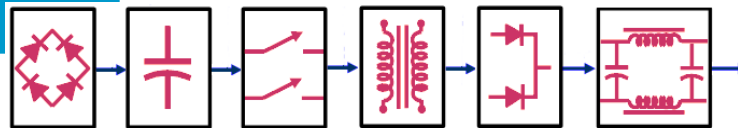
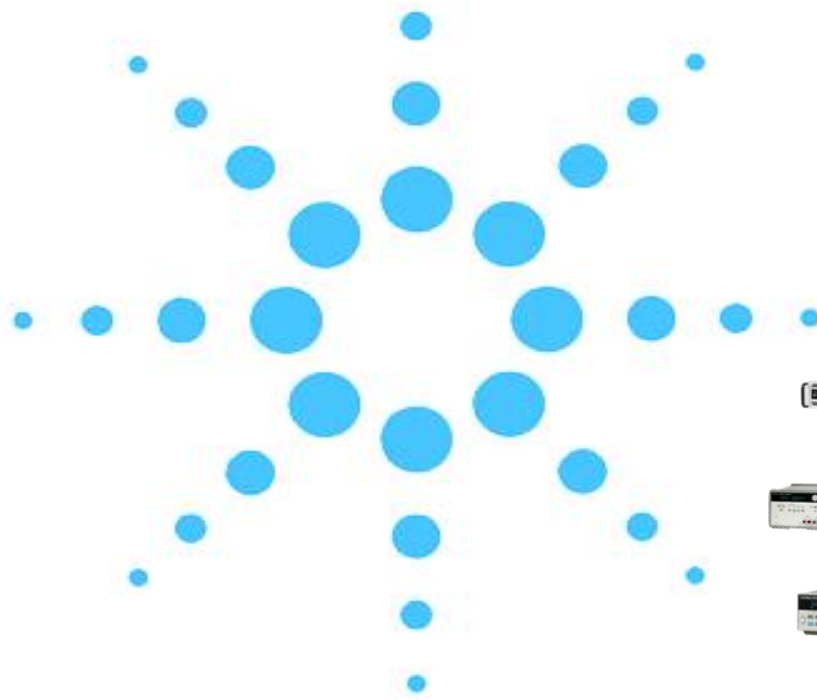


Power Product Technology Trends



Choosing the right power supply



Agilent Power Products

Click on Image to Navigate to the Topic



Agilent Technologies

Today's Power Supplies: Meeting Basic and
Sophisticated Application Requirements
August 8, 2011

Choosing a power supply

– Consider these factors

Ripple & Noise

- if <10 mV p-p, choose a linear or precision switch mode supply: E8000, E3600, 6541-55, 6641-45, N6750 series

Output Measurements

- if output measurements are needed instead of a set point read back, choose any Agilent power supply

Number of Outputs

- If multiple outputs are needed, choose E3620-31, E3641-49, 6620, N6700, or 66000 series

Output Accuracy

- if programming accuracy of <0.03, choose a performance supply: 6620 or N6760 series

Computer Control

- Choose any Agilent power supply except for 6500 series, U8000 series, and E3610A-30A

Front or Rear Outputs

- if front terminals are needed, choose U8000, E3600, 6610, or N6705 series

Output Response

- if fast output response of <15 ms, choose a performance supply: 6610-55, N6750, or N6760 series

Analog Control

- Choose 6540/50 series, 6640/50 series, or N5700/N8700 series

Physical Size

- If half rack is needed, choose U8000, E3600, or 6610 series

Page Down for more



Attributes of Agilent's Power Supply Types

Attribute	Basic	Performance	Precision	Specialty
Computer Interface	GPIB	GPIB, LAN, USB		
Device Protection	yes			
Output Measurements	yes			
Fully specified	yes			
Remote Sensing	Some models	yes		
Low Ripple & Noise <10 mVpp	yes	Some models	yes	
Fast Transient Resp <75 msec	no	Some models	yes	
LIST mode	no	Some models		
High Accuracy	no	no	yes	
Polarity Reversal and Disconnect	no	Some models		no
Analog control	Some models		no	no
Seamless measurement ranges	no	Some models	no	yes
Zero burden current measurements	no	Some models	no	yes
Battery emulation	no	Some models	no	yes

Page Down for more



Examples Power Supply Application Choices

Task	Description	Power Supply Required
Basic DC Bias	Set the output to one voltage or current to power the DUT	Basic PS
Burn-in	Large amount of power or numerous channels	Basic PS
Margin Testing	- Test DUT at a variety of points in its operating range - Speed can be important if high throughput is required or if DUT has a large number of test points	Basic PS or Performance PS
Turn-on and Inrush Testing	- Multiple outputs must be sequenced - Measure how much current is drawn when DC bias is first applied	Performance PS
Characterization using Waveforms	- Stimulate the DUT with a time varying voltage to test under dynamic test conditions - Speed of changing output V or I is important	Performance PS
Parametric Testing of Devices	- Characterize the power consumption - Characterize performance of transistors, diodes, resistors and capacitors	Battery Drain Analyzer Precision SMU

Depends on required speed or required accuracy of V setting



Technology Trends in Power Supplies

BASIC Technologies

[Linear and switch mode with ripple & noise comparison](#)

[Constant V or I, ranging and V&I profiles](#)

[Output accuracy, measurements, and remote sensing](#)

[Combining power supplies in series and parallel](#)

[Safety features](#)

[Controlling the power supply via computer and analog input](#)

[Physical characteristics](#)

PERFORMANCE Technologies

[Precision source of voltage and current](#)

[High speed response to load or set point changes](#)

[Down programming](#)

[Arbitrary LIST of voltage & current output](#)

[Sequencing multiple outputs](#)

[Seamless ranging for pulsed current](#)

[Zero burden current measurements](#)

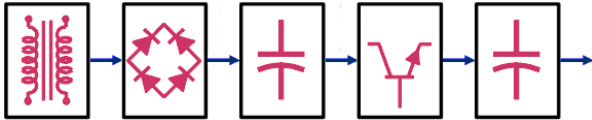
[Emulating solar arrays](#)

Click on the links above for details



Linear DC Power Supply Topology

Linear or series-pass



Applications

- Bench & laboratory
- Automated test
- Low power: < 500 W

Advantages

- Low output ripple & noise
- Fast programming speed
- Fast transient recovery

Disadvantages

- Low efficiency
- High weight/watt
- Physically large

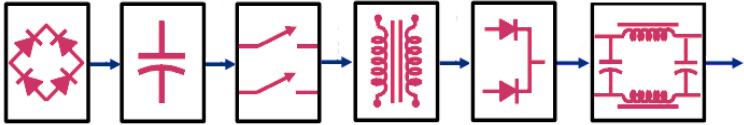
Note: Agilent's linear Power Supplies classically have fast programming speed which make them a good fit in test systems.

