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In this issue:





CEO's Corner

Modern devices rarely behave like simple resistive loads. Their performance changes with bias, polarity, timing, temperature, and operating region, so engineers need more than a source and a meter working independently. The **SIGLENT SMM3000X Series Source Measure Unit** brings stimulus and measurement into one synchronized instrument, providing the control and resolution needed to expose how semiconductors, materials, batteries, and optoelectronic devices actually behave.

With four-quadrant operation, 6½-digit resolution, high-speed acquisition, flexible sweep modes, and pulsed current capability up to 10.5 A, the **SMM3000X** is built for precise characterization and faster test development. Its

touchscreen interface and USB and LAN connectivity also make it equally useful for interactive bench work and automated validation systems.

Read on for more details!

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Why and in what applications would I need an SMU?



Answer You need a source measure unit when a device must be stimulated with a precisely controlled voltage or current while its electrical response is measured at the same connection point. An SMU replaces several separate instruments by combining a voltage source, current source, voltmeter, ammeter, and ohmmeter in one tightly coordinated platform. It is especially valuable for I-V characterization, low-level leakage measurements, four-quadrant testing, pulsed device evaluation, and automated sweeps. Typical applications include diodes and transistors, GaN and SiC power devices, optoelectronic components, emerging materials, new-energy batteries, and high-density integrated circuits.

One Instrument for Sourcing and Measuring

A conventional setup may require separate power supplies, electronic loads, digital multimeters, waveform generators, and switching or control hardware. An SMU consolidates core sourcing and measurement functions so the applied stimulus and measured response remain closely coordinated. The SMM3000X can operate as a voltage source, current source, voltmeter, ammeter, and ohmmeter, while also supporting pulse generation and arbitrary waveform output.

This integration matters most when small changes in the applied signal can materially affect the result. By controlling the stimulus and capturing the response within the same platform, engineers can simplify connections, improve repeatability, shorten setup time, and build more efficient closed-loop tests.

Why Four Quadrant Operation Matters

Four-quadrant operation allows the instrument to source or sink current at either positive or negative voltage. In practical terms, the SMM3000X can deliver power to a device and absorb power returned by it. That bidirectional behavior supports devices and systems whose current flow or polarity changes during operation, and it gives engineers a more complete view of performance than a one-direction source alone can provide.

- **Source positive voltage and current. Bias and power devices during forward-operation tests.**
- **Source voltage while sinking current. Evaluate devices that return energy or operate in regenerative regions.**
- **Reverse polarity when required. Characterize behavior across positive and negative operating regions.**
- **Close the loop. Apply a controlled stimulus, measure the response, and adjust the operating point within one instrument.**
-

Performance Built for Demanding Measurements

The SMM3000X Series combines broad output capability with fine programming and measurement resolution. This range lets engineers move from low-level leakage and sensitive material measurements to higher-energy device tests without changing the fundamental test platform.

Capability	SMM3000X Series
Operating architecture	Four-quadrant source and measure operation
Display resolution	6½ digits
DC voltage output	Up to ±210 V
DC current output	Up to ±3.03 A
Pulsed current output	Up to ±10.5 A
Resolution	Down to 10 fA and 100 nV
Maximum acquisition rate	100,000 points per second
Minimum pulse width	50 µs
Sweep modes	Linear, logarithmic, and pulsed
Additional output capability	Pulse generation and arbitrary waveform output
User interface	5-inch high-resolution capacitive touchscreen

Connectivity	USB and LAN



Applications Where an SMU Earns Its Place

Semiconductor Current Voltage Characterization

Linear, logarithmic, and pulsed sweeps let engineers rapidly map current-versus-voltage behavior in diodes, transistors, and other nonlinear devices. These sweeps can reveal turn-on behavior, conduction regions, leakage, and response across changing bias conditions, producing the data needed for design verification, model development, comparison, and screening.

GaN and SiC Power Device Testing

Wide-bandgap devices can switch high voltage and current rapidly, making transient behavior a central part of their evaluation. In pulse mode, the SMM3000X can deliver current up to 10.5 A with pulse widths as short as 50 µs. Short, controlled pulses help emulate transient operating conditions while reducing the duration of device heating, supporting work such as switching-loss evaluation and R&D validation.

Optoelectronic Device Evaluation

LEDs, photodiodes, sensors, and related optoelectronic devices often require precise biasing together with sensitive current measurement. The SMM3000X provides the coordinated source-and-measure capability needed to capture electrical response across operating points, including low-level behavior that can be difficult to resolve with general-purpose instruments.

