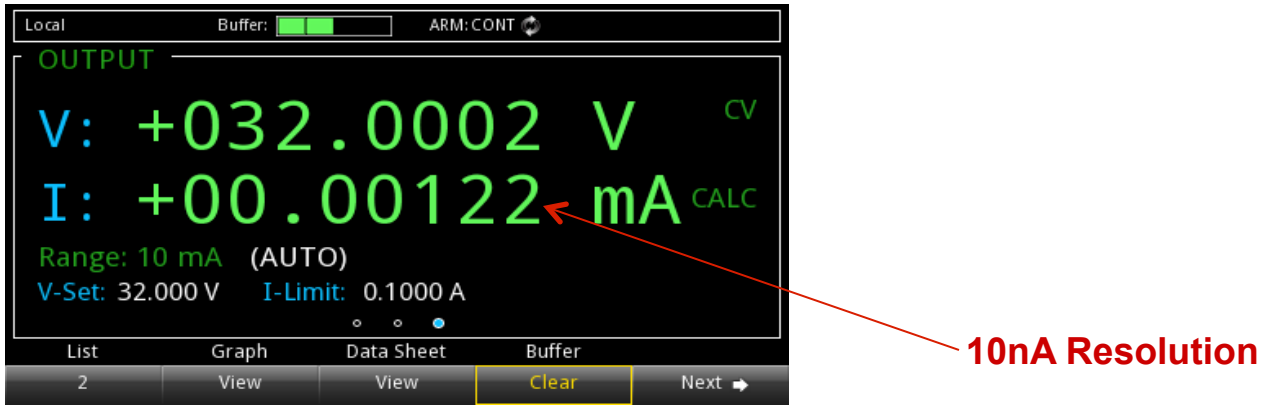
Application Overview:
Monitoring Sleep and Standby Currents from Low Power Devices

Measuring sleep mode and standby mode currents drawn by low power, portable devices such as consumer products (cellular phones, tablets, laptops), industrial products (wireless transmitters, intrinsically safe instruments), and implantable medical devices (pacemakers, defibrillators, neurological stimulators) is essential to ensure that critical power consumption specifications are met. These tests require precise low current measurements down to microamp levels, which requires not only good measurement techniques but also sensitive instrumentation with special capabilities for measuring very small load currents. However, specialized, sensitive instrumentation is costly and adds more complexity to the test circuit. A readback power supply for both sourcing voltage and measuring current is one solution, but most conventional programmable power supplies have a measuring resolution of only milliamps at best and, therefore, cannot be used for low current measurements.

Unlike conventional power supplies, Keithley's Series 2280S Precision Measurement, Low Noise, Programmable DC Power Supplies make digital multimeter- (DMM) quality measurements with up to 6½ digits. Users can employ filtering and control the number of power line cycles used to measure load currents from amps to 100nA. Resolution is optimized with four ranges of load current measurement - 10A, 1A, 100mA, and 10mA – so full load currents as well as standby mode and sleep mode currents can be measured accurately. With up to 6½ digits, even very small changes in load currents can be confidently detected.



With its flexibility for controlling the number of power line cycles for the measurement and ability to use filtering, the Series 2280S can measure very low currents down to 100nA.

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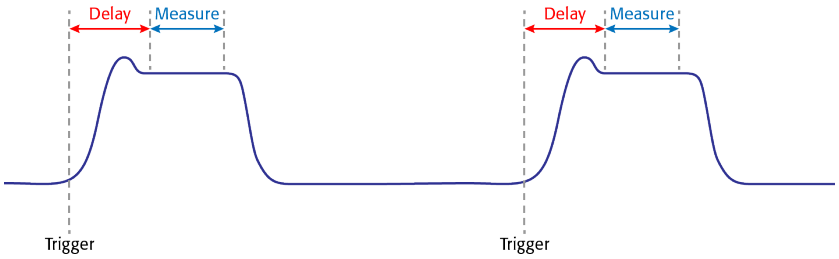
Application Overview: Determining Device Power Consumption When Device Current is Drawn in Short Pulses