Page Down for more



Switched Mode DC Power Supply Topology

Switched mode (SMPS)



Advantages

- High power in small package
- High efficiency

Disadvantages

- Moderate to high** ripple & noise
- Moderate programming speed
- Moderate transient recovery

Applications

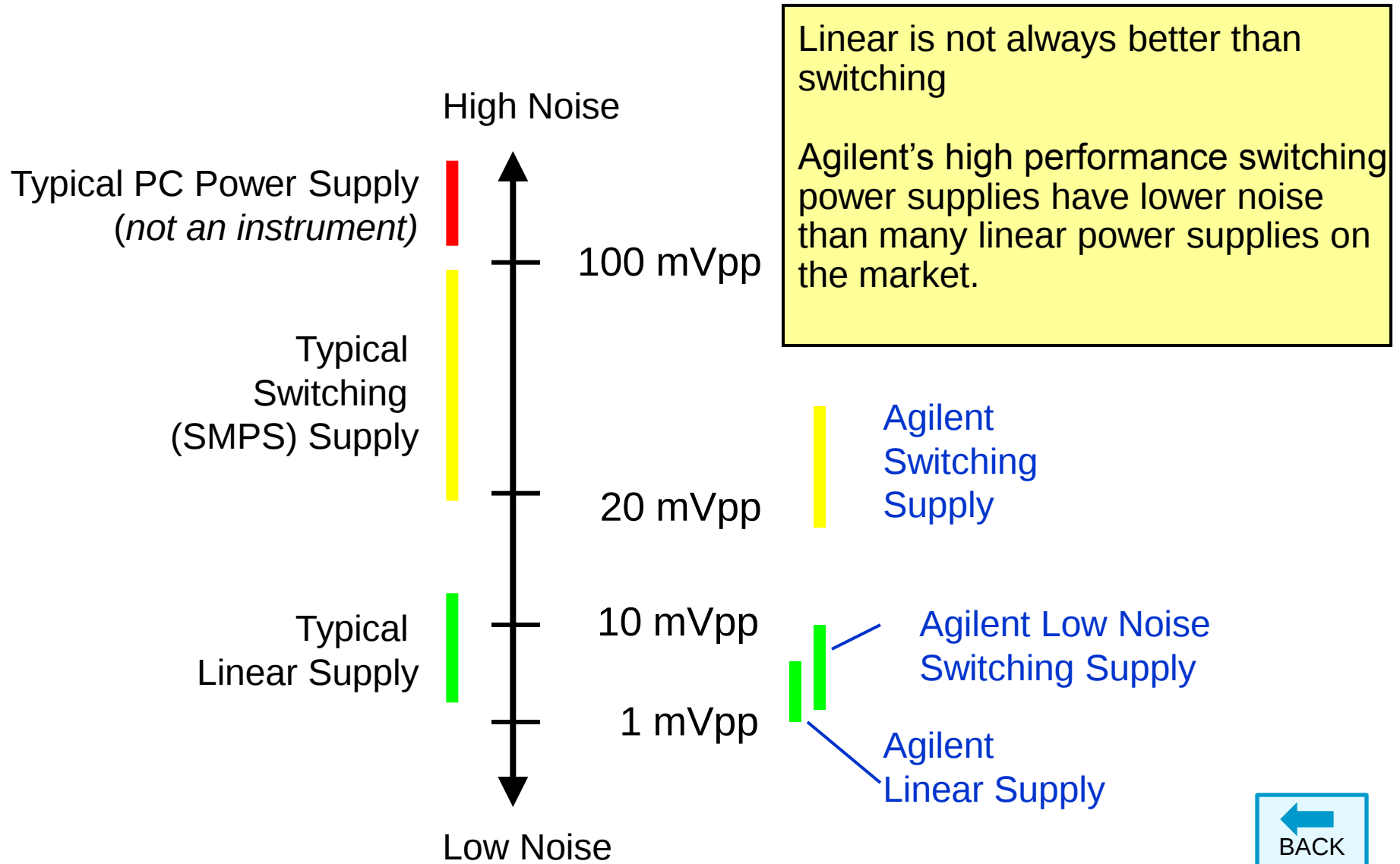
- Subassembly test
- Burn-in
- Bench & laboratory
- Electromechanical test

**Note: Agilent's newest Switching Power Supplies have noise, slew rate, programming speed and transient performance nearly that of linear supplies

Page Down for more



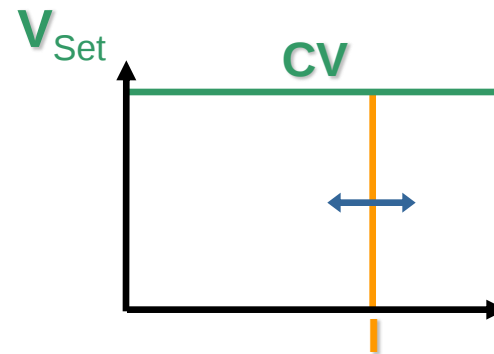
Ripple & Noise of Linear and SMPS



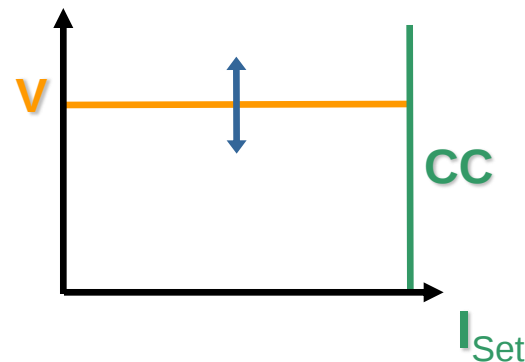
Constant Voltage and Constant Current

Constant voltage (CV) mode

- Output sensing



Constant current (CC) mode

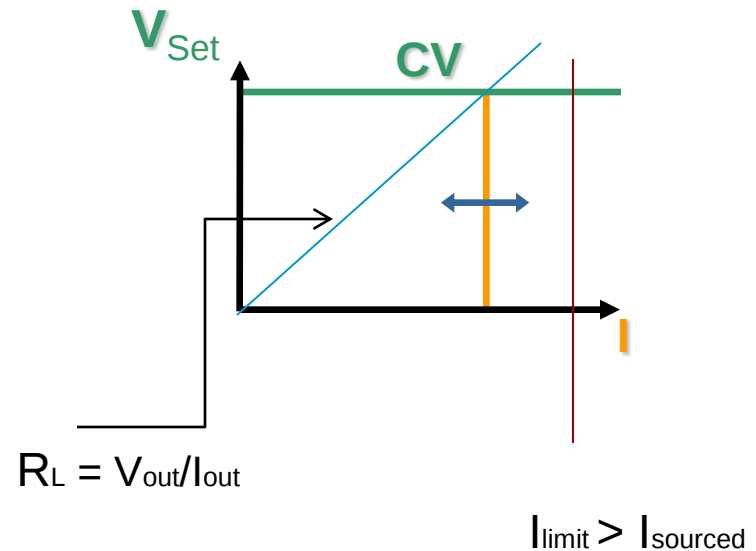


Page Down for more



Constant Voltage Example

- Assume we have a 10V, 10A Power supply
- Set V to 5V and I limit to 7A
- Assume 1 ohm load
- PS will source 5V, and resulting current draw will be 5A
- Since current drawn is < the current limit, PS operates in CV mode
- Load line intersects the V limit

