

TEST & MEASUREMENT SOLUTIONS FOR IoT

From Power Management to Wireless Compliance and Performance

The Power of IoT

For IoT devices, battery testing and power management presents unique challenges. Since many IoT devices and sensors are battery powered, energy efficiency is critical. Components must be tested under real-world conditions to ensure maximum battery life. An expected 10-year battery life for low-power sensors and machine-type devices means that a wealth of data can be collected and acted upon.

In the IoT era, a flood of new products will need to be tested and verified, increasing the burden on R&D teams and their test equipment.

Contact us today to learn more about our complete portfolio of power measurement solutions and IoT design and testing equipment.

Why Electro Rent?

Electro Rent enables power management and IoT design and testing in a host of industries. Our test and measurement solutions help companies around the world reduce costs and increase efficiency. Our large inventory ensures that you get the equipment you need, when you need it, and our worldwide logistics facilities bring you global capabilities. We have a variety of easy-to-start rental and financing options to fit practically any budget. We proudly offer solutions from world-leading manufacturers. Let us help you on your journey to success.



Battery Drain Analysis

Keithley 2281S-20-6 Battery Simulator



The Series 2281S Battery Simulator and Precision DC Power Supply integrates battery simulation with the functions of a high-precision power supply for battery testing. Analyze the DC power consumption of a device under test, test a battery and generate a battery model based on the battery charging process and simulate a battery based on the battery model.

The 2281S-20-6 can output up power to 20 V and 6 A and sink current up to 1 A.

- Simulate battery output during the charge and discharge cycles.
- Create, edit, import and export battery models.
- Display the real-time change of the SOC, Voc and Vt for the simulated battery.
- Compute battery capacity in Amp-Hours and Equivalent Series Resistance (ESR).
- Program the battery SOC, Voc, capacity and resistance.
- Monitor charge/discharge current and voltage.
- Output up to 120 W of low-noise, linear-regulated power.
- Monitor load currents from 100 nA to 6 A with high accuracy.
- Measure voltage and current with 6 1/2-digit resolution.
- Sink current up to 1 A and source current up to 6 A.
- GPIB, USB and LAN interfaces.

Battery Drain Analysis

Keysight N6705C/056 DC Power Analyzer Battery Drain analysis modules for sourcing and measuring current consumption and battery drain analysis



The N6705C DC Power Analyzer provides productivity gains for sourcing and measuring DC voltage and current into the DUT by integrating up to four (4) advanced power supplies with DMM, Scope, Arb and Data Logger features. Eliminates the need to gather multiple pieces of equipment and create complex test setups, including transducers (such as current probes and shunts) to measure current in your DUT.

The DC Power Analyzer also eliminates the need to develop and debug programs to control a collection of instruments and take useful measurements because all functions and measurements are accessible on the front panel.

When automated bench setups are required, the N6705C is fully programmable over GPIB, USB, LAN and is LXI Compliant. The N6705C offers flexible configuration to meet your power sourcing and analysis requirements

- 4-slot mainframe holds up to 600 W of total power and up to 4 modules.
- More than 30 DC power modules to choose from (modules ordered separately).
- Voltmeter accuracy: Up to 0.025% + 50 μ V, up to 18 bits.
- Ammeter accuracy: Up to 0.025% + 8 nA, up to 18 bits.
- Arbitrary waveform generator function: Bandwidth up to 100 kHz, output power up to 500 W.
- Scope function: Digitizes voltage and current at up to 200 kHz, 512 kpts, up to 18 bits.

Battery Drain Analysis

Keysight N6781A / N6785A



The N6781A and N6785A offer the features to accurately capture the power consumption of portable, battery-powered devices from 20 W to 80 W. When used with the Keysight 14585A software, the N6781A and N6785A become an even more powerful battery drain analysis solution, offering greater insights into your measurements.

Whether the DUT is an e-Book reader, MP3 player, mobile phone, “phablet,” tablet, or IoT device, the N6781A and N6785A’s seamless measurement ranging, programmable output resistance and auxiliary DVM combine to create a solution to help you deliver exceptional battery life.

- Deliver exceptional battery life with insight into device power consumption.
- Measure all modes of operation simultaneously without the need to change measurement ranges and seamless, dynamic measurements down to nA and μV .
- Accurately emulate battery performance with internal resistance of a battery using the programmable output resistance of the N6781A and N6785A.
- Perform tests with the actual battery. Monitor battery voltage with the built-in auxiliary voltage measurement system while using the SMU’s ammeter mode (zero-burden current shunt) to perform real-world battery rundown tests.
- Easily understand your measurements, including scope, data logger, and cumulative distribution function (CCDF) statistical analysis.

