10^{14} Ω	0.015% + 50 mV

Temperature Coefficient (0°–18 °C and 28°–50 °C) [4]

±(0.15 × accuracy specification)/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

Current Measurement Accuracy [2]

Range	Default Display Resolution [5]	Voltage Burden [6]	Accuracy (1 Year), 23 °C ±5 °C ±(% rdg. + amps)
*100 pA [7, 8]	0.1 fA	<1 mV	0.15% + 120 fA
1 nA [7, 9]	1 fA	<1 mV	0.15% + 240 fA
10 nA	10 fA	<1 mV	0.15% + 3 pA
100 nA	100 fA	<1 mV	0.06% + 40 pA
1 µA	1 pA	<1 mV	0.025% + 400 pA
10 µA	10 pA	<1 mV	0.025% + 1.5 nA
100 µA	100 pA	<1 mV	0.02% + 25 nA
1 mA	1 nA	<1 mV	0.02% + 200 nA
10 mA	10 nA	<1 mV	0.02% + 2.5 µA
100 mA	100 nA	<1 mV	0.02% + 20 µA
1 A	1 µA	<1 mV	0.03% + 1.5 mA
1.5 A	1 µA	<1 mV	0.05% + 3.5 mA
10 A [10]	10 µA	<1 mV	0.4% + 25 mA

*100 pA range not available on Model 2634B.

Current Measure Settling Time (time for measurement to settle after a V_{step}) [11]

Time required to reach within 0.1% of final value after source level command is processed on a fixed range. Values for V_{out} = 2 V unless noted.

Current Range	1 mA.
Settling Time	<100 µs (typical).

Temperature Coefficient (0°–18 °C and 28°–50 °C) [12]

±(0.15 × accuracy specification/°C. Applicable for normal mode only. Not applicable for high capacitance mode.

NOTES

1. Add 50 µV to source accuracy specifications per volt of HI lead drop.
2. Derate 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%

3. Applies when in single channel display mode.
4. High Capacitance Mode accuracy is applicable for 23 °C ±5 °C only.
5. Applies when in single channel display mode.
6. Four-wire remote sense only with current meter mode selected. Voltage measure set to 200 mV or 2 V range only.
7. 10-NPLC, 11-Point Median Filter, <200 V range, measurements made within 1 hour after zeroing. 23 °C ± 1 °C
8. Under default specification conditions: ±(0.15% + 750 fA).
9. Under default specification conditions: ±(0.15% + 1 pA).
10. 10 A range accessible only in pulse mode.
11. Delay factor set to 1. Compliance equal to 100 mA.

12. High Capacitance Mode accuracy is applicable for 23 °C ±5 °C only.

Additional Meter Specifications

Maximum Load Impedance	**Normal Mode:** 10 nF (typical). **High Capacitance Mode:** 50 µF (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	$>10^{14}$Ω.

Contact Check [1] (not available on 2634B)

Speed	Maximum Measurement Time to Memory For 60 Hz (50 Hz)	Accuracy (1 Year), 23 °C ±5 °C ±(%rdg. + ohms)
FAST	1 (1.2) ms	5% + 10 Ω
MEDIUM	4 (5) ms	5% + 1 Ω
SLOW	36 (42) ms	5% + 0.3 Ω

High Capacitance Mode [2, 3, 4]

Voltage Source Output Settling Time

Time required to reach 0.1% of final value after source level command is processed on a fixed range. Current limit = 1 A.

Voltage Source Range	Settling Time with C_{load} = 4.7 µF
200 mV	600 µs (typical)
2 V	600 µs (typical)
20 V	1.5 µs (typical)
200 V	20 ms (typical)

Current Measure Settling Time

Time required to reach 0.1% of final value after voltage source is stabilized on a fixed range. Values below for V_{out} = 2 V unless noted.

Current Measure Range	Settling Time
1.5 A – 1 A	<120 µs (typical) (R_{load} > 6 Ω)
100 mA – 10 mA	<100 µs (typical)
1 mA	< 3 ms (typical)
100 µA	< 3 ms (typical)
10 µA	< 230 ms (typical)
1 µA	< 230 ms (typical)

Capacitor Leakage Performance Using HIGH-C Scripts [5]

Load = 5 µF||10 MΩ. **Test:** 5 V step and measure. 200 ms (typical) @ 50 nA.