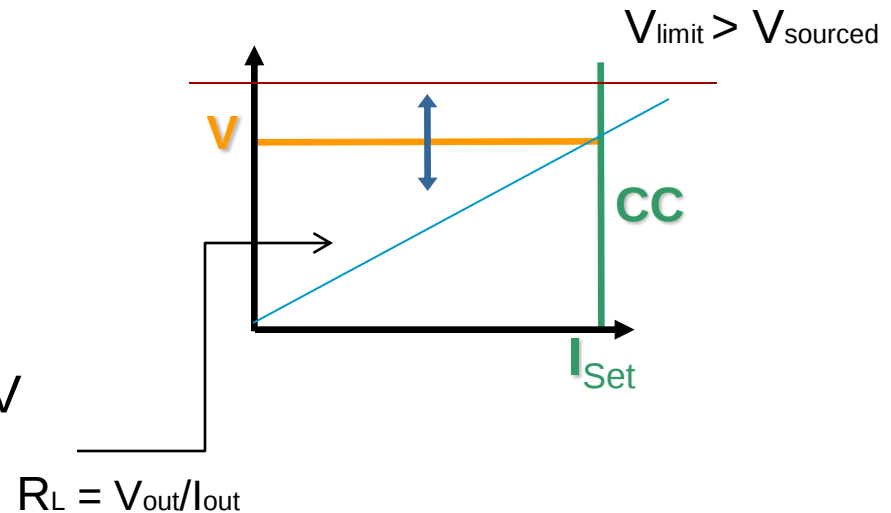


Page Down for more



Constant Current Example

- Same example, 10V 10A DC PS
- Set V limit to 5V, set I limit to 4A
- Assume 1 ohm load
- PS will source 5V, and attempt to source the resulting 5A
- Since $I_{\text{source}} > I_{\text{limit}}$, current is limited to the 4A setting and resulting V must drop to accommodate
- Load line intersects I limit

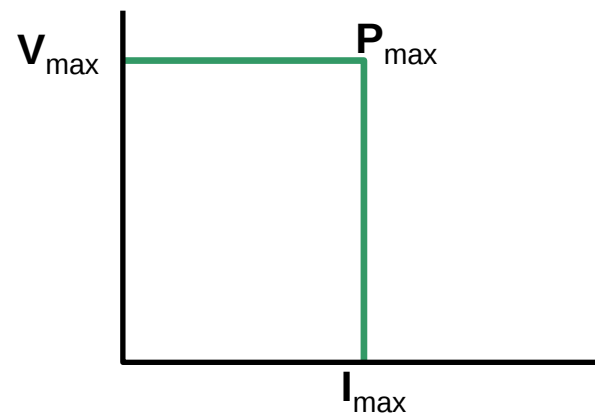


Page Down for more

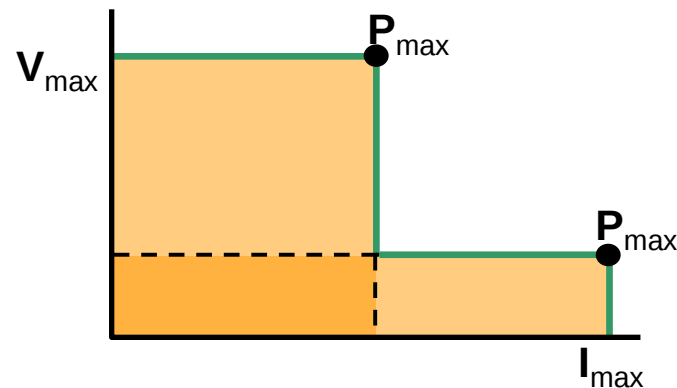


Output Voltage and Current Profiles

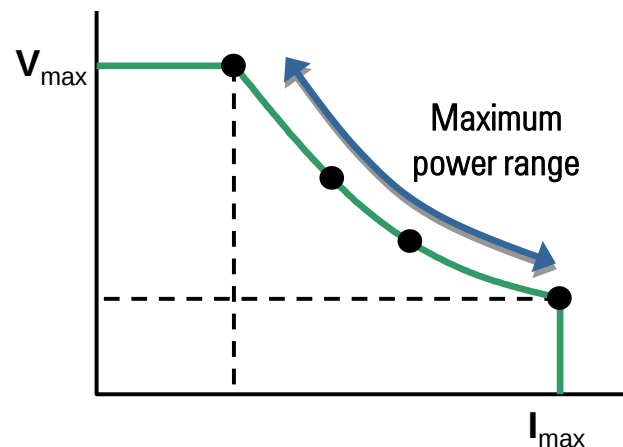
Rectangular



Dual-range



Autoranging



Output Accuracy

- There are two considerations for output accuracy
 - programming accuracy – how close to the set point it can be programmed
 - read back accuracy – how much uncertainty is there in the internal measurements
- Programming accuracy varies depending on the design of the power supply
 - $0.015\% + 6 \text{ mV}$ for a 50V, 3A Precision supply
 - $0.5\% + 300 \text{ mV}$ for a 600V, 1.8A Basic supply
- Read back accuracy depends on the internal DMM
 - $0.016\% + 6 \text{ mV}$ for a 50V 1.5A Precision supply
 - $0.1\% + 600 \text{ mV}$ for a 600V, 5A Basic supply



N5700 and N8700 Series



N6700 Series

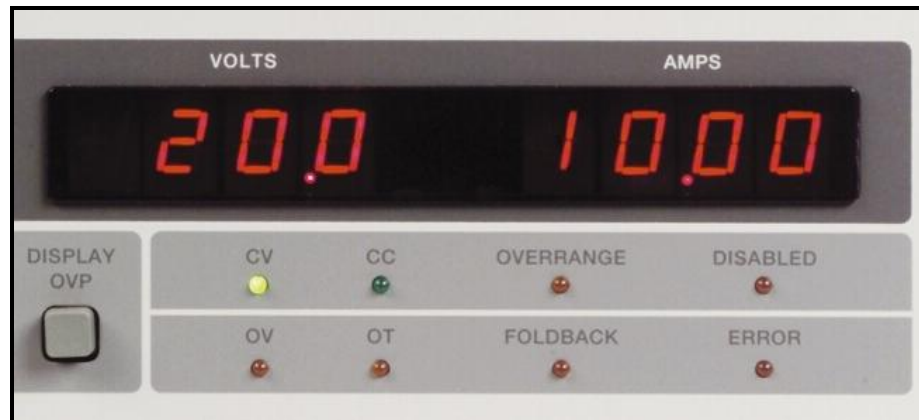


Page Down for more



Output Measurements

- Many power supplies have a built-in voltmeter and ammeter to read back its own output
- The measurements can be displayed on the front panel or queried by a computer connected to the interface
- These measurements are particularly useful in computer controlled systems
- Measurement (or read back) accuracy is specified as a percent of full scale plus an offset

