Scalable, integrated source and measure solutions

Series 2600 System SourceMeter instruments offer electronic component and semiconductor device manufacturers a scalable, high throughput, highly cost-effective solution for precision DC, pulse, and low frequency AC source-measure testing. Building on the tightly integrated source-measure technology originally developed for Keithley’s popular Series 2400 SourceMeter line, Series 2600 instruments provide from two to four times the test speed of competitive products in I-V functional test applications. They also offer higher source-measure channel density and a significantly lower cost of ownership than competing products. The analog-to-digital converters provide simultaneous I and V measurements in less than 100µs (10,000 rdgs/s) and source-measure sweep speeds of less than 200µs per point (5,500 points/s). This high speed source-measure capability, plus advanced automation features and time-saving software tools make Series 2600 SourceMeter instruments an ideal solution for I-V testing of a wide range of devices.

System scalability without a mainframe

Series 2600 instruments incorporate an innovative technology that makes it possible to create multi-channel I-V test systems economically, without sacrificing test throughput. TSP-Link is a high speed system expansion interface, which test system builders can use to connect multiple channels to an existing mainframe or computer. Multiple Series 2600 channels can be economically combined into a single system, using TSP-Link master/slave connections.

Contact check function ensures high integrity measurements

10,000 readings/s and 5,500 source-measure points/s to memory provide faster test times

The embedded Test Script Processor (TSP™) offers unparalleled system automation and two to four times the test throughput of competitive products in I-V functional test applications

Family of products offers wide dynamic range: 1pA to 10A and 1µV to 200V

TSP-Link™ master/slave connection seamlessly integrates multiple Series 2600 SourceMeter channels into a system that can be programmed and controlled as a single instrument

Free Test Script Builder software simplifies creating powerful test scripts for programming custom test functions

Free LabTracer™ 2.0 software available for curve tracing and fast, easy startup

Each SourceMeter channel is electrically isolated for high integrity measurements and wiring flexibility

Industry’s highest SMU rack density for automated test applications

TSP-Link makes it easy to scale the system’s channel count to match the application.
Series 2600

Multi-Channel I-V Test Solutions

Series 2600 instruments in a master/slave configuration. Once connected, all the Series 2600 instruments in a system can be programmed and operated under the control of the master unit, just as if they were housed in the same chassis. By eliminating the need for a chassis/mainframe, the TSP-Link provides virtually unlimited flexibility to scale a test system’s channel count up or down as the application requires, while ensuring seamless integration.

New capabilities for increasing test speed and lowering test cost

The Test Script Processor (TSP)

Any Series 2600-based system can run high speed, embedded test scripts on the master unit’s Test Script Processor (TSP), the other major new technology on which the Series 2600 is based. The test sequence is processed and run on the embedded computer in the instrument, rather than from an external PC controller, so delays due to GPIB traffic congestion are eliminated. TSP test scripts allow throughput gains of up to 10× over equivalent PC-based programs controlling the same instruments via GPIB. TSP test scripts can be loaded and run from the front panel or over the system’s GPIB interface. A single TSP test script, running on the master unit, can control all the SourceMeter channels in the system and acquire data from any Series 2600 instrument connected to the TSP-Link, which supports connections for up to 64 Series 2600 instruments.

TSP for advanced automation

A Series 2600-based system can stand alone as a complete measurement and automation solution for semiconductor device or component testing, with the master unit controlling sourcing, measuring, pass/fail decisions, test sequence flow control, binning, and the component handler or prober. In contrast with existing embedded test sequencers for instrumentation, the TSP test scripts offer far greater programming flexibility, including support for:

- Instrument command queuing
- Modular subroutines with passable parameters
- Pass/fail and limit testing
- A wide range of math operations
- Flexible branching and looping capability
- Flexible external triggering
- Intelligent digital I/O read and write capability
- RS-232 communication

Factory and custom TSP test scripts

The Test Script Processor is programmed with a simple BASIC-style programming language that runs in real time on the instrument. Keithley provides built-in test scripts for:

- Sweeping
- Pulsing
- Waveform generation
- Common component tests like binary search, \( V_f \), \( V_{TH} \), LIV (light intensity/voltage)

A number of test scripts are included in the instrument, while others can be downloaded at no charge from www.keithley.com. These pre-written factory test scripts can be used as provided or easily customized for a given application, so production users can get their systems up and running faster than ever before.

Users can also create custom test scripts in several different ways, including a programming tool called Test Script Builder. Custom scripts can be downloaded from the PC to the master SourceMeter unit and saved in non-volatile memory. All four programs provide 16 megabytes of non-volatile memory for storing up to 50,000 lines of TSP code and more than 100,000 readings.