Device Power Consumption Testing

Keithley 2636B



The Keithley 2636B is a 2600B series dual channel system SourceMeter® (SMU) instrument (0.1fA, 10A pulse). It is a leading current/voltage source and measure solution. This dual channel model combines the capabilities of a precision power supply, true current source, 6 1/2 digit DMM, arbitrary waveform generator, pulse generator and electronic load all into one tightly integrated instrument.

The result is a powerful solution that significantly boosts productivity in applications ranging from bench-top I-V characterization through highly automated production test. It has 100mV to 40V voltage, 100nA to 10A current measurement range (source).

This is a tightly-integrated, 4-quadrant voltage/current source and measure instrument that offers high performance with 6 1/2digit resolution. Built-in web browser-based software enables remote control through any browser, on any computer, from anywhere in the world.

- Compatible with the Keithley IVy mobile app.
- Simplifies semiconductor component test, verification and analysis.
- Ethernet, IEEE-488, USB 2.0, LXI-C, GPIB, RS-232 and digital I/O interfaces.
- SMU per pin parallel testing with TSP-Link technology.
- 100V to 250VAC, 50Hz to 60Hz (auto sensing) power supply, 240VA maximum power consumption.
- Perform Quick I-V characterization with Android devices.

Device Power Consumption Testing

Keithley
2450



The 2450 is Keithley's next-generation SourceMeter.

The 2450 is the SMU for everyone: a versatile instrument, particularly well-suited for characterizing modern scaled semiconductors, nanoscale devices and materials, organic semiconductors, printed electronics and other small-geometry and low-power devices.

With front panel input banana jacks, this rear panel input source measure unit (SMU) instrument truly brings Ohm's law (current, voltage and resistance) testing to your fingertips. The innovative graphical user interface (GUI) and advanced, capacitive touchscreen technology allow intuitive usage and minimize the learning curve to enable engineers and scientists to learn faster, work smarter and invent easier.

- Capabilities of analyzers, curve tracers, and I-V systems at a fraction of the cost.
- Five-inch, high-resolution capacitive touchscreen GUI.
- 0.012% basic measure accuracy with 6½-digit resolution.
- Enhanced sensitivity with new 20mV and 10nA source/measure ranges.
- Built-in, context-sensitive front panel help.
- Four "Quickset" modes for fast setup and measurements.
- Source and sink (four-quadrant) operation.
- 2450 SCPI and TSP scripting programming modes.
- Front panel USB memory port for data/programming/configuration I/O/capacitance effects.

Device Power Consumption Testing

Keysight
B2900A Series
Precision SMU's for sourcing and measuring low voltage and current



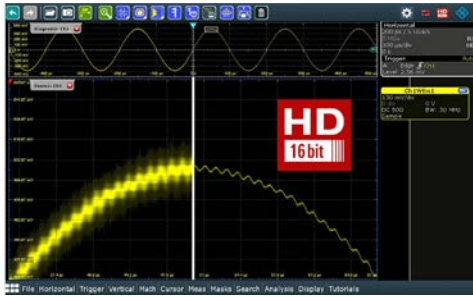
The Keysight B2900A Series of Precision Source/Measure Units are compact and cost-effective bench-top Source/Measure Units (SMUs) with the capability to source and measure both voltage and current. These capabilities make the B2900A Series ideal for a wide variety of IV (current versus voltage) measurement tasks that require both high resolution and accuracy.

The Keysight B2900A Series of SMUs have broad voltage (± 210 V) and current (± 3 A DC and ± 10.5 A pulsed) sourcing capability, high precision (minimum 10 fA/100 nV sourcing and measuring resolution) and a superior color LCD graphical user interface (GUI). In addition, several task-based viewing modes dramatically improve productivity for test, debug and characterization

- Integrated 4-quadrant sourcing and measuring capabilities.
- Measurement range: ± 210 V, ± 3 A (DC), ± 10.5 A (pulsed).
- Source and measurement resolution down to 10 fA and 100 nV.
- User-friendly front panel GUI with 4.3 inch color LCD display supports both graphical and numerical view modes.
- 10 microsecond digitizing capability.
- Small form factor with USB2.0, LAN, GPIB and digital I/O interfaces.