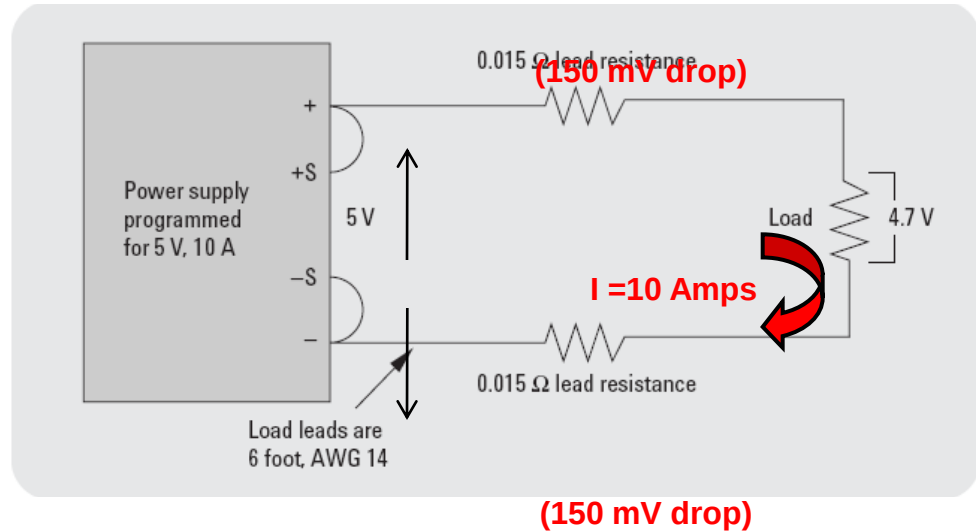


Page Down for more

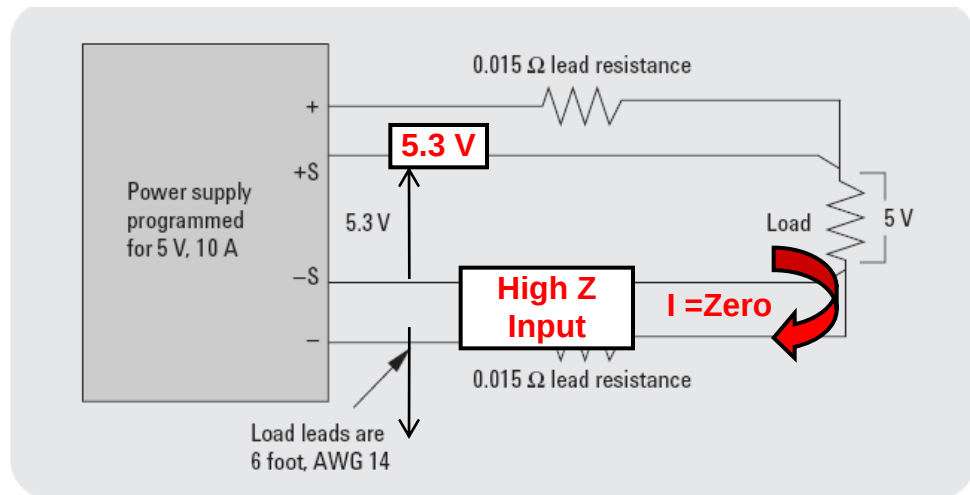


Remote Sense

Lead resistance can contribute a significant voltage drop between the output of the supply and the actual voltage presented at the load



The sense leads measure the voltage present at the load itself, and adjusts the output of the supply to compensate for the voltage drops in the leads



Page Down for more



Remote Sensing Best Practice

- Minimize Wiring Path Impedance

Four steps to minimize path impedance:

- Use larger gauge, twisted pair wire.
- Reduce distance between power supply and DUT.
- Minimize the use of relays / connectors.
- Select relays / connectors to minimize contact resistance; consider initial and end of life specs.

Beware of transient response issues for dynamic loads

- Use an adequate bypass capacitor at the DUT
- Consider a supply tailored for remote sensing with pulsed loads

Page Down for more



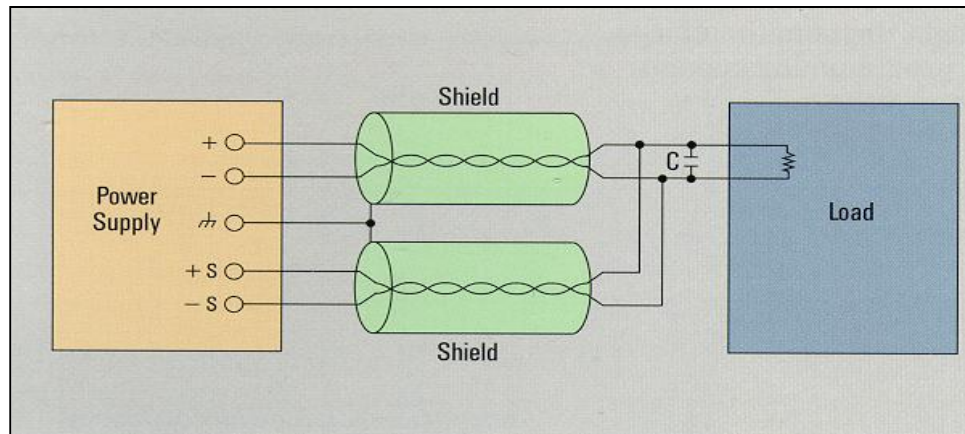
Minimizing the Effects of Noise Sources

Start with a low noise power supply

- it's easier to eliminate noise at the source than to filter it out later

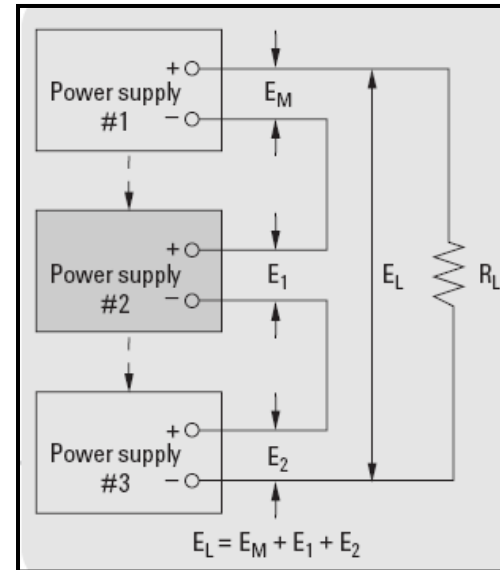
Use good connection practice to avoid pickup:

- eliminate loops; twist and shield connections from power supply to DUT
- carefully route power lines from ac mains to supply
- think through grounding connections; prefer a single point ground

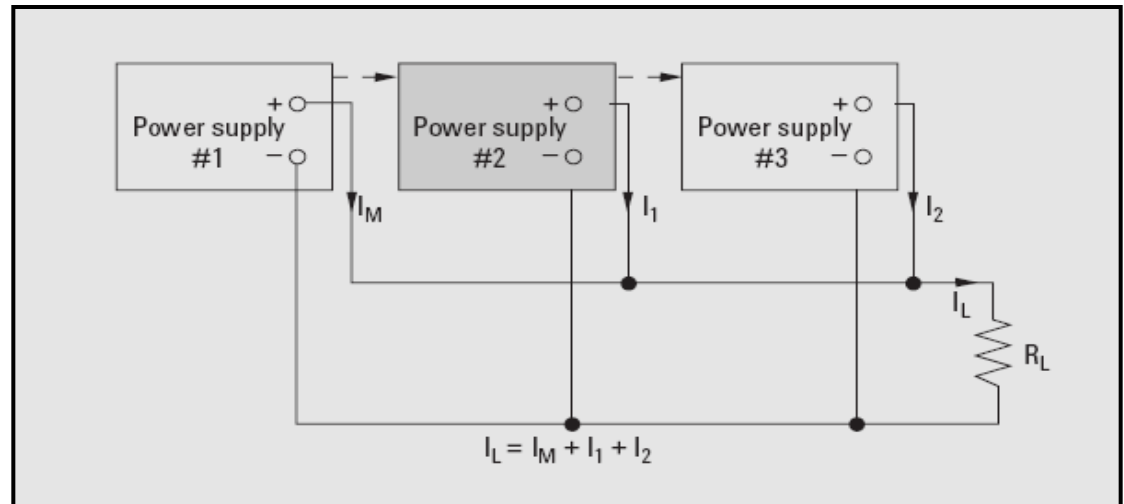


Combining Supplies

Connect Power Supplies in series for higher voltages



Connect Power Supplies in parallel for higher currents



Page Down for more


BACK

Parallel and Series Safety Precautions

SERIES CONNECTION

- Never exceed the floating voltage rating of any of the supplies.
- Never subject any of the power supplies to negative voltages.
- Program each power supply independently. If two supplies are used, program each one for 50% of the total output voltage. If three supplies are used, program each supply for about 33% of the total output voltage. Set the current limit of each supply to the maximum that the load can safely handle.