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www.keithley.com

ACCESSORIES AVAILABLE

CABLES AND CONNECTORS

2600-BAN Banana Test Leads/Adapter Cable. For a single Series 2600 SMU channel
2600-KIT Extra screw terminal connector, strain relief, and cover for a single SourceMeter channel (one supplied with 2601/2611, two with 2602/2612)
2600-TRIAX Triax Adapter. For a single Series 2600 SourceMeter (two needed for use with 2602/2012)
7078-TRIAX S-Slot, Low Noise Triax Cable. For use with 2600-TRIAX Adapter
8606 High Performance Modular Probe Kit. For use with 2600-BAN
SG-200 Shielded Twisted Pair Cable. Recommended for general-purpose use with Series 2600 System SourceMeter instruments
2600-4IC Safety Interlock Adapter Connector (one supplied with 2611/2012)

DIGITAL I/O, TRIGGER LINK AND TPS-LINK

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

GPIB INTERFACES AND CABLES

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

SWITCHING

7002-HD High Density Switch Mainframe
7002-HD-MTXI Differential 6x32 Matrix Card
7002-HD-MUXI Differential Quad 1x40 Multiplexer Card

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

SOFTWARE

LabTracer™ 2.0 Curve Tracing Software (downloadable)

EXTENDED WARRANTIES

2601-EW 1 Year Extended Warranty for Model 2601
2602-EW 1 Year Extended Warranty for Model 2602
2611-EW 1 Year Extended Warranty for Model 2611
2612-EW 1 Year Extended Warranty for Model 2612

ACCESSORIES SUPPLIED

2600-4IC Safety Interlock Adapter Connector (one supplied with 2611/2612)
Test Script Builder software
LabTracer Software (downloadable)
IVI/VISA drivers for Visual Basic, VC/C++, LabVIEW, TestPoint, and LabWindows™/CVI

CA-180-3A CAT5 Crossover Cable for TSP-Link (one supplied)
CA-126-1 Digital I/O and Trigger Cable, 1.5m
2600-TLINK Digital I/O to TLINK Adapter Cable, 1m
DIGITAL I/O, TRIGGER LINK AND TPS-LINK

SC-200 Shielded T wisted Pair Cable. Recommended for general-purpose use with Series 2600 System SourceMeter instruments
2600-BAN Banana Test Leads/Adapter Cable. For a single Series 2600 SMU channel
2600-KIT Extra screw terminal connector, strain relief, and cover for a single SourceMeter channel (one supplied with 2601/2011, two with 2602/2612)
2600-TRIAX Triax Adapter. For a single Series 2600 SourceMeter (two needed for use with 2602/2012)
7078-TRIAX S-Slot, Low Noise Triax Cable. For use with 2600-TRIAX Adapter
8606 High Performance Modular Probe Kit. For use with 2600-BAN
SG-200 Shielded Twisted Pair Cable. Recommended for general-purpose use with Series 2600 System SourceMeter instruments
2600-4IC Safety Interlock Adapter Connector (one supplied with 2611/2012)

DIGITAL I/O, TRIGGER LINK AND TPS-LINK

2600-TLINK Digital I/O to TLINK Adapter Cable, 1m
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CA-180-3A CAT5 Crossover Cable for TSP-Link (one supplied)
Series 2600

Series SourceMeter®
Multi-Channel I-V Test Solutions

Third-generation SMU design ensures faster test times

The Series 2600’s new SMU design enhances test speed in several ways. For example, while earlier designs used a parallel current ranging topology, the Series 2600 uses a series ranging topology (patent pending), which provides faster and smoother range changes and outputs that settle more quickly. It also allows the current output limit to be programmed independently of the measurement current range for fast charging of capacitive loads and more intuitive operation during bench use.

Each Series 2600 SourceMeter channel offers a highly flexible, four-quadrant source coupled with precision voltage and current meters/limiters. Each channel can be configured as a:

- Precision power supply (up to 200V and 3A DC/10A pulsed output with 1pA readback resolution)
- True current source
- DMM (DCV, DCL, ohms, power, with 5½-digit resolution)
- Power V or I pulse generator (Pulse width: 200µs and longer—source and measure)
- Power V or I waveform generator (20-point sine wave up to 400Hz in a TSP test script)
- Electronic load (with sink mode capability)

High speed and precision A/Ds with simultaneous source-readback

All Series 2600 instruments provide four-quadrant operation and can be connected in series or in parallel to extend their dynamic range. In the first and third quadrants, they operate as a source, delivering power to a load. In the second and fourth quadrants, they operate as a sink, dissipating power internally. They measure voltage and current simultaneously with up to 5½-digit resolution, and they display voltage, current, resistance, or power readings.

Two analog-to-digital converters per channel (one for I, one for V) can run simultaneously, providing precise source-readback without sacrificing test throughput. These A/D converters offer the flexibility of programmable integration rates, allowing the user to optimize for either high speed (>10,000 rdgs/s at 0.001 NPLC setting) or for high resolution (up to 24 bits at 10 NPLC setting) to make high accuracy measurements.

Digital I/O Interface

A back panel port on every Series 2600 instrument provides 14 bits of universal digital I/O to link the instrument to a variety of popular handlers for sorting and binning components after testing. These I/O lines are also backward-compatible with Keithley’s earlier Trigger Link instrument triggering technology. These lines simplify integrating Series 2600 instruments into systems that employ other external instrumentation, including Series 2400 SourceMeter instruments, Series 7000 switch mainframes, and Series 2700 Integra data acquisition/multimeter systems.

Built-in Contact Check Function

The Contact Check function makes it simple to verify good connections quickly and easily before an automated test sequence begins. This eliminates measurement errors and false product failures associated with contact fatigue, breakage, contamination, loose or broken connection, relay failures, etc.
Graphical instrument setup. LabTracer 2.0 supports up to eight Series 2600 SourceMeter channels. Model 2400 and Model 2410 SourceMeter instruments are also supported for extended voltage capability. Drop-down menus in LabTracer 2.0’s instrument setup window allow configuring any channel of a SourceMeter instrument for fixed point or sweeping operation. Once the instrument is configured, a single key press is all it takes to execute a test.