Emerging Materials Research

New conductive, resistive, photovoltaic, and energy-related materials may display nonlinear, polarity-dependent, or time-dependent behavior. Fine resolution down to 10 fA and 100 nV helps researchers examine subtle electrical effects, while multiple sweep modes and arbitrary waveform output provide flexibility for exploring device response under different stimulus profiles.

Battery and Energy Device Development

Four-quadrant operation is useful when a test must alternate between delivering and absorbing power. For new-energy battery development, the ability to source and sink within the same instrument can simplify controlled charge-discharge research, device characterization, and validation workflows. The integrated measurement functions capture voltage and current response as operating conditions change.

High Density Integrated Circuit Testing

Modern integrated circuits often require precise supply conditions, current-consumption measurements, and repeatable bias sweeps. The SMM3000X combines accurate sourcing with high-resolution measurement and acquisition rates up to 100,000 points per second, supporting faster characterization and helping engineers identify dynamic behavior that slower test methods may miss.

Low Current and Leakage Measurement

When device quality is defined by tiny currents, instrument sensitivity becomes critical. With programming and measurement resolution down to 10 fA, the SMM3000X can support leakage-current investigations and other low-level measurements where ordinary power supplies and handheld meters may not provide sufficient control or visibility.

Sweep Pulse and Waveform Flexibility

Different devices call for different stimulus strategies. Linear sweeps provide an intuitive view across evenly spaced operating points. Logarithmic sweeps concentrate measurements across decades of current or voltage, making them useful when device behavior spans a wide dynamic range. Pulsed sweeps apply brief stimulus intervals for transient analysis and reduced self-heating. Arbitrary waveform output extends the platform beyond standard sweeps when a custom stimulus profile is needed.

Together, these modes allow the same instrument to support exploratory bench measurements, repeatable characterization routines, and automated test sequences. Engineers can begin with manual operation on the capacitive touchscreen and move the same work into a PC-controlled environment through USB or LAN as the test matures.

A Faster Path from Bench Test to Automation

The 5-inch high-resolution capacitive touchscreen provides direct access to setup and measurement functions for day-to-day laboratory use. USB and LAN interfaces make the instrument easy to connect to a computer or integrate into an automated system. This combination supports a practical development path: investigate device behavior interactively, define the correct limits and sweeps, and then automate repeat testing for validation or production-oriented workflows.
Because sourcing and measurement are combined, automation can also require fewer independent instruments and fewer synchronization steps. The result is a more compact test station, simpler programming logic, and a clearer relationship between the applied stimulus and acquired data.

When to Choose the SMM3000X

Consider the SIGLENT SMM3000X Series when your work requires one or more of the following:

- **Synchronized stimulus and response measurement.** Apply voltage or current and measure the device response through the same coordinated platform.
- **Bidirectional operation.** Source and sink power across positive and negative voltage and current regions.
- **Sensitive low-level measurements.** Resolve currents and voltages that demand finer control than general-purpose bench instruments provide.
- **High-current pulsed testing.** Apply brief current pulses up to 10.5 A with a minimum width of 50 µs.
- **Rapid I-V acquisition.** Use linear, logarithmic, or pulsed sweeps and acquisition rates up to 100,000 points per second.
- **A smooth path to automation. Move from touchscreen-based bench measurements to USB- or LAN-connected PC control.**
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The Practical Advantage

The central advantage of an SMU is not simply that it combines several instruments. It creates a unified measurement loop in which sourcing, limiting, measuring, and data capture work together. For nonlinear, sensitive, or bidirectional devices, that coordination can improve repeatability, reduce setup complexity, and reveal behavior that is difficult to capture with loosely connected equipment.
The **SIGLENT SMM3000X** Series extends that advantage with four-quadrant operation, fine resolution, fast acquisition, flexible sweeps, and substantial pulsed-current capability. It is a versatile platform for engineers and researchers developing the next generation of semiconductors, energy devices, optoelectronics, materials, and integrated circuits.

Available from Saelig Company

The **SIGLENT SMM3000X** Series Source Measure Units are available from SIGLENT technical distributor Saelig Company, Inc. For detailed specifications, free technical assistance, or more



information, call **1-888-7SAELIG**, email **info@saelig.com**, or visit **www.saelig.com**.

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