PARALLEL CONNECTION

- One unit must operate in constant voltage (CV) mode and the other(s) in constant current (CC) mode.
- The output load must draw enough current to keep the CC unit(s) in CC mode.
- Program the current limit of each unit to its maximum value and program the output voltage of the CV unit to a value slightly lower than the CC unit(s). The CC units supply the maximum output current that they have been set to and drop their output voltage until it matches the voltage of the CV unit, which supplies only enough current to fulfill the total load demand.



Safety Features

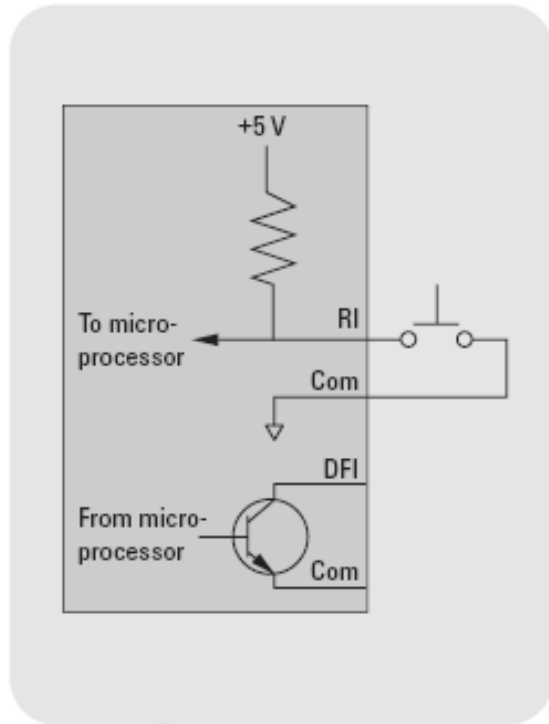


Figure 1. Remote inhibit and discrete fault indicator schematic

Protecting the Device Under Test

- Over Voltage Protection (OVP)
- Over Current Protection (OCP)
- Discrete Fault Indicator (DFI) / Remote Inhibit (RI)

Protecting the Power Supply

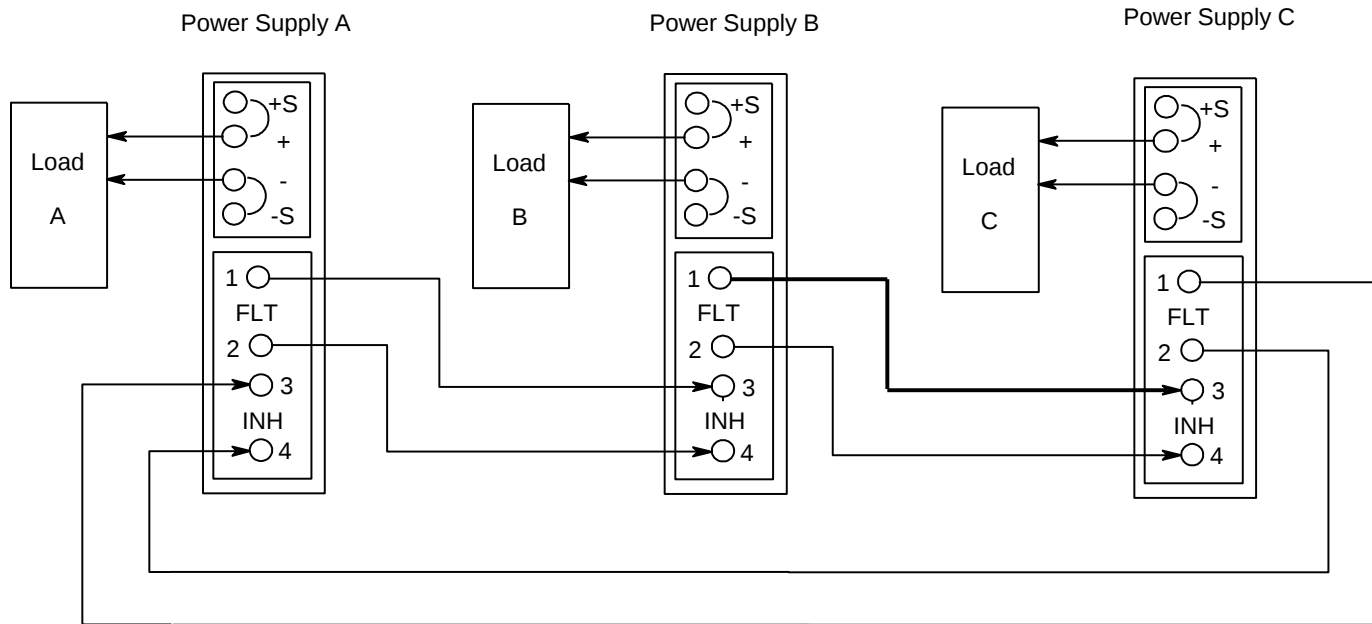
- Over Temperature Protection (OTP)
- Output Disconnect Relay
- Output Polarity Reversal

Page Down for more



Output protection features

Daisy-Chain of Three Power Supplies for Emergency Shutdown



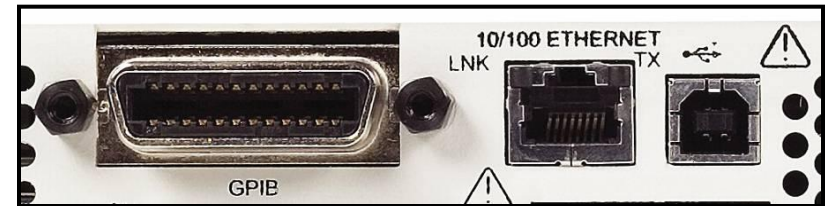
- For multiple bias input subassemblies, if one bias supply senses a failure, a signal is sent to shut down connected supplies
- TTL Input/Output
- Fault definition defined by system controller at set-up



Controlling the Power Supply

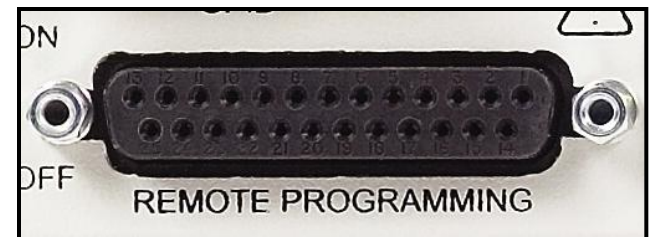
Computer Interfaces

- Many DC power supplies have both manual and computer control
- Hardware interfaces can include GPIB, USB, and LXI-C LAN



Analog Voltage Control Signal

- Some power supplies provide an analog voltage control input
- The power supply acts as an amplifier, providing current up to its rated maximum
- Use the Analog Control input to:
 - Amplify the power of the input signal
 - Track an analog voltage



Physical Characteristics



Physical size / Form Factor

- Half rack width or full rack width, some vendors offer ¼ rack width
- Height ranges from 1U to 4U (1.75 in to 7.00 in).
- Half rack width is generally better for bench applications
- Full rack width works well in system racks

Front or Rear Output Terminals

- System and high current power supplies have their outputs located on the rear panel
- Bench and some low current power supplies have their outputs on the front

Number of Outputs

- Multiple output power supplies can save space on the bench or in a rack



Precision voltage and current

Precision low-level performance

- The N6760 Series Precision DC Power Modules provide precision in the milliampere and microampere regions.

Source Measure Unit modules offer even more precision

- The N6780 Series of Source/Measure Units offer accurate measurements down to nanoamperes
- Also operate as a DC voltage source, DC current source, and electronic load.



