# System 93

# I-V Systems



- **Flexible, modular SMU design fits a variety of I-V test applications**

- **DC characterization from 10fA to 3A and 10µV to 1100V**

- **Metrics-ICS software allows point-and-click instrument setup under Windows**

- **Flexible analysis and spreadsheet functions for parameter extraction**

- **Optional switching for fully automatic testing**

- **Optional C-V capability**



**Model 2400 SourceMeter instrument**

## Complete DC Characterization Systems

The System 93 I-V test cluster offers interactive testing of current vs. voltage (I-V) in the research, development, and evaluation of semiconductor devices, processes, and materials. It uses three Keithley Source-Measure Units (SMUs) to measure device characteristics at currents from 10fA to 3A and voltages from 10µV to 1100V. These SMUs offer source-measure times at 1ms, plus sophisticated triggering for I-V curve family tests and DC source-measure tests. This versatile system offers complete characterization of devices and comprehensive analysis of test results, without the need to write code or learn GPIB commands.

## Configuration Flexibility

The standard Model 93 hardware configuration includes three Model 236 SMUs, but it can also be configured with an optional Model 237 High Voltage SMU, a Model 238 High Current SMU, or a Series 2400 SourceMeter instrument. Under Metrics-ICS control, the Model 2361 Trigger Controller Unit (TCU) synchronizes the source and measure activity of each SMU.

This integrated control also makes it possible to apply any configuration of sweep step or constant outputs using any SMUs selected, without the need to program the instruments or operate their front panel controls.

The optional Model 213 Quad Voltage Source (QVS) adds four channels of voltage bias capability. The QVS can be used to apply voltages to device pins at up to ±10V and 10mA. The optional switching capability can be used to direct any SMU output to any DUT pin. This further enhances system flexibility, particularly when a Model 237 or 238 is included in the configuration.

## Process Development

Automate parameter extraction, such as Threshold Voltage, using the Numerical Transform Editor. The Transform Editor defines nested equations used to extract parameters from measured data.

## OPTIONAL SYSTEM ENHANCEMENTS

| SOURCE-MEASURE UNITS | |
| --- | --- |
| 237 | High Voltage Source-Measure Unit |
| 238 | High Current Source-Measure Unit |
| **SOURCEMETER INSTRUMENTS** | |
| 2400 | Digital SourceMeter |
| 2410 | High Voltage SourceMeter |
| 2420 | High Current SourceMeter |
| 2430 | Pulse SourceMeter |
| **SWITCHING** | |
| 707A | Switching Matrix – up to 8×72 |
| 708A | Switching Matrix – up to 8×12 |
| 7174A | 8×12 Low Current Matrix Card |
| 7072 | 8×12 Semiconductor Matrix Card |

| SOFTWARE | |
| --- | --- |
| Metrics-ICS-SW | Switch Drivers |
| Metrics-ICS-CV | C-V Analysis Library |
| TestPoint | Test Development Software |
| **RACK KITS** | |
| 4288-1 | Fixed Rack Mount Kit for Model 2400 |
| 4288-2 | Fixed Rack Mount Kit for Model 2400 |
| 1938 | Fixed Rack Mount Kit for Model 236 |
| **CABLES** | |
| 7007-1 | Shielded IEEE-488 Interface |
| 7007-2 | Shielded IEEE-488 Interface |
| 8503 | Trigger Cable, DIN to BNC |

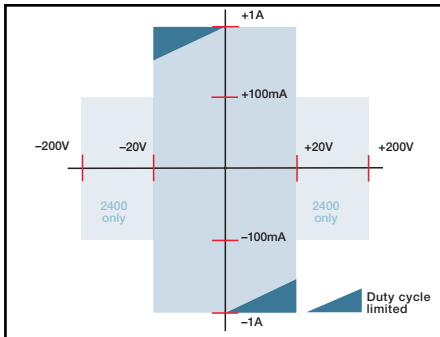**1.888.KEITHLEY** (U.S. only)