NOTES

1. Includes measurement of SENSE HI to HI and SENSE LO to LO contact resistances.
2. High Capacitance Mode specifications are for DC measurements only.
3. 100 nA range is not available in High Capacitance Mode.
4. High Capacitance Mode utilizes locked ranges. Auto Range is disabled.
5. Part of KI Factory scripts. See reference manual for details.

Mode Change Delay

100 µA Current Range and Above	Delay into High Capacitance Mode: 10 ms. Delay out of High Capacitance Mode: 10 ms.
1 µA and 10 µA Current Ranges	Delay into High Capacitance Mode: 230 ms. Delay out of High Capacitance Mode: 10 ms.

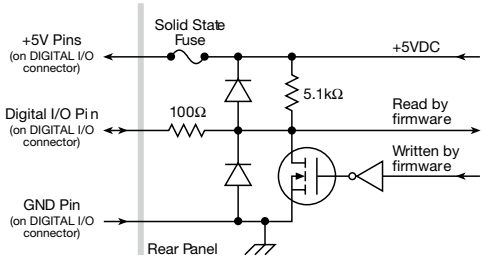
Voltmeter Input Impedance 30 GΩ in parallel with 3300 pF.

Noise, 10 Hz–20 MHz (20 V Range)	<30 mV peak-peak (typical).

Voltage Source Range Change Overshoot (for 20 V range and below)
<400 mV + 0.1% of larger range (typical). Overshoot into a 200 kΩ load, 20 MHz BW.

General (2634B, 2635B, 2636B)

IEEE-488	IEEE-488.1 compliant. Supports IEEE-488.2 common commands and status model topology.
USB Control (rear)	USB 2.0 device, TMC488 protocol.
RS-232	Baud rates from 300 bps to 115200 bps. Programmable number of data bits, parity type, and flow control (RTS/CTS hardware or none).
Ethernet	RJ-45 connector, LXI Class C, 10/100BT, no auto MDIX.
Expansion Interface	The TSP-Link expansion interface allows TSP enabled instruments to trigger and communicate with each other. (Not available on 2634B.)
Cable Type	Category 5e or higher LAN crossover cable.
Length	3 meters maximum between each TSP enabled instrument.
LXI Compliance	LXI Class C 1.4.
LXI Timing	**Total Output Trigger Response Time:** 245 µs min., 280 µs typ., (not specified) max. **Receive LAN[0-7] Event Delay:** Unknown. **Generate LAN[0-7] Event Delay:** Unknown.
Digital I/O Interface	(Not available on Model 2634B)



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.

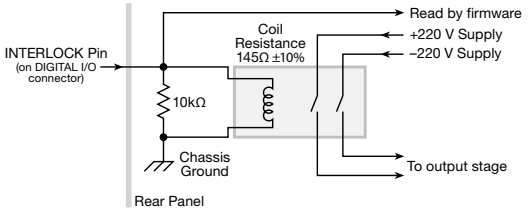
Maximum Logic Low Input Voltage
0.7 V, +850 µA max.

Minimum Logic High Input Voltage
2.1 V, +570 µA.

Maximum Source Current (flowing out of Digital I/O bit)
+960 µA.

Maximum Sink Current @ Maximum Logic Low Voltage (0.7 V)
–5.0 mA.

Absolute Maximum Sink Current (flowing into Digital I/O pin)	–11 mA.
5 V Power Supply Pins	Limited to 250 mA total for all three pins, 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 ensure 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:



USB File System (Front)	**USB 2.0 Host:** Mass storage class device.
Power Supply	100 V to 250 VAC, 50–60 Hz (auto sensing), 240 VA max.
Cooling	Forced air. Side intake and rear exhaust. One side must be unobstructed when rack mounted.
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 and feet):** 104mm high × 238mm wide × 460mm deep (4⅛ in × 9⅜ in × 17½ in).
Weight	**2635B:** 4.75 kg (10.4 lbs). **2634B, 2636B:** 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.

See pages 30 and 31 for measurement speeds and other specifications.