Power Integrity Tests

Rohde & Schwarz RTO-K31



The Rohde & Schwarz RTx-K31 software option provides essential measurement functions for analyzing power electronics, including inrush current, output spectrum and safe operating area. A measurement wizard with detailed instructions guides the user through the test setup. The oscilloscope configures itself automatically and delivers quick results. Optimal display configuration for each task.

Available on the following oscilloscopes

- RTO2000
- RTM3000
- RTA4000

Power Integrity Tests

Tektronix PA3000

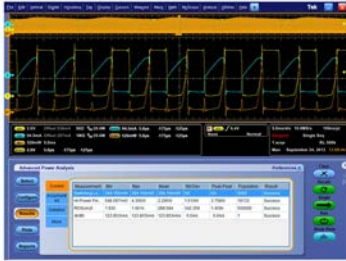


The Tektronix PA3000 is a one-to-four-channel power analyzer that is optimized for testing today's single and multi-phase, high efficiency power conversion products and designs. Use it to quickly visualize, analyze and document power efficiency, energy consumption, and electrical performance to the latest regional and international standards, including Level VI, EnergyStar, CEC, IEC 62301, CQC-3146 and more.

- One to four channels support single and three-phase applications.
- 10 mW standby power measurement.
- 1 MHz bandwidth with 1 MS/s sampling rate.
- 16-bit A/D.
- Harmonic analysis to 100th order.
- $\pm 0.04\%$ basic voltage and current accuracy.
- Measurements to 30 Arms and 600 Vrms Cat II (2000 Vpk).
- High accuracy supports testing to Level VI efficiency standards for external AC/DC power supplies.
- Dedicated energy consumption testing in integration mode for standards like Energy star and CEC.
- Complete solution for full compliance testing to IEC 62301 standby power requirements.
- High 1 MHz bandwidth supports the LED module energy certification requirements of CQC-3146, as well as harmonic analysis of designs with higher fundamental frequencies.
- More than 50 standard measurement functions, including harmonics, frequency and star-delta computation.
- Built-in ± 15 V supplies for external transducers to support high-current applications.
- USB and LAN interfaces standard (GPIB option).

Power Integrity Tests

Tektronix DPO4PWR for MDO4104C



DPO4PWR, Advanced Power Measurement and Analysis software for the Tektronix MDO4104C, allows power supply designers to configure multiple measurements with custom defined settings, measure and analyze power dissipation in switching devices and measure and analyze magnetic parameters in a single acquisition.

The addition of new measurements such as Inrush current, Capacitance and Reactive power provides more insight into the input/output characterization of power supplies. Designers who otherwise spend a lot of time manually analyzing power dissipations per cycle can now, with the Switching loss plot and the Time trend plot, measure power dissipation at all switching cycles graphically.

A single .mht format with the append feature provides an easy way to generate reports that include measurements, test results, and plot images. This solution elevates your productivity to a new level and helps SMPS designers meet pre-compliance requirements.

Signal Integrity Tests

Keithley DMM7510



The DMM7510 combines all the advantages of a precision digital multimeter, a graphical touchscreen display, and a high speed, high resolution digitizer to create an industry first: a graphical sampling multimeter.

The digitizer gives the DMM7510 high signal analysis flexibility; the five-inch capacitive touchscreen display makes it easy to observe, interact with, and explore measurements with “pinch and zoom” simplicity. This combination of high performance and ease of use offers deep insights into your test results.

- Precision multimeter with 3½ to 7½ digit resolution.
- Capture and display waveforms or transients with 1 MS/sec digitizer.
- Large internal memory buffer; store more than 11 million readings in standard mode or 27.5 million in compact mode.
- 14 PPM basic one-year DCV accuracy.
- 100 mV, 1 Ω, and 10 μA ranges offer the sensitivity to measure low level signals such as portable device sleep mode currents.
- Make accurate low resistance measurements with offset compensated ohms, four-wire and dry circuit functions.
- Auto-calibration feature improves accuracy and stability by minimizing temperature and time drift.
- Readings and screen images can be saved quickly via the front panel USB memory port.
- Multiple connectivity options: GPIB, USB and LXI- compliant LAN interfaces.

Signal Integrity Tests

Keysight 34470A



The Keysight 34470A 7½ digit, Performance Truevolt DMMs offer higher levels of accuracy, speed and resolution. Get more insight quickly: Truevolt DMM's graphical capabilities such as trend and histogram charts that offer insights quickly. Both models also provide a data logging mode for easier trend analysis and a digitizing mode for capturing transients.