Once a test is complete, data is displayed in the spreadsheet panel and graphing panel. Measurement data can be manipulated in the spreadsheet by applying a formula to the results. For more detailed analysis, data can also be exported to Microsoft Excel with a simple cut and paste.
**Series 2600**

**System SourceMeter® Multi-Channel I-V Test Solutions**

**Dramatic throughput improvements for production test**

Series 2600 instruments help component manufacturers improve their test throughput dramatically, as well as provide test solutions that can handle today’s devices, which often have higher pin counts and more analog circuitry than earlier designs. In the past, manufacturers have been forced by the lack of optimized test solutions for multi-channel source-measure applications to choose between bulky, expensive mainframe-based systems, slow instrument-based systems employing PC control, or fast instrument-based systems that require complex development. The Series 2600 offers:

- The highest density available in any SMU-based system to address growing pin counts.
- The industry’s fastest throughput, which helps reduce the cost of test. The speed of the onboard processor and TSP test scripts, combined with the tight triggering synchronization offered by the TSP-Link bus, makes high speed parallel testing practical.
- A lower capital investment. By eliminating the need for a mainframe/chassis, they allow test engineers to configure a readily scalable system at a significantly lower cost per channel than other solutions.

**Test Script Builder software**

Test Script Builder is a free software tool that is provided with all Series 2600 SourceMeter instruments to help users create, modify, debug, and store TSP test scripts. It provides a project/file manager window to store and organize test scripts, a text-sensitive program editor (like Visual Basic) to create and modify test TSP code, and an immediate instrument control window to send GPIB commands and receive data from the instrument. The immediate window allows viewing the output of a given test script and simplifies debugging.

**TYPICAL APPLICATIONS**

- I-V functional test and characterization of a wide range of devices, including:
  - Discrete and passive components
  - Two-leaded – Resistors, disk drive heads, metal oxide varistors (MOVs), diodes, zener diodes, sensors, capacitors, thermistors
  - Three-leaded – Small signal bipolar junction transistors (BJTs), field-effect transistors (FETs), and more
  - Parallel test – Two- and three-leaded component arrays
  - Simple ICs – Optos, drivers, switches, sensors
  - Integrated devices – Small Scale Integrated (SSI) and Large Scale Integrated (LSI).
    - Analog ICs
    - Radio frequency integrated circuits (RFICs)
    - Application specific integrated circuits (ASICs)
    - System on a chip (SOC) devices
  - Optoelectronic devices such as light-emitting diodes (LEDs), laser diodes, high brightness LEDs (HBLEDs), vertical cavity surface-emitting lasers (VCSELs), displays
  - R&D and device characterization of these types of devices
System SourceMeter®
Multi-Channel I-V Test Solutions

2601
2602

SPECIFICATION CONDITIONS

This document contains specifications and supplemental information for the Models 2601 and 2602. Specifications are the standards against which the Models 2601 and 2602 are tested. Upon leaving the factory the 2601 and 2602 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 SourceMeter CHANNEL A (2601 and 2602) or SourceMeter CHANNEL B (2602) terminals under the following conditions:

1. 23°C ± 5°C, <70% relative humidity.
2. After 2 hour warm-up.
3. Speed normal (1 NPLC).
5. Remote sense operation or properly zeroed local operation.
6. Calibration period = 1 year.

SOURCE AND MEASURE

Series 2600 specifications

6. Calibration period = 1 year.
5. Remote sense operation or properly zeroed local operation.
3. Speed normal (1 NPLC).
2. After 2 hour warm-up.
1. Add 10µmV to source accuracy specifications per volt of HI lead drop.

SOURCE AND MEASURE

Series 2600 specifications

6. Calibration period = 1 year.
5. Remote sense operation or properly zeroed local operation.
3. Speed normal (1 NPLC).
2. After 2 hour warm-up.
1. Add 10µmV to source accuracy specifications per volt of HI lead drop.

SOURCE AND MEASURE

Series 2600 specifications

6. Calibration period = 1 year.
5. Remote sense operation or properly zeroed local operation.
3. Speed normal (1 NPLC).
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SOURCE AND MEASURE

Series 2600 specifications

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Series 2600 specifications

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3. Speed normal (1 NPLC).
2. After 2 hour warm-up.
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SOURCE AND MEASURE

Series 2600 specifications

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5. Remote sense operation or properly zeroed local operation.
3. Speed normal (1 NPLC).
2. After 2 hour warm-up.
1. Add 10µmV to source accuracy specifications per volt of HI lead drop.

SOURCE AND MEASURE

Series 2600 specifications

6. Calibration period = 1 year.
5. Remote sense operation or properly zeroed local operation.
3. Speed normal (1 NPLC).
2. After 2 hour warm-up.
1. Add 10µmV to source accuracy specifications per volt of HI lead drop.
METER SPECIFICATIONS

VOLTAGE MEASUREMENT ACCURACY 1

<table>
<thead>
<tr>
<th>RANGE</th>
<th>DISPLAY RESOLUTION1</th>
<th>VOLTAGE BURDEN1</th>
<th>ACCURACY (1 Year) 23°C ±25°C ±(% rdg. + volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.000 mV</td>
<td>1 µV</td>
<td>&gt;10 GΩ</td>
<td>0.015% + 150 µV</td>
</tr>
<tr>
<td>1.00000 V</td>
<td>10 µV</td>
<td>&gt;10 GΩ</td>
<td>0.015% + 200 µV</td>
</tr>
<tr>
<td>6.00000 V</td>
<td>10 µV</td>
<td>&gt;10 GΩ</td>
<td>0.015% + 1 mV</td>
</tr>
<tr>
<td>40.0000 V</td>
<td>100 µV</td>
<td>&gt;10 GΩ</td>
<td>0.015% + 8 mV</td>
</tr>
</tbody>
</table>