Measurement Speed Specifications [1, 2, 3] (All Instruments)

Maximum Sweep Operation Rates (operations per second) for 60Hz (50Hz):

A/D Converter Speed	Trigger Origin	Measure To Memory Using User Scripts	Measure To GPIB Using User Scripts	Source Measure To Memory Using User Scripts	Source Measure To GPIB Using User Scripts	Source Measure To Memory Using Sweep API	Source Measure To GPIB Using Sweep API
0.001 NPLC	Internal	20000 (20000)	10500 (10500)	7000 (7000)	6200 (6200)	12000 (12000)	5900 (5900)
0.001 NPLC	Digital I/O	8100 (8100)	7100 (7100)	5500 (5500)	5100 (5100)	11200 (11200)	5700 (5700)
0.01 NPLC	Internal	5000 (4000)	4000 (3500)	3400 (3000)	3200 (2900)	4200 (3700)	3100 (2800)
0.01 NPLC	Digital I/O	3650 (3200)	3400 (3000)	3000 (2700)	2900 (2600)	4150 (3650)	3050 (2775)
0.1 NPLC	Internal	580 (490)	560 (475)	550 (465)	550 (460)	575 (480)	545 (460)
0.1 NPLC	Digital I/O	560 (470)	450 (460)	545 (460)	540 (450)	570 (480)	545 (460)
1.0 NPLC	Internal	59 (49)	59 (49)	59 (49)	59 (49)	59 (49)	59 (49)
1.0 NPLC	Digital I/O	58 (48)	58 (49)	59 (49)	59 (49)	59 (49)	59 (49)

Maximum Single Operation Rates (operations per second) for 60Hz (50Hz):

A/D Converter Speed	Trigger Origin	Measure To GPIB	Source Measure To GPIB	Source Measure Pass/Fail To GPIB
0.001 NPLC	Internal	1900 (1800)	1400 (1400)	1400 (1400)
0.01 NPLC	Internal	1450 (1400)	1200 (1100)	1100 (1100)
0.1 NPLC	Internal	450 (390)	425 (370)	425 (375)
1.0 NPLC	Internal	58 (48)	57 (48)	57 (48)

Maximum Measurement Range Change Rate
<150 µs for ranges >10 µA, typical. When changing to or from a range ≥1 A, maximum rate is <450 µs, typical.

Maximum Source Range Change Rate
<2.5 ms for ranges >10 µA, typical. When changing to or from a range ≥1 A, maximum rate is <5.2 ms, typical.

Maximum Source Function Change Rate
<1 ms, typical.

Command Processing Time
Maximum time required for the output to begin to change following the receipt of the smux.source.levelv or smux.source.leveli command. <1 ms typical.

NOTES
1. Tests performed with a 2602B, 2612B, or 2636B on Channel A using the following equipment: PC Hardware (Pentium® 4 2.4 GHz, 512 MB RAM, National Instruments PCI-GPIB). Driver (NI-486.2 Version 2.2 PCI-GPIB). Software (Microsoft® Windows® 2000, Microsoft Visual Studio 2005, VISA version 4.1).
2. Exclude current measurement ranges less than 1 mA.
3. 2635B/2636B with default measurement delays and filters disabled.

Triggering and Synchronization Specifications [1]

Triggering

Trigger in to Trigger Out 0.5 µs, typical.

Trigger in to Source Change [2] 10 µs, typical.

Trigger Timer Accuracy ±2 µs, typical.

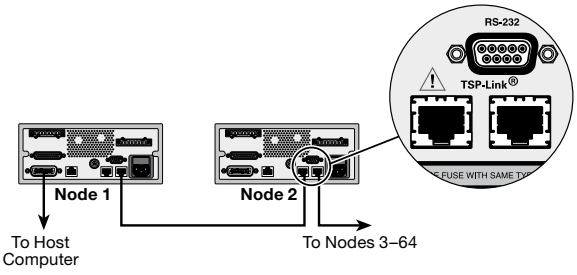
Source Change [2] After LXI Trigger
280 µs, typical.

Synchronization
Single-Node Synchronized Source Change [2]: <0.5 µs, typical.
Multi-Node Synchronized Source Change [2]: <0.5 µs, typical.

NOTES
1. TSP-Link not available on 2604B, 2614B, and 2634B.
2. Fixed source range, with no polarity change.