N6700 Series



N6700 Series



N6760 and N6780 Series Modules



High speed response to output changes

➤ How fast the power supply changes its output in response to a load change and/or a set point change is determined by the design of the power supply

➤ Power supplies designed for use in relatively static conditions, such as a bias supply, tend to be slower

➤ Transient response on a 500V, 5A Basic supply is 5 millisecond

➤ Power supplies designed for dynamic load or set point changes, such as a battery emulator, tend to be much faster

➤ Transient response on a 50V, 3A Basic supply is <100 microsecond



6030 Series



N6700 Series



Down Programming

- **Capacitors discharge slowly under light loads**
 - Static voltage source: no problem
 - Varying voltage levels: slow tests
- **Down programming**
 - Rapidly decrease the output voltage
 - Reducing discharge times by hundreds of ms

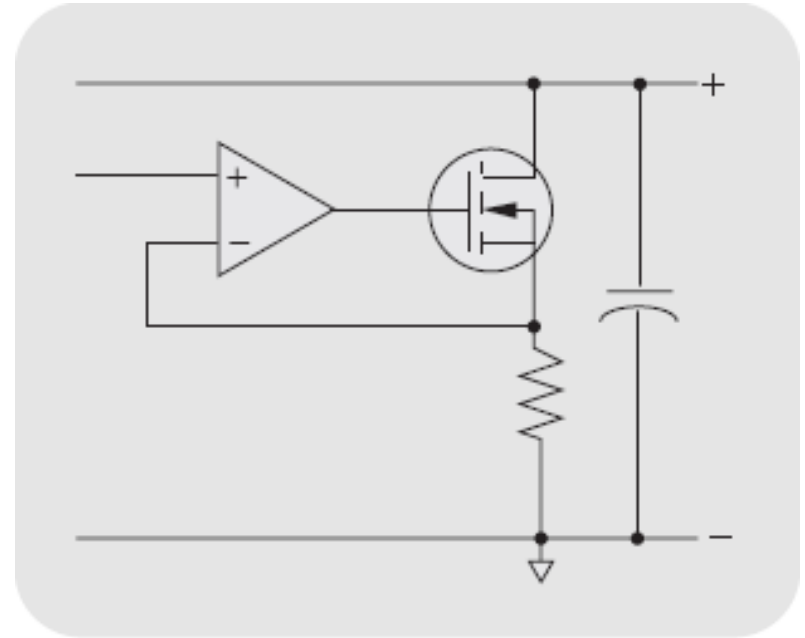
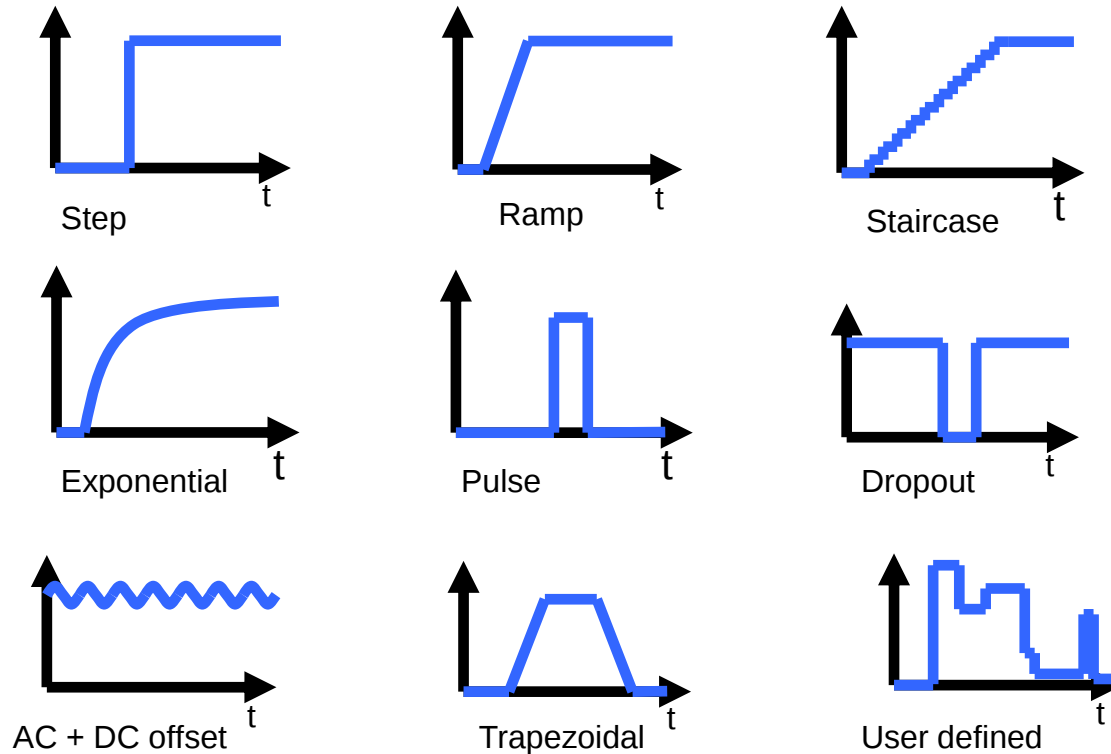


Figure 1: A down programming circuit with an FET across the output terminals



Arbitrary LIST of voltage outputs

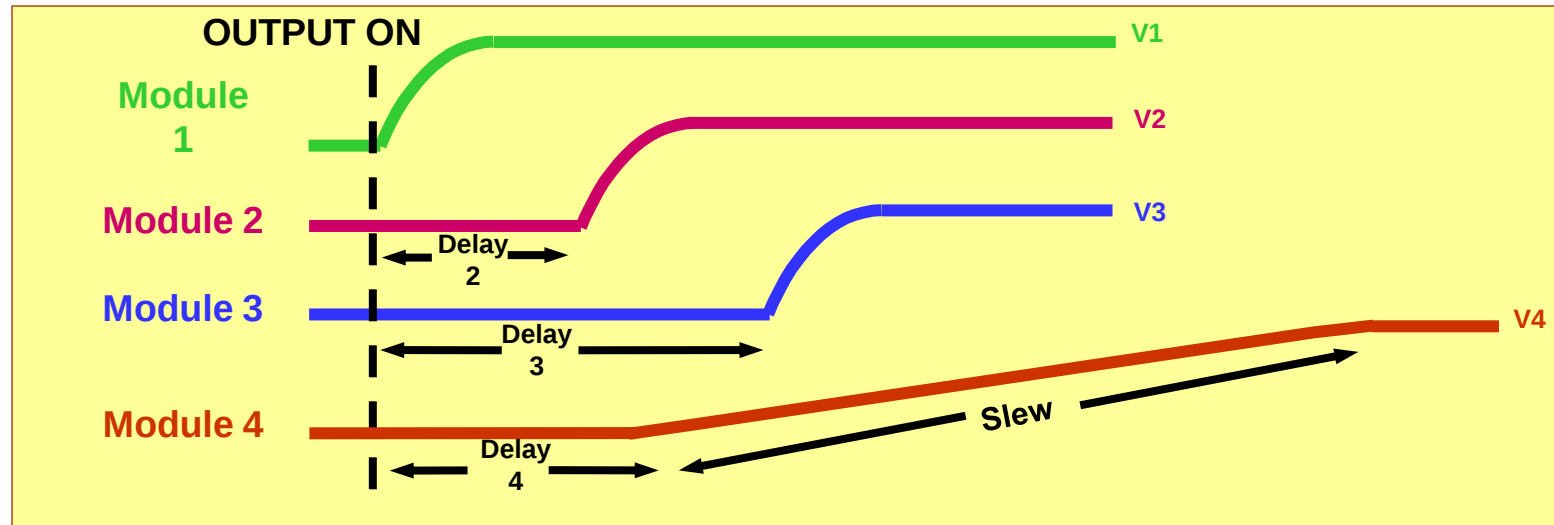


Programmable LIST of voltages are used to create time-varying outputs in a similar manner of an arbitrary waveform generator