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

CURRENT MEASUREMENT ACCURACY

<table>
<thead>
<tr>
<th>RANGE</th>
<th>DISPLAY RESOLUTION1</th>
<th>VOLTAGE BURDEN1</th>
<th>ACCURACY (1 Year) 23°C ±25°C ±(% rdg. + amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.000 nA</td>
<td>1 pA</td>
<td>&gt;1 mΩ</td>
<td>0.05% + 100 pA</td>
</tr>
<tr>
<td>1.00000 µA</td>
<td>10 pA</td>
<td>&gt;1 mΩ</td>
<td>0.025% + 300 pA</td>
</tr>
<tr>
<td>10.0000 µA</td>
<td>100 pA</td>
<td>&gt;1 mΩ</td>
<td>0.025% + 1.5 nA</td>
</tr>
<tr>
<td>100.000 µA</td>
<td>1 nA</td>
<td>&gt;1 mΩ</td>
<td>0.02% + 25 nA</td>
</tr>
<tr>
<td>1.00000 mA</td>
<td>10 nA</td>
<td>&gt;1 mΩ</td>
<td>0.02% + 2 nA</td>
</tr>
<tr>
<td>10.0000 mA</td>
<td>100 nA</td>
<td>&gt;1 mΩ</td>
<td>0.02% + 200 nA</td>
</tr>
<tr>
<td>100.000 mA</td>
<td>1 µA</td>
<td>&lt;1 mΩ</td>
<td>0.01% + 25 µA</td>
</tr>
<tr>
<td>1.00000 A</td>
<td>10 µA</td>
<td>&lt;1 mΩ</td>
<td>0.01% + 200 µA</td>
</tr>
<tr>
<td>10.0000 A</td>
<td>100 µA</td>
<td>&lt;1 mΩ</td>
<td>0.05% + 3.5 mA</td>
</tr>
</tbody>
</table>

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

CONTACT CHECK2

<table>
<thead>
<tr>
<th>SPEED</th>
<th>MAXIMUM MEASUREMENT TIME TO MEMORY FOR 60Hz (50Hz)1</th>
<th>ACCURACY (1 Year) 23°C ±25°C ±(% rdg. + ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST</td>
<td>1 (1.2) ms</td>
<td>5% + 10</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>4 (5) ms</td>
<td>5% + 1</td>
</tr>
<tr>
<td>SLOW</td>
<td>36 (42) ms</td>
<td>5% + 0.5</td>
</tr>
</tbody>
</table>

LOAD IMPEDANCE: Stable into 10,000pF typical.

COMMON MODE VOLTAGE: 250VDC.

COMMON MODE ISOLATION: >1GΩ, <500pF.

OVERRANGE: 101% of source range, 102% of measure range.

MAXIMUM SENSE LEAD RESISTANCE: 1Ω for rated accuracy

SENS INPUT IMPEDANCE: 1kΩ for rated accuracy.

NOTES
1. Add 90μA to source accuracy specifications per volt of HI lead drop.
2. Four-wire remote sense only.
3. Applies when in single channel display mode.
4. Includes measurement of SENSE HI to HI and SENSE LO to LO contact resistances.

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A GREATER MEASURE OF CONFIDENCE

HOST INTERFACES: Computer control interfaces.


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). 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:

Connector: 25-pin female D.

Input/Output Pins: I/4 pin open drain I/O bits.

Absolute Maximum Input Voltage: ±5.25V.

Absolute Minimum Input Voltage: ±2.5V.

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

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

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

Maximum Sink Current (flowing out of Digital I/O pin): ±1mA.

5V Power Supply Pin: Limited to 600mA, solid state fuse protected.

CONTACT CHECK:

<table>
<thead>
<tr>
<th>SPEED</th>
<th>MAXIMUM MEASUREMENT TIME TO MEMORY FOR 60Hz (50Hz)1</th>
<th>ACCURACY (1 Year) 23°C ±25°C ±(% rdg. + ohms)</th>
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</tr>
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<td>5% + 1</td>
</tr>
<tr>
<td>SLOW</td>
<td>36 (42) ms</td>
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</tr>
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LOAD IMPEDANCE: Stable into 10,000pF typical.

COMMON MODE VOLTAGE: 250VDC.

COMMON MODE ISOLATION: >1GΩ, <500pF.

OVERRANGE: 101% of source range, 102% of measure range.

MAXIMUM SENSE LEAD RESISTANCE: 1Ω for rated accuracy

SENS INPUT IMPEDANCE: 1kΩ for rated accuracy.

NOTES
1. Add 90μA to source accuracy specifications per volt of HI lead drop.
2. Four-wire remote sense only.
3. Applies when in single channel display mode.
4. Includes measurement of SENSE HI to HI and SENSE LO to LO contact resistances.

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A GREATER MEASURE OF CONFIDENCE

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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:

Connector: 25-pin female D.

Input/Output Pins: I/4 pin open drain I/O bits.

Absolute Maximum Input Voltage: ±5.25V.

Absolute Minimum Input Voltage: ±2.5V.

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

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

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

Maximum Sink Current (flowing out of Digital I/O pin): ±1mA.