Supplemental Information (All Instruments)

Front Panel Interface		Two-line vacuum fluorescent display (VFD) with keypad and rotary knob.
	Display	Show error messages and user defined messages. Display source and limit settings. Show current and voltage measurements. View measurements stored in dedicated reading buffers.
	Keypad Operations	Change host interface settings. Save and restore instrument setups. Load and run factory and user defined test scripts (i.e. sequences) that prompt for input and send results to the display. Store measurements into dedicated reading buffers.
Programming		Embedded Test Script Processor (TSP) accessible from any host interface. Responds to individual instrument control commands. Responds to high speed test scripts comprised of instrument control commands and Test Script Language (TSL) statements (e.g. branching, looping, math, etc.). Able to execute high speed test scripts stored in memory without host intervention.
	Minimum Memory Available	16 MB (approximately 250,000 lines of TSL code).
	Test Script Builder	Integrated development environment for building, running, and managing TSP scripts. Includes an instrument console for communicating with any TSP enabled instrument in an interactive manner. Requires: VISA (NI-VISA included on CD) Pentium III 800MHz or faster personal computer Microsoft .NET Framework (included on CD) Microsoft Windows 98, NT, 2000, or XP Keithley I/O Layer (included on CD)
	Software Interface	TSP Express (embedded), Direct GPIB/VISA, READ/WRITE for VB, VC/C++, LabVIEW, LabWindows/CVI, etc.
Reading Buffers		Dedicated storage area(s) reserved for measurement data. Reading buffers are arrays of measurement elements. Each element can hold the following items: Measurement Source setting (at the time the measurement was taken) Measurement Status Range information Timestamp
		Two reading buffers are reserved for each SourceMeter channel. Reading buffers can be filled using the front panel STORE key and retrieved using the RECALL key or host interface. **Buffer Size, with timestamp and source setting:** >60,000 samples. **Buffer Size, without timestamp and source setting:** >140,000 samples.
System Expansion		The TSP-Link expansion interface allows TSP enabled instruments to trigger and communicate with each other. Not applicable for 2604B, 2614B, and 2634B. See figure below:



Each SourceMeter SMU instrument has two TSP-Link connectors to facilitate chaining instruments together.

Once SourceMeter SMU instruments are interconnected via TSP-Link, a computer can access all of the resources of each SourceMeter SMU instrument via the host interface of any SourceMeter SMU instrument.

A maximum of 32 TSP-Link nodes can be interconnected. Each SourceMeter SMU instrument consumes one TSP-Link node.

TIMER	Free running 47-bit counter with 1 MHz clock input. Reset each time instrument powers up. Rolls over every 4 years.
Timestamp	TIMER value automatically saved when each measurement is triggered.
Resolution	1 µs.
Accuracy	±100 ppm.

Supplied Accessories (All Instruments)

Operators and Programming Manuals	
2600-ALG-2	Low Noise Triax Cable with Alligator Clips, 2 m (6.6 ft.) (two supplied with 2634B and 2636B, one with 2635B)
2600-Kit	Screw Terminal Connector Kit (2601B, 2602B, 2604B, 2611B, 2612B, 2614B)
2600B-800A	Series 2400 Emulation Script for Series 2600B (supplied on USB memory stick)
7709-308A	Digital I/O Connector
CA-180-3A	TSP-Link/Ethernet Cable (two per unit)
TSP Express Software Tool	(embedded)
Test Script Builder Software	(supplied on CD)
LabVIEW Driver	(supplied on CD)
ACS Basic Edition Software	(optional)

Available Accessories (All Instruments)

Software

ACS-BASIC	Component Characterization Software

Rack Mount Kits

4299-1	Single Rack Mount Kit with front and rear support
4299-2	Dual Rack Mount Kit with front and rear support
4299-5	1U Vent Panel

Cables and Connectors

2600-BAN	Banana Test Leads/Adapter Cable. For a single 2601B/2602B/2604B/2611B/2612B/2614B SMU instrument channel
2600-KIT	Extra screw terminal connector, strain relief, and cover for a single SourceMeter channel (one supplied with 2601B and 2611B, two with 2602B, 2604B, 2612B, 2614B)
2600-FIX-TRX	Phoenix-to-Triax Adapter for 2 wire sensing
2600-TRIAX	Phoenix-to-Triax Adapter for 4 wire sensing
7078-TRX-*	3-Slot, Low Noise Triax Cable, 0.3m–6.1m. For use with 2600-TRIAX Adapter
7078-TRX-GND	3-Slot male triax to BNC adapter (guard removed)
7709-308A	Digital I/O Connector (model specific)
8606	High Performance Modular Probe Kit. For use with 2600B-BAN