Bandwidth is commensurate with a DC power supply (i.e., 500 Hz)



Output Sequencing



Can control output sequencing between modules with 1 ms resolution

Can control slew rate from 1 ms to 10 seconds for 0 to max V transition

Useful for powering up devices, PC boards, or subassemblies that require control of multiple bias supplies during startup

Can also set the output off sequence independently

Extendable across mainframes for > 4 outputs



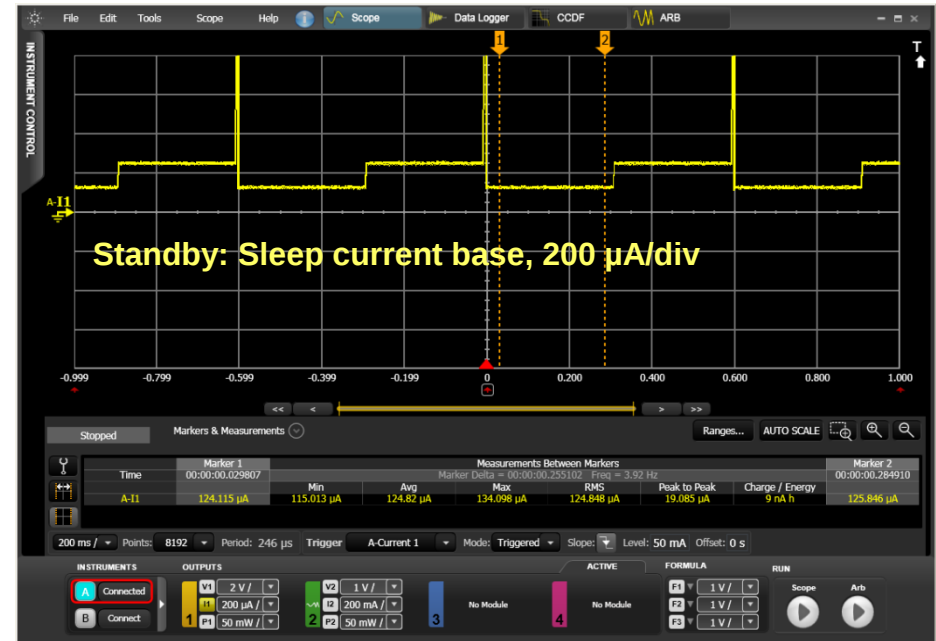
Seamless Measurement Ranging

The N6781A SMU features an automatic ranging function allows you to see low level detail on a high level signal



Fixed Range Measurement

With fixed ranging we are limited to the DC offset accuracy and noise floor of the 3A range



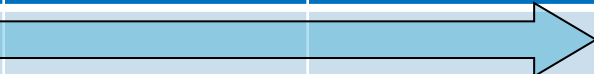
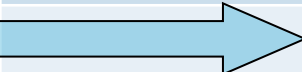
Seamless Ranging Measurement

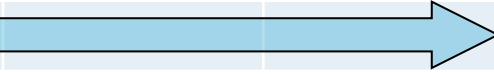
With seamless ranging we can measure up to 3A while having the DC offset accuracy and noise floor of the 1 mA range

Page Down for more



Agilent N6781A Seamless Ranging Innovation

Voltage				
Range	20 V	6 V	1 V	100 mV
Programming Accuracy	$\pm(0.025\% + 1.8 \text{ mV})$	$\pm(0.025\% + 600 \mu\text{V})$		
Measurement Accuracy	$\pm(0.025\% + 1.2 \text{ mV})$			
			$\pm(0.025\% + 75 \mu\text{V})$	$\pm(0.025\% + 50 \mu\text{V})$
   Seamless measurement between these 3 ranges				

Current						
Range	3 A	1 A	300 mA	100 mA	1 mA	10 μA
Programming Accuracy	±(0.04%+ 300μA)	±(0.04%+300μA)	±(0.03%+150μA)			
Measurement Accuracy	±(0.03% + 250 μA)			±(0.025% + 10μA)	±(0.025% + 100 nA)	±(0.025% + 8 nA)
   Seamless measurement between these 3 ranges						

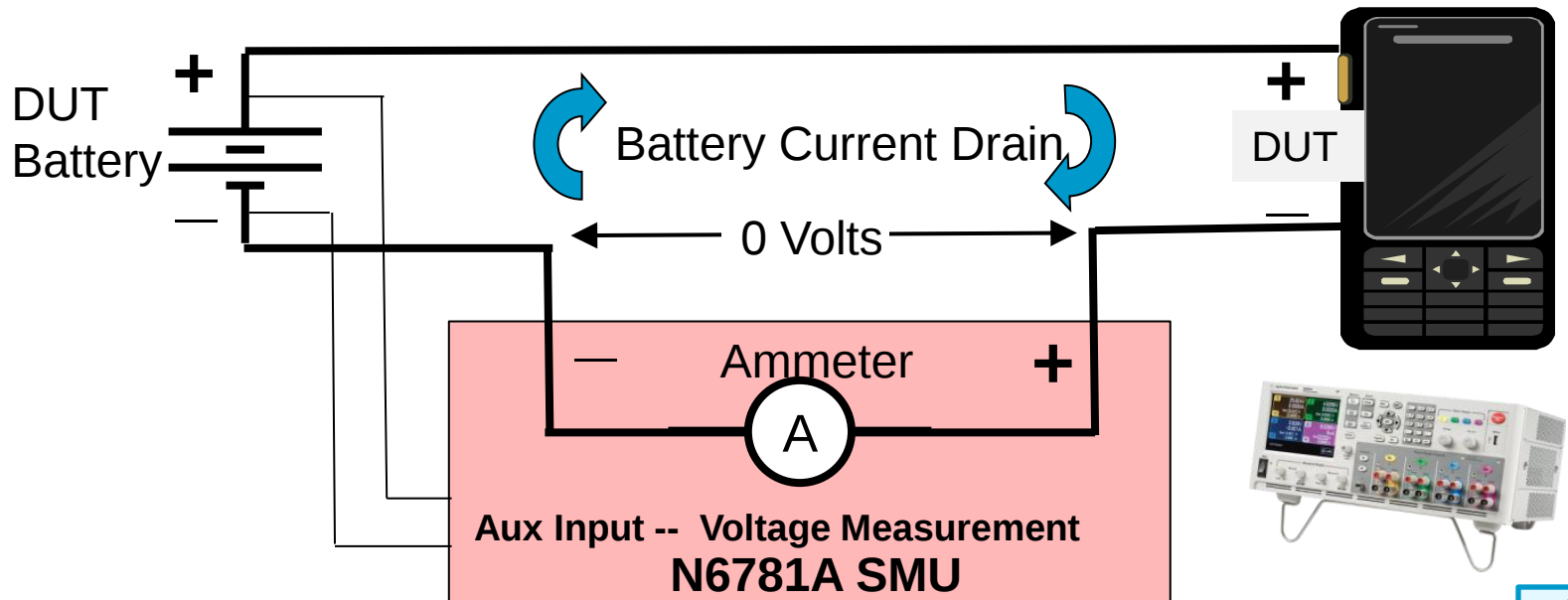
- Seamless ranging continually changes ranges without glitch nor loss of readings
- 200 kHz, 18-bit digitizer, with seamless ranging, acts like single range of ~28-bits
- 3 A range with an effective offset error as low as 100 nA (0.03 PPM) Accurate measurements from Amps to μA during a single scope sweep or data-log