5V Power Supply Pin: Limited to 600mA, solid state fuse protected.

CONTACT CHECK:

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**SPECIFICATION CONDITIONS**

This document contains specifications and supplemental information for the Models 2611 and 2612. Specifications are the standards against which the Models 2611 and 2612 are tested. Upon leaving the factory the 2611 and 2012 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 SourceMeter CHANNEL A (2611 and 2612) or SourceMeter CHANNEL B (2612) terminals under the following conditions:

1. 23°C ± 5°C, <70% relative humidity.
2. After 2 hour warm-up.
3. Speed normal (1 NPLC).
5. Remote sense operation or properly zeroed local sense operation.
6. Calibration period = 1 year.

**SOURCE AND MEASURE**

**8. Series 2600 specifications**

**1. SOURCE SPECIFICATIONS**

**VOLTAGE PROGRAMMING ACCURACY**

<table>
<thead>
<tr>
<th>RANGE</th>
<th>PROGRAMMING RESOLUTION</th>
<th>ACCURACY (1 Year)</th>
<th>NOISE (peak-peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23°C ±25°C</td>
<td>±(% rdg. + volts)</td>
<td>0.1Hz–10Hz</td>
</tr>
<tr>
<td>200.000 mV</td>
<td>5 µV</td>
<td>0.02% + 375 µV</td>
<td>20 µV</td>
</tr>
<tr>
<td>2.00000 V</td>
<td>50 µV</td>
<td>0.02% + 600 µV</td>
<td>50 µV</td>
</tr>
<tr>
<td>20.0000 V</td>
<td>500 µV</td>
<td>0.02% + 5 mV</td>
<td>300 µV</td>
</tr>
<tr>
<td>200.000 V</td>
<td>5 mV</td>
<td>0.02% + 50 mV</td>
<td>2 mV</td>
</tr>
</tbody>
</table>

**TEMPERATURE COEFFICIENT (0º–18°C & 28º–50°C): ±0.15 %/°C**

**MAXIMUM OUTPUT POWER AND SOURCE/SINK LIMITS**: ±30.603W per channel maximum.

±20.2V @ ±1.515A = ±202V @ ±101mA, four quadrant source or sink operation.

**VOLTAGE REGULATION**: Line:

±(0.01% of range + 100pA).

**CURRENT REGULATION**: Line:

±(0.15% + 10mV) typical (step size = 10% to 90% of range, resistive load, maximum source level command is processed on a fixed range. Values below for Iout · Rload = 2V unless noted.

1.5A–1A Ranges: ±120µA typical (Iload = 62Ω).

10mA–10mA Ranges: ±50µA typical.

1mA Ranges: ±50µA typical.

100µA Ranges: ±5µA typical.

**NOISE**: 10Hz–20MHz:

<4mV (current source).

**GUARD OFFSET VOLTAGE**: Bipolar current limit (compliance) set with single value. Minimum value is 10mA. Accuracy same as current source.

**OVERSHOOT**: <±(0.1% + 10mV) typical (step size = 10% to 90% of range, resistive load, maximum current limit/compliance).

**GUARD OFFSET VOLTAGE**: <±(0.1% + 10mV) typical.

**CURRENT PROGRAMMING ACCURACY**

<table>
<thead>
<tr>
<th>RANGE</th>
<th>PROGRAMMING RESOLUTION</th>
<th>ACCURACY (1 Year)</th>
<th>NOISE (peak-peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23°C ±25°C</td>
<td>±(% rdg. + amps)</td>
<td>0.1Hz–10Hz</td>
</tr>
<tr>
<td>100.000 mA</td>
<td>2 pA</td>
<td>0.06% + 100 pA</td>
<td>5 pA</td>
</tr>
<tr>
<td>1.00000 µA</td>
<td>20 pA</td>
<td>0.03% + 800 pA</td>
<td>25 pA</td>
</tr>
<tr>
<td>10.0000 µA</td>
<td>200 pA</td>
<td>0.05% + 5 mA</td>
<td>60 pA</td>
</tr>
<tr>
<td>100.000 µA</td>
<td>2 mA</td>
<td>0.05% + 60 mA</td>
<td>3 mA</td>
</tr>
<tr>
<td>1.00000mA</td>
<td>20 mA</td>
<td>0.03% + 500 mAh</td>
<td>6 mAh</td>
</tr>
<tr>
<td>10.0000mA</td>
<td>200 mA</td>
<td>0.03% + 6 mA</td>
<td>200 mA</td>
</tr>
<tr>
<td>100.000 mA</td>
<td>2 µA</td>
<td>0.03% + 30 µA</td>
<td>600 mAh</td>
</tr>
<tr>
<td>1.00000 A</td>
<td>20 µA</td>
<td>0.05% + 1.8 mA</td>
<td>70 µA</td>
</tr>
<tr>
<td>1.50000 A</td>
<td>50 µA</td>
<td>0.06% + 4 mA</td>
<td>150 µA</td>
</tr>
<tr>
<td>10.0000 A</td>
<td>200 µA</td>
<td>0.5% + 40 mAh</td>
<td></td>
</tr>
</tbody>
</table>

**TEMPERATURE COEFFICIENT (0º–18°C & 28º–50°C): ±0.15 %/°C**

**MAXIMUM OUTPUT POWER AND SOURCE/SINK LIMITS**: ±30.603W per channel maximum.

±1.515A @ ±20.2V, ±101mA @ ±202V, four quadrant source or sink operation.