Measure low-power devices: The ability to measure very low current, 1 µA range with pA resolution, allows you to make measurements on very low power devices. Maintain calibrated measurements: Auto calibration allows you to compensate for temperature drift, so you can maintain measurement accuracy throughout your workday.

- Resolutions up to 7½ digits.
- Reading rates up to 50,000 readings/s.
- Memory up to 2 million readings.
- Voltage ranges from 100 mV to 1,000 V.
- Current range from 1 µA to 10 A.
- USB and LAN interfaces, optional GPIB.
- BenchVue software enabled.

Signal Integrity Tests for IoT

Keysight 34972A



The Keysight 34970A data acquisition/data logger switch unit consists of a three-slot mainframe with a built-in 6 1/2 digit digital multimeter. Each channel can be configured independently to measure one of 11 different functions without the added cost or hassle of signal-conditioning accessories.

Choose from eight optional plug-in modules to create a compact data logger, full-featured data acquisition system or low-cost switching unit. On-module screw-terminal connections eliminate the need for terminal blocks, and a unique relay maintenance feature counts every closure on every switch for easy, predictable relay maintenance. The module 34901A features a built-in thermocouple reference and 20 two-wire channels.

- 3-slot mainframe with USB and LAN.
- 6 ½-digit (22-bit) internal DMM, scanning up to 250 channels per second.
- 8 switch and control plug-in modules to choose from.
- Built-in signal conditioning measures thermocouples, RTDs and thermistors, AC/DC volts and current; resistance; frequency and period.
- 50k readings of non-volatile memory holds data when power is removed.
- Hi/LO alarm limits on each channel, plus 4 TTL alarm outputs.
- BenchVue software enabled: BenchVue DAQ Control and Analysis app enables you to create tests without programming.

Signal Integrity Tests for IoT

Keysight 6000 X-Series



The 6000 X-Series delivers an affordable 6-GHz bandwidth and an low noise floor of 210 μ Vrms at 1 mV/div to help you make the most accurate measurements. The 6000 X-Series' 450,000 waveforms-per-second update rate coupled with the exclusive hardware-based zone touch trigger provide unprecedented visualization power to help you isolate waveforms of interest.

Add a new depth of "visualization" to your designs with a 12-inch multi-touch capacitive touch screen with gesture support, embedded-OS-oscilloscope optional jitter/real-time eye analysis and standard histogram and color grade.

The 6000 X-Series has 7-in-1 integration, combining digital channels, serial protocol analysis, a built-in dual-channel waveform generator, frequency response analysis, built-in digital multimeter and built-in 10-digit counter with totalizer.

N2820A

This N2820A current probe comes with two parallel amplifiers possessing different gain settings. The low-gain side allows you to see the entire waveform (or the 'zoomed out' view) and the high gain amplifier provides a 'zoomed in' view.

The precision sense resistor is positioned in the interchangeable Rsense head that is plugged into the probe body. The probe body can be found at the same location as the differential amplifier. On the 'user-defined' sense head, there is no resistor, which allows the probe to be used with the user's sense resistor on the target. The user will need to enter the sense resistor value into the scope.

Signal Integrity Tests for IoT

Keysight DSOX6PWR



The Keysight DSOX6PWR is a power measurement and analysis option integrated into InfiniiVision 6000 X-Series scopes. The embedded application provides a quick and easy way of analyzing the reliability, efficiency and performance of your switching and linear power supplies.

Signal Integrity Tests for IoT

Keysight N7020A



The N7020A power rail probe is for users making power integrity measurements that need mV sensitivity when measuring noise, ripple and transients on their DC power rails. The probe is designed for measuring periodic and random disturbances (PARD), static and dynamic load response, programmable power rail response and similar power integrity measurements. Many of today's products have tighter tolerances on their DC power rails than the previous generations of these products, and the N7020A power rail probe is designed to help users assure that their products meet these tighter tolerances.

The N7020A power rail probe can be used with the Keysight InfiniiVision 3000T and 4000 X-Series oscilloscopes, InfiniiVision 6000 X-Series oscilloscopes ordered after Feb 1, 2016, the Infiniium S-Series DSO and MSO high-definition oscilloscope and the Infiniium 9000 Series DSO and MSO oscilloscopes running software revision 5.20 or newer. If you need higher bandwidth, the N7024A power rail probe has a bandwidth of 6 GHz and can be used with S, V, and Z-Series Infiniium oscilloscopes.