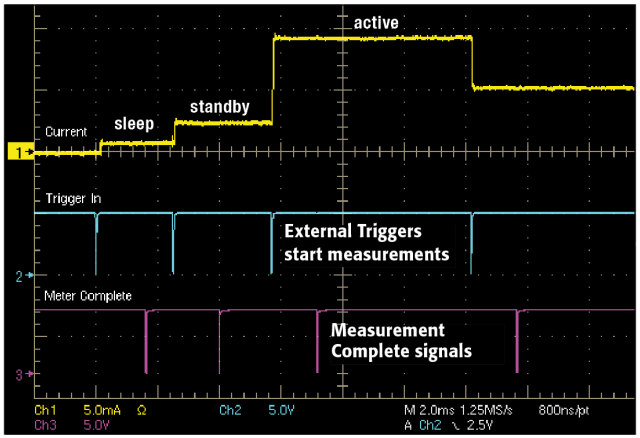
Design engineers need to minimize the total power consumption of their designs to maximize battery life so they need to be able to monitor the current consumption for all the operating states of their devices. However, many electronic devices, including automotive keyless entry devices, remotely-located wireless transmitters used in industrial processes, portable and implantable medical devices, and portable consumer electronics, operate in standby mode most of the time and are only fully active for short intervals. Their current loads during their active states are pulse-like.

To measure load currents during short active periods, test instruments need to have a wide current measurement range and the capability to measure dynamic load currents that are extremely narrow pulses. Traditional power supplies take measurements only over an integral number of power line cycles, but the pulse-like load currents may only last for 100s of microseconds, so a digital multimeter (DMM) or data acquisition instrument is needed in series with the power supply. When an additional instrument is used as a voltage measuring device, then a sense resistor must also be added to the circuit. This technique adds significant cost, more complexity to a test configuration, and an additional source of error.

Unlike most power supplies on the market, Keithley's Series 2280S Precision Measurement, Low Noise, Programmable DC Power Supplies measure narrow pulse-like loads currents without the need for additional instruments. They offer a wide current measurement range from 100nA to 6A and can also make fast measurements to capture load changes that occur in intervals as short as 140µs. With the Series 2280S, designers and manufacturers of portable, battery-operated devices can easily monitor load currents during all a device's operating modes; and, as a result, determine the its total power consumption.



Series 2280S power supplies enable time-critical measurements on fast-changing or pulse-like loads. An external trigger initiates the acquisition. Programmable delay and measure times enable measurements at a specific time on the load current pulse such as when the peak has stabilized.



Series 2280S power supplies measure the start-up load currents as a device powers up. An external trigger tells the Series 2280S when to make a measurement. The Series 2280S signals when the measurement is completed so that the device can be put in its next state.

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Series 2280S Precision Measurement DC Power Supplies - Much More than Just Sources of Clean Power

Keithley's Series 2280S Precision Measurement, Low Noise, Programmable DC Power Supplies can source stable, low noise voltages as well as monitor load currents over a wide dynamic range from amps to 100 nanoamps. The Model 2280S-32-6 can output up to 32V at up to 6A; the Model 2280S-60-3 can output up to 60V at up to 3.2A.

These precision measurement power supplies combine a high resolution color screen display with soft-key buttons and a navigation wheel to provide an easy-to-navigate user interface that speeds instrument setup and operation. Built-in plotting functions allow monitoring trends such as drift. Series 2280S power supplies provide the flexibility required for both benchtop and automated test system applications and even provide a list mode, triggers, and other speed optimization functions to minimize test time in automated testing applications.

Features		2280S-32-6	2280S-60-3
Max Voltage		32V	60V
Max Current		6A	3.2A
Max Power		192W	192W
Voltage Setting Accuracy		± (0.02% + 3 mV)	± (0.02% + 6 mV)
Voltage Setting Resolution		1 mV	1 mV
Voltage Measurement Accuracy		± (0.02% + 2 mV)	± (0.02% + 4 mV)
Voltage Measurement Resolution		0.1 mV	0.1 mV
Output Ripple and Noise (Bandwidth 20Hz-20MHz)		< $1mV_{RMS}$	< $2mV_{RMS}$
Current Limit Setting Accuracy		±(0.05% + 5 mA)	±(0.05% + 5 mA)
Current Limit Setting Resolution		0.1 mA	0.1 mA
Current Measurement			
Range	**Resolution**		
10 mA	10 nA	±(0.05% + 10 µA)	±(0.05% + 10 µA)
100 mA	100 nA	±(0.05% + 10 µA)	±(0.05% + 10 µA)
1 A	1 µA	±(0.05% + 250 µA)	±(0.05% + 250 µA)
10 A	10 µA	±(0.05% + 250 µA)	±(0.05% + 250 µA)
Minimum load Current Measurement Pulse Width (1A and 10A range)		140µs	140µs
Interfaces		GPIB, USB, LAN LXI	
Front/Rear Output Connections:		Front – 2 wire, Rear – 4 wire	
Digital I/O:		6 input/out pins	

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