**CURRENT REGULATION**: Line:

±(0.15% + 10mV) typical (step size = 10% to 90% of range, resistive load, maximum source level command is processed on a fixed range. Values below for Iout · Rload = 2V unless noted.

1.5A–1A Ranges: ±120µA typical (Iload = 62Ω).

10mA–10mA Ranges: ±50µA typical.

1mA Ranges: ±50µA typical.

100µA Ranges: ±5µA typical.

**NOISE**: 10Hz–20MHz:

<4mV (current source).

**GUARD OFFSET VOLTAGE**: Bipolar voltage limit (compliance) set with single value. Minimum value is 10mA. Accuracy same as voltage source.

**OVERSHOOT**: <±(0.1% + 10mV) typical (step size = 10% to 90% of range, resistive load, maximum voltage limit/compliance).

**GUARD OFFSET VOLTAGE**: <±(0.1% + 10mV) typical.

**CURRENT PROGRAMMING ACCURACY**

<table>
<thead>
<tr>
<th>REGION</th>
<th>MAXIMUM CURRENT LIMIT</th>
<th>MAXIMUM PULSE WIDTH</th>
<th>MAXIMUM DUTY CYCLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 mA (I) @ 200 V</td>
<td>DC, no limit</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>1 A (I) @ 20 V</td>
<td>DC, no limit</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>1 A (I) @ 180 V</td>
<td>8.5 ms</td>
<td>1%</td>
</tr>
<tr>
<td>3</td>
<td>1 A (I) @ 200 V</td>
<td>2.2 ms</td>
<td>1%</td>
</tr>
<tr>
<td>4</td>
<td>10 A (I) @ 5 V</td>
<td>1 ms</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

**MINIMUM PROGRAMMABLE PULSE WIDTH**: 20µs. NOTE: Minimum pulse width for settled source at a given I/V output and load can be longer than 20µs. See note 11 for typical settling times.

**PULSE WIDTH PROGRAMMING RESOLUTION**: 1µs.

**PULSE WIDTH PROGRAMMING ACCURACY**: ±25µs.

**TYPICAL PULSE WIDTH JITTER**: 50µs.
NOTES
1. Add 50V 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.
3. For sink mode operation (quadrants II and IV), add 12% of range to corresponding current limit accuracy specifications. For 1A range add an additional 4mA of uncertainty.
4. 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.
5. 10A range accessible only in pulse mode.
6. Accuracy specifications do not include connector leakage. Derate accuracy by Vout/2E11 per °C when operating outside the power sink operation, refer to Section 8 – Operating Boundaries in the Series 2600 Reference Manual for additional power derating information.
7. 150mV under pulse conditions with compliance set to 1A.
8. Times measured from the start of pulse to the start of off-time; see figure below.
9. Thermally limited in sink mode (quadrants 2 and 4) and ambient temperatures above 30°C. See power equations in the reference manual for more information.
10. Voltage source operation with 1.5A current limit.

PULSE SPECIFICATIONS (continued)

<table>
<thead>
<tr>
<th>Pulse Level</th>
<th>Start ton</th>
<th>Bias Level</th>
<th>End ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>10%</td>
<td>90%</td>
<td>10%</td>
</tr>
</tbody>
</table>

SOURCE AND MEASURE SPECIFICATIONS

<table>
<thead>
<tr>
<th>RANGE</th>
<th>DISPLAY RESOLUTION</th>
<th>VOLTAGE BURDEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>200.000 mV</td>
<td>1 µV</td>
<td>N/A</td>
</tr>
<tr>
<td>2.00000 V</td>
<td>10 µV</td>
<td>&gt;10 GΩ</td>
</tr>
<tr>
<td>10.0000 mA</td>
<td>100 µA</td>
<td>&gt;10 GΩ</td>
</tr>
<tr>
<td>100.000 mA</td>
<td>1 mA</td>
<td>&gt;10 GΩ</td>
</tr>
<tr>
<td>1.00000 A</td>
<td>10 µA</td>
<td>&gt;10 GΩ</td>
</tr>
<tr>
<td>10.0000 A</td>
<td>100 µA</td>
<td>&gt;10 GΩ</td>
</tr>
</tbody>
</table>

CONTACT CHECK

<table>
<thead>
<tr>
<th>SPEED</th>
<th>MAXIMUM MEASUREMENT TIME TO MEMORY</th>
<th>ACCURACY (1 Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST</td>
<td>1 (1.2) ms</td>
<td>23°C ±5°C ±(% rdg. + ohms)</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>4 (5) ms</td>
<td>23°C ±5°C ±(% rdg. + ohms)</td>
</tr>
<tr>
<td>SLOW</td>
<td>36 (42) ms</td>
<td>23°C ±5°C ±(% rdg. + ohms)</td>
</tr>
</tbody>
</table>

ADDITIONAL METER SPECIFICATIONS

LOAD IMPEDANCE: Stable into 10,000pF typical.
COMMON MODE VOLTAGE: 250VDC.
COMMON MODE ISOLATION: >1GΩ, <500pF.
OVERRANGE: 10% of source range, 102% of measure range.
MAXIMUM SENSE LEAD RESISTANCE: 15Ω for rated accuracy.
SENSE INPUT IMPEDANCE: >10GΩ.