Zero burden voltage when measuring current

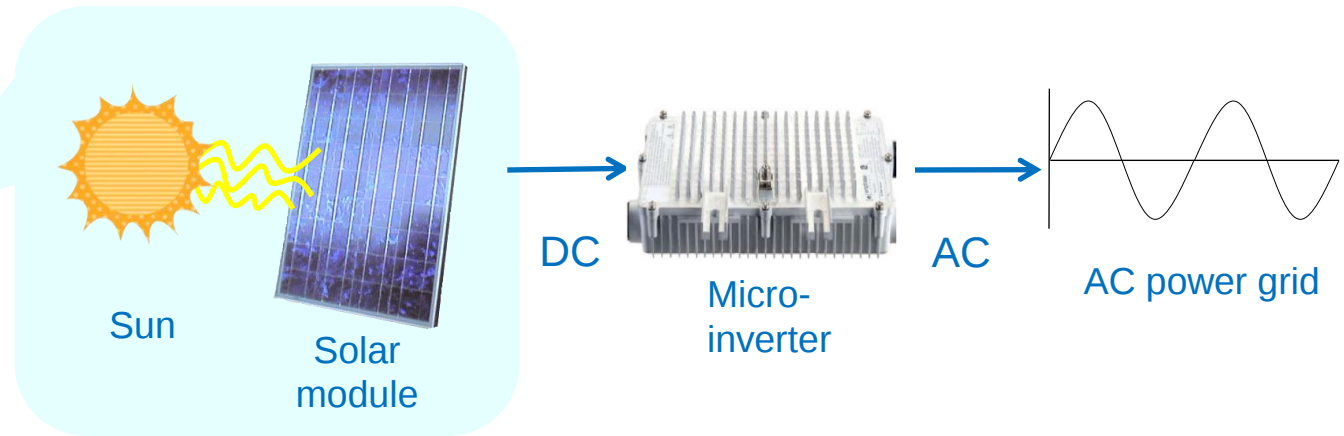
The N6781A can also be used as a logging meter for battery run-down testing

- Most realistic assessment of DUT performance is with its actual battery
- N6781A Measure-only operating mode logs actual battery current, voltage, power, amp-hours and watt-hours
- N6781A's output regulates zero volts while measuring current, becoming a zero-burden ammeter. Eliminates voltage drop problems that current shunt resistors have
- N6781A's Auxiliary DVM input simultaneously logs battery voltage

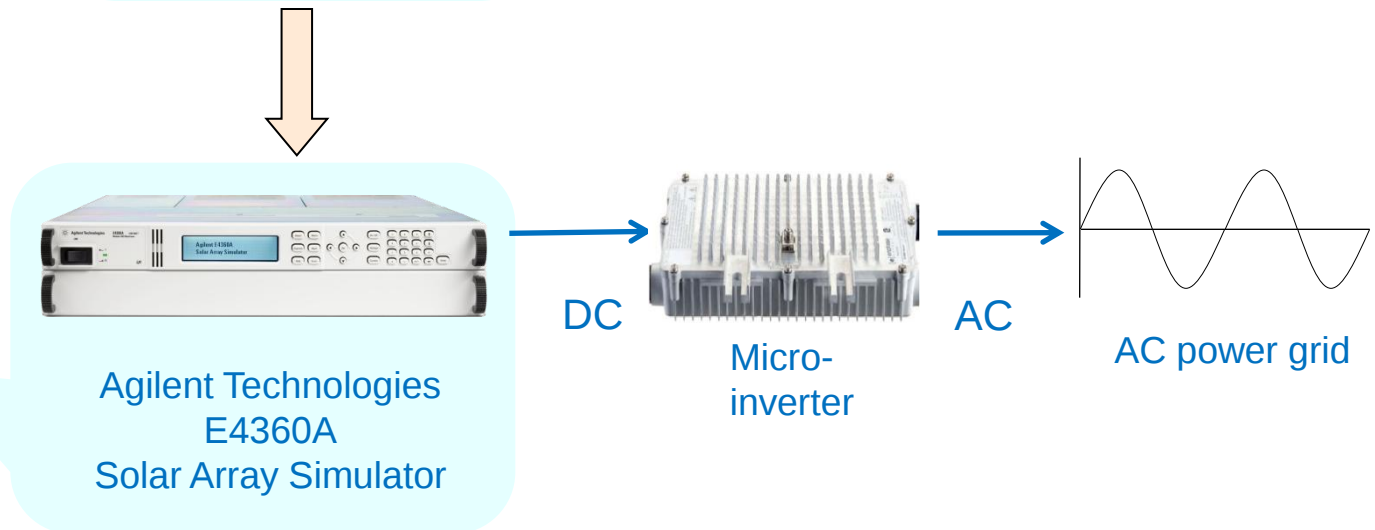


Solar Array Simulation

Difficult to implement
and control during test



Easy to implement
and control during test

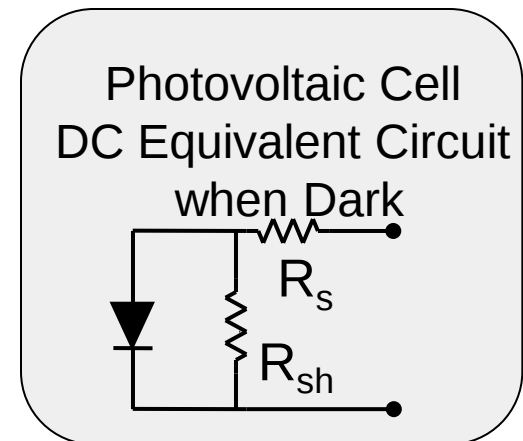
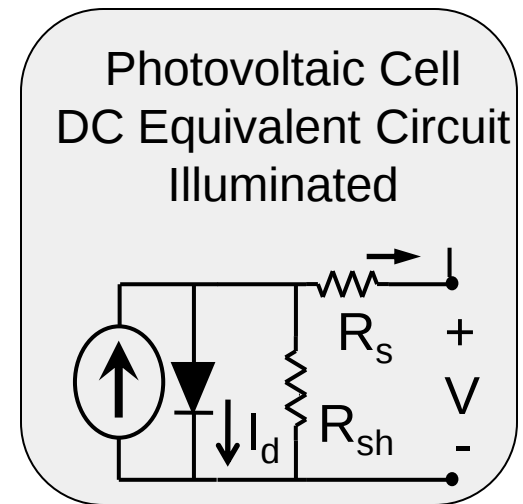
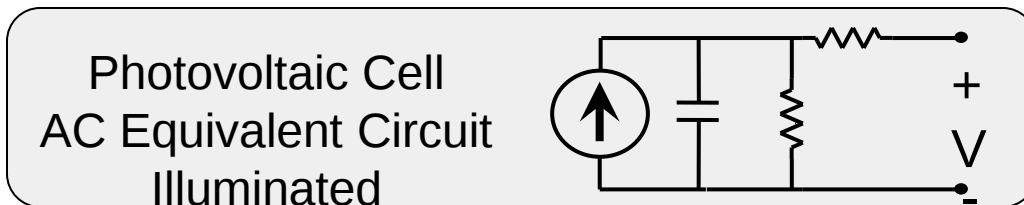