**www.keithley.com**
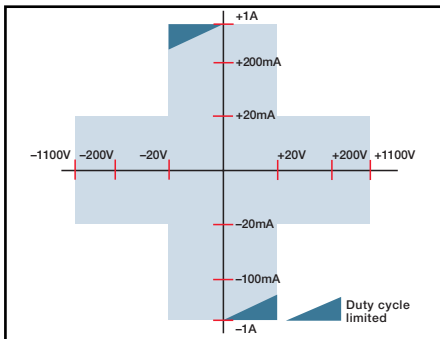
**KEITHLEY**

A  GREATER  MEASURE  OF  CONFIDENCE
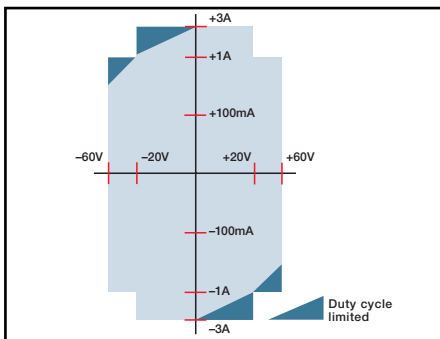
# I-V Systems
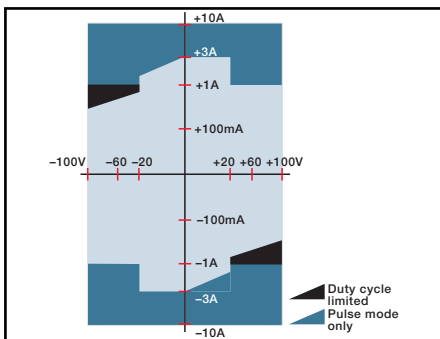## Optional SourceMeter Choices

Model 2400 and 2400-LV SourceMeter

Model 2410 High-Voltage SourceMeter

Model 2420 3A SourceMeter

Model 2430 1kW Pulse Mode SourceMeter

### Device Characterization

Automatically characterize new devices using auto-sequence execution of measurements. Data is stored based on user-defined attributes, such as process, lot, wafer, die, and more.

### Process Monitoring/Reliability

Solve in-line production problems by tracking parameters such as line width, resistivity, and mask alignment. Automatically export results to generate early warning reports. Perform on-wafer reliability tests, such as Metal Migration, Time Dependent Dielectric Breakdown, and Hot Carrier Injection.

### Higher Power, Throughput, and Accuracy

Model 93 I-V Characterization Systems can be upgraded with Keithley Series 2400 SourceMeter instruments for faster throughput, higher power, and increased accuracy. The Series 2400 line combines precision voltage and current sources with a high resolution digital multimeter and measurement firmware compatible with Model 93 I-V systems. The latest Metrics-ICS software drivers allow mixing of SourceMeter instruments with previously purchased Model 236, 237, and 238 SMUs, providing seamless integration or replacement in existing systems. Drivers are also available to control Keithley C-V systems, switching systems, and thermal chucks.

The Series 2400 SourceMeter line allows expanded testing in a wide variety of applications, including:

• Device development and characterization

• New material and device development, such as wide band-gap silicon carbide MOSFETs

• High-power testing on rectifiers, diodes, and solar cells

• Testing power semiconductors and industrial electronic devices used in:
  - automotive systems
  - industrial controls
  - aerospace applications

### Basic Specifications

The Series 2400 line not only offers extended voltage and current capabilities, but also greater power levels, as shown in Table 1.

Table 1. Series 2400 Source and Measure Capabilities

| Parameter | 2400 | 2410 | 2420 | 2430 |
|---|---|---|---|---|
| Meas. Accuracy, I/V (± reading) | ±0.03%/0.02% | ±0.03%/0.02% | ±0.03%/0.02% | ±0.03%/0.02% |
| Current Output | ±50pA to ±1.05A | ±50pA to ±1.05A | ±500pA to ±3.15A | ±100pA to ±10A (pulse) |
| Voltage Output | ±5μV to ±210V | ±5μV to ±1100V | ±5μV to ±63V | ±1μV to ±100V |
| Power Output | 20W | 20W | 60W | 100W pulse |
| Source Accuracy, I/V (± setting) | ±0.03%/0.02% | ±0.03%/0.02% | ±0.03%/0.02% | ±0.03%/0.02% |

These instruments also offer additional features that simplify I-V testing:

• Digital I/O interface provides a fast data link to widely used probers and hot chucks with Start-of-Test, End-of-Test, and three category bits

• Programmable voltage and current output sweeps for fixed, linear stair, log stair, pulse, linear stair pulse, and log stair pulses

• External or hardware (Trigger Link) trigger compatible with the Model 2361 TCU

• Programmable delay time from 0 to 65,000ms

• Built-in over-voltage and over-temperature protection

• Fully guarded four-terminal (Kelvin) and two-terminal measurements

**NOTE:** Any Series 2400 SourceMeter in a system operating under Metrics-ICS software requires a Model 2361 in the system and an 8503 Trigger Link to BNC cable. Also requires firmware revision of C-19 or higher (Model 2430 must have C-22 or higher) and Metrics-ICS revision 3.5.2 or higher.

**1.888.KEITHLEY** (U.S. only)

**www.keithley.com**

**KEITHLEY**

A  G R E A T E R   M E A S U R E   O F   C O N F I D E N C E

**Interactive testing of current vs. voltage**

**SEMICONDUCTOR**