NOTES
1. Add 50V to source accuracy specifications per volt of HI lead drop.
2. Four-wire remote sense only.
3. Applies when in single channel display mode.
4. Includes measurement of SENSE HI to HI and SENSE LO to LO contact resistances.
5. 10A range accessible only in pulse mode.
6. Derate accuracy by Vout/2E11 per °C when operating between 18°C–28°C. Derate accuracy by Vout/2E11 + (0.15 × Vout/2E11) per °C when operating <18°C and >28°C.
7. Derate accuracy specifications for NPLC setting <1 by increasing error term. Add appropriate % of range term using accuracy specification)/°C.

VOLTAGE MEASUREMENT ACCURACY

<table>
<thead>
<tr>
<th>RANGE</th>
<th>DISPLAY RESOLUTION</th>
<th>VOLTAGE BURDEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>200.000 mV</td>
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</tr>
<tr>
<td>2.00000 V</td>
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<td>10.0000 mA</td>
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</tr>
</tbody>
</table>

METER SPECIFICATIONS

<table>
<thead>
<tr>
<th>SPEED</th>
<th>MAXIMUM MEASUREMENT FOR 60Hz (50Hz)</th>
<th>ACCURACY (1 Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST</td>
<td>1 (1.2) ms</td>
<td>23°C ±5°C ±(% rdg. + ohms)</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>4 (5) ms</td>
<td>23°C ±5°C ±(% rdg. + ohms)</td>
</tr>
<tr>
<td>SLOW</td>
<td>36 (42) ms</td>
<td>23°C ±5°C ±(% rdg. + ohms)</td>
</tr>
</tbody>
</table>

ADDITIONAL METER SPECIFICATIONS

LOAD IMPEDANCE: Stable into 10,000pF typical.
COMMON MODE VOLTAGE: 250VDC.
COMMON MODE ISOLATION: >1GΩ, <500pF.
OVERRANGE: 10% of source range, 102% of measure range.
MAXIMUM SENSE LEAD RESISTANCE: 15Ω for rated accuracy.
SENSE INPUT IMPEDANCE: >10GΩ.

NOTES
1. Add 50V to source accuracy specifications per volt of HI lead drop.
2. Four-wire remote sense only.
3. Applies when in single channel display mode.
4. Includes measurement of SENSE HI to HI and SENSE LO to LO contact resistances.
5. 10A range accessible only in pulse mode.
6. Derate accuracy by Vout/2E11 per °C when operating between 18°C–28°C. Derate accuracy by Vout/2E11 + (0.15 × Vout/2E11) per °C when operating <18°C and >28°C.
7. Derate accuracy specifications for NPLC setting <1 by increasing error term. Add appropriate % of range term using accuracy specification)/°C.

VOLTAGE MEASUREMENT ACCURACY

<table>
<thead>
<tr>
<th>RANGE</th>
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</thead>
<tbody>
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<td>&gt;10 GΩ</td>
</tr>
<tr>
<td>1.00000 A</td>
<td>10 µA</td>
<td>&gt;10 GΩ</td>
</tr>
<tr>
<td>10.0000 A</td>
<td>100 µA</td>
<td>&gt;10 GΩ</td>
</tr>
</tbody>
</table>
### GENERAL

**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 300 bps to 115200 bps. 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:** 5.25V.
- **Absolute Minimum Input Voltage:** –0.25V.
- **Maximum Logic Low Input Voltage:** 0.7V, +850µA max.
- **Minimum Logic High Input Voltage:** 2.1V, +570µA.
- **Maximum Source Current (flowing out of Digital I/O bit):** +960µA.
- **Maximum Sink Current @ Maximum Logic Low Voltage (0.7V):** –5.0mA.
- **5V Power Supply Pin:** Limited to 600mA, solid state fuse protected.
- **Safety Interlock Pin:** Active high input. >3.4V @ 24mA (absolute maximum of 6V) must be externally applied to this pin to insure 200V operation. This signal is pulled down to chassis ground with a 10kΩ resistor. 200V operation will be blocked when the INTERLOCK signal is <0.4V (absolute minimum of –0.4V). See figure below:

**POWER SUPPLY:** 100V to 240VAC, 50–60Hz (manual setting), 240VA 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 89/336/EEC, EN 61326-1.

**SAFETY:** Conforms to European Union Directive 73/23/EEC, EN 61010-1, and UL 61010-1.

**DIMENSIONS:** 89mm high × 213mm wide × 460mm deep (3½ in × 8⅞ in × 17½ in). Bench Configuration (with handle & feet):
- 104mm high × 238mm wide × 460mm deep (4⅛ in × 9⅞ in × 17½ in).

**WEIGHT:**
- **2611:** 4.75kg (10.4 lbs).
- **2612:** 5.50kg (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 SPECIFICATIONS