- Low noise: 1:1 attenuation ratio probe adds only 10% to the baseline noise of the oscilloscope to which it is attached.
- Large offset range: Has a large +/-24 V offset range, enabling users to set their oscilloscope at maximum sensitivity and have the signal centered on the screen.
- Low DC loading: 50 kΩ DC input impedance will not significantly load DC power rails.
- Large active signal range: Has a +/-850 mV active signal range in addition to its large offset range so users can measure large transitions of their power rails.
- High bandwidth: 2-GHz bandwidth makes it very useful for finding high-speed transients that can have detrimental effects on clocks and digital data.

Signal Integrity Tests for IoT

Rohde & Schwarz RTO2014



Rohde & Schwarz RTO oscilloscopes perform precise measurements at a high input sensitivity and very low inherent noise. The unique high-definition mode enables up to 16-bit resolution. With an acquisition rate of up to one million waveforms per second, these oscilloscopes detect sporadic signal faults very quickly.

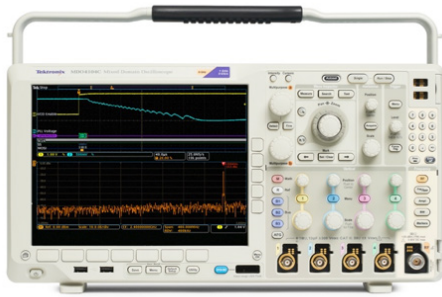
The RTO oscilloscopes are engineered for multi-domain challenges and to facilitate debugging of systems with different signal types. The oscilloscopes enable simultaneous time, frequency, logic and protocol analysis and displays the results referenced over time. For the first time, a special tool is available for these applications: a zone trigger that can be used in both the time domain and in the frequency domain.

These oscilloscopes are extremely easy to use. Gesture operation simplifies measurement tasks. You can even customize the waveform display. The app cockpit provides fast access to all available applications.

- Precise measurements due to very low noise level: 1 % of full scale at 1 mV/Div and 1 GHz.
- High dynamic range due to single-core A/D converter.
- Wide selection of measurement functions: over 90 automated measurements.
- High-resolution touchscreen for ease of use.
- Color coding for clear overview.
- Class-leading 400 MHz logic analysis: 5 Gsample/s and 200 Msample memory on 16 channels.
- High definition: see more with up to 16-bit vertical resolution.

Signal Integrity Tests for IoT

Tektronix MDO4104C/PWR + TCP0150



Introducing the high performance 6-in-1 integrated oscilloscope that includes a spectrum analyzer, arbitrary/function generator, logic analyzer, protocol analyzer and DVM/frequency counter.

The MDO4000C Series has the performance to solve the embedded design challenges quickly and efficiently. When configured with an integrated spectrum analyzer, it provides simultaneous and synchronized acquisition of analog, digital and spectrum, ideal for incorporating wireless communications (IoT) and EMI troubleshooting. The MDO4000C is completely customizable and fully upgradeable, so you can add the instruments you need at any time.

Oscilloscope

- 4 analog channels.
- 1 GHz, 500 MHz, 350 MHz, and 200 MHz bandwidth model's bandwidth is upgradeable up to 1 GHz.
- Up to 5 GS/s sample rate.
- 20 M record length on all channels.
- > 340,000 wfms maximum waveform capture rate.
- Standard passive voltage probes with 3.9 pF capacitive loading and 1 GHz or 500 MHz analog bandwidth.
- Spectrum Analyzer (Optional) Frequency range of 9 kHz - 3 GHz or 9 kHz - 6 GHz.
- Ultra-wide capture bandwidth ≥ 1 GHz.
- Time-synchronized capture of spectrum analyzer with analog and digital acquisitions.
- 50 MHz waveform generation.

About

Electro Rent is a leading global provider of test and technology solutions that enable customers to accelerate innovation and optimize asset investments. Our rental, lease, sales, and asset management solutions serve innovators in communications, aerospace and defense, automotive, energy, education, and electronics industries, and we have been doing so since 1965.

Contact Us Today

Contact us today to learn more about our complete portfolio of power measurement and IoT design and testing solutions.

You can reach us by phone at **1.800.553.2255** or email **iotpower@electrorent.com**. Our advisors are available to assist with your product testing and financing needs.



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