GPIB Interfaces and Cables

7007-1	Double Shielded GPIB Cable, 1 m (3.3 ft.)
7007-2	Double Shielded GPIB Cable, 2 m (6.6 ft.)
KPCI-488LPA	IEEE-488 Interface/Controller for the PCI Bus

Digital I/O, Trigger Link, and TSP-Link

2600-TLINK	Digital I/O to TLINK Adapter Cable, 1 m
CA-126-1A	Digital I/O and Trigger Cable, 1.5 m
CA-180-3A	CAT5 Crossover Cable for TSP-Link and direct Ethernet connection (two supplied)

Test Fixtures

8101-PIV	DC, Pulse I-V and C-V Component Test Fixture
8101-4TRX	4 Pin Transistor Fixture
LR8028	Component Test Fixture – Optimized for device testing at up to 200 V/1 A

Switching

Series 3700A	DMM/Switch Systems
707B	Semiconductor Switching Matrix Mainframe

Calibration and Verification

2600-STD-RES	Calibration Standard 1 GΩ Resistor for 2634B, 2635B, and 2636B

Available Services (All Instruments)

Extended Warranties

26xxB-EW	1 Year Factory Warranty extended to 2 years
26xxB-3Y-EW	1 Year Factory Warranty extended to 3 years
26xxB-5Y-EW	1 Year Factory Warranty extended to 5 years

Calibration Contracts

C/26xxB-3Y-STD	3 Calibrations within 3 years
C/26xxB-5Y-STD	5 Calibrations within 5 years
C/26xxB-3Y-DATA	3 Calibrations within 3 years and includes calibration data before and after adjustment
C/26xxB-5Y-DATA	5 Calibrations within 5 years and includes calibration data before and after adjustment
C/26xxB-3Y-17025	3 IS0-17025 accredited calibrations within 3 years
C/26xxB-5Y-17025	5 IS0-17025 accredited calibrations within 5 years

Ordering Information (All Instruments)

2601B	Single-channel System SourceMeter SMU Instrument (3 A DC, 10 A Pulse)
2602B	Dual-channel System SourceMeter SMU Instrument (3 A DC, 10 A Pulse)
2604B	Dual-channel System SourceMeter SMU Instrument (3 A DC, 10 A Pulse, Benchtop Version)
2611B	Single-channel System SourceMeter SMU Instrument (200 V, 10 A Pulse)
2612B	Dual-channel System SourceMeter SMU Instrument (200 V, 10 A Pulse)
2614B	Dual-channel System SourceMeter SMU Instrument (200 V, 10 A Pulse, Benchtop Version)
2634B	Dual-channel System SourceMeter SMU Instrument (1 fA, 10 A Pulse, Benchtop Version)
2635B	Single-channel System SourceMeter SMU Instrument (0.1 fA, 10 A Pulse)
2636B	Dual-channel System SourceMeter SMU Instrument (0.1 fA, 10 A Pulse)

Warranty Information

Warranty Summary	This section summarizes the warranties of the Series 2600B. For complete warranty information, refer to the Series 2600B Reference Manual. Any portion of the product that is not manufactured by Keithley is not covered by this warranty and Keithley will have no duty to enforce any other manufacturer's warranties.
Hardware Warranty	Keithley Instruments, Inc. warrants the Keithley manufactured portion of the hardware for a period of one year from defects in materials or workmanship; provided that such defect has not been caused by use of the Keithley hardware which is not in accordance with the hardware instructions. The warranty does not apply upon any modification of Keithley hardware made by the customer or operation of the hardware outside the environmental specifications.
Software Warranty	Keithley warrants for the Keithley produced portion of the software or firmware will conform in all material respects with the published specifications for a period of ninety (90) days; provided the software is used on the product for which it is intended in accordance with the software instructions. Keithley does not warrant that operation of the software will be uninterrupted or error-free, or that the software will be adequate for the customer's intended application. The warranty does not apply upon any modification of the software made by the customer.

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