### MAXIMUM SWEEP OPERATION RATES (operations per second) FOR 60Hz (50Hz):

<table>
<thead>
<tr>
<th>A/D CONVERTER SPEED</th>
<th>TRIGGER ORIGIN</th>
<th>MEASURE TO MEMORY</th>
<th>MEASURE TO GPIB</th>
<th>SOURCE MEASURE TO MEMORY</th>
<th>SOURCE MEASURE TO GPIB</th>
<th>SOURCE MEASURE PASS/FAIL TO MEMORY</th>
<th>SOURCE MEASURE PASS/FAIL TO GPIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001 NPLC</td>
<td>Internal</td>
<td>10000 (10000)</td>
<td>8000 (8000)</td>
<td>5500 (5500)</td>
<td>5600 (5600)</td>
<td>4900 (4900)</td>
<td>3100 (3100)</td>
</tr>
<tr>
<td>0.001 NPLC</td>
<td>Digital I/O</td>
<td>2700 (2650)</td>
<td>2100 (2100)</td>
<td>2000 (2000)</td>
<td>1900 (1875)</td>
<td>2200 (2150)</td>
<td>1800 (1775)</td>
</tr>
<tr>
<td>0.01 NPLC</td>
<td>Internal</td>
<td>4000 (3500)</td>
<td>3600 (3200)</td>
<td>2750 (2700)</td>
<td>2300 (2100)</td>
<td>2800 (2500)</td>
<td>2100 (1975)</td>
</tr>
<tr>
<td>0.01 NPLC</td>
<td>Digital I/O</td>
<td>1900 (1775)</td>
<td>1600 (1500)</td>
<td>1700 (1600)</td>
<td>1450 (1400)</td>
<td>1600 (1500)</td>
<td>1400 (1325)</td>
</tr>
<tr>
<td>0.1 NPLC</td>
<td>Internal</td>
<td>565 (475)</td>
<td>555 (470)</td>
<td>540 (450)</td>
<td>510 (440)</td>
<td>555 (455)</td>
<td>505 (430)</td>
</tr>
<tr>
<td>0.1 NPLC</td>
<td>Digital I/O</td>
<td>490 (420)</td>
<td>470 (405)</td>
<td>470 (410)</td>
<td>450 (390)</td>
<td>470 (400)</td>
<td>450 (390)</td>
</tr>
<tr>
<td>1.0 NPLC</td>
<td>Internal</td>
<td>59 (49)</td>
<td>59 (49)</td>
<td>58 (49)</td>
<td>58 (48)</td>
<td>58 (49)</td>
<td>58 (48)</td>
</tr>
<tr>
<td>1.0 NPLC</td>
<td>Digital I/O</td>
<td>58 (48)</td>
<td>58 (48)</td>
<td>58 (48)</td>
<td>57 (48)</td>
<td>57 (48)</td>
<td>57 (48)</td>
</tr>
</tbody>
</table>

### MAXIMUM SINGLE MEASUREMENT RATES (operations per second) FOR 60Hz (50Hz):

<table>
<thead>
<tr>
<th>A/D CONVERTER SPEED</th>
<th>TRIGGER ORIGIN</th>
<th>MEASURE TO GPIB</th>
<th>SOURCE MEASURE TO GPIB</th>
<th>SOURCE MEASURE PASS/FAIL TO GPIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001 NPLC</td>
<td>Internal</td>
<td>1110 (1080)</td>
<td>880 (880)</td>
<td>840 (840)</td>
</tr>
<tr>
<td>0.001 NPLC</td>
<td>Digital I/O</td>
<td>950 (890)</td>
<td>780 (760)</td>
<td>750 (710)</td>
</tr>
<tr>
<td>0.1 NPLC</td>
<td>Internal</td>
<td>390 (345)</td>
<td>355 (320)</td>
<td>340 (305)</td>
</tr>
<tr>
<td>1.0 NPLC</td>
<td>Internal</td>
<td>57 (48)</td>
<td>56 (47)</td>
<td>56 (47)</td>
</tr>
</tbody>
</table>

### NOTES

1. See the Speed Specifications Test Conditions Appendix in the Series 2600 Reference Manual for more information regarding test conditions.

Specifications are subject to change without notice. Rev B
Series 2600

SUPPLEMENTAL INFORMATION

FRONT PANEL INTERFACE: 2-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 non-volatile 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 non-volatile 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: 3 Mbytes (approximately 50,000 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:
• VIS (NISI) included on CD
• Microsoft .NET Framework (included on CD)
• Keithley I/O Layer (included on CD)
• Pentium III 800MHz or faster personal computer
• Microsoft Windows 98, NT, 2000, or XP

Drivers: DLL/DSA drivers for VB, VC/C++, LabVIEW TestPoint, and LabWindows/CVI

READING BUFFERS: Non-volatile storage area(s) reserved for measurement data. Reading buffers are arrays of measurement elements. Each element can hold the following items:
• Measurement
• Range information
• Source setting (at the time the measurement was taken)
• Timestamp
• Measurement status
• Show current and voltage readings
• Show error messages and user defined messages

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, without timestamp and source setting: >50,000 samples.
Buffer Size, with timestamp and source setting: >100,000 samples.

Battery Backup: Lithium-ion battery backup. 30 days of non-volatile storage @ 23°C, and >4 hours of charge time. 5 year battery life @ 25°C. 1.5 year battery life @ 50°C.

FACTORY TSP SCRIPTS: See www.keithley.com for Keithley-supported application-specific scripts.

SYSTEM EXPANSION: The TSP-Link expansion interface allows TSP enabled instruments to trigger and communicate with each other. See figure below:

Each SourceMeter has two TSP-Link connectors to facilitate chaining instruments together.
• Once SourceMeter instruments are interconnected via TSP-Link, a computer can access all of the resources of each SourceMeter via the host interface of any SourceMeter.
• A maximum of 64 TSP-Link nodes can be interconnected. Each SourceMeter consumes one TSP-Link node.

TIMER: Free running 47 bit counter with 1MHz clock input. Reset each time instrument powers up. Rolls over every 4 years.

TStamp: TIMER value automatically saved when each measurement is triggered.

Resolution: 1µs.
Accuracy: 50ppm.

Specifications are subject to change without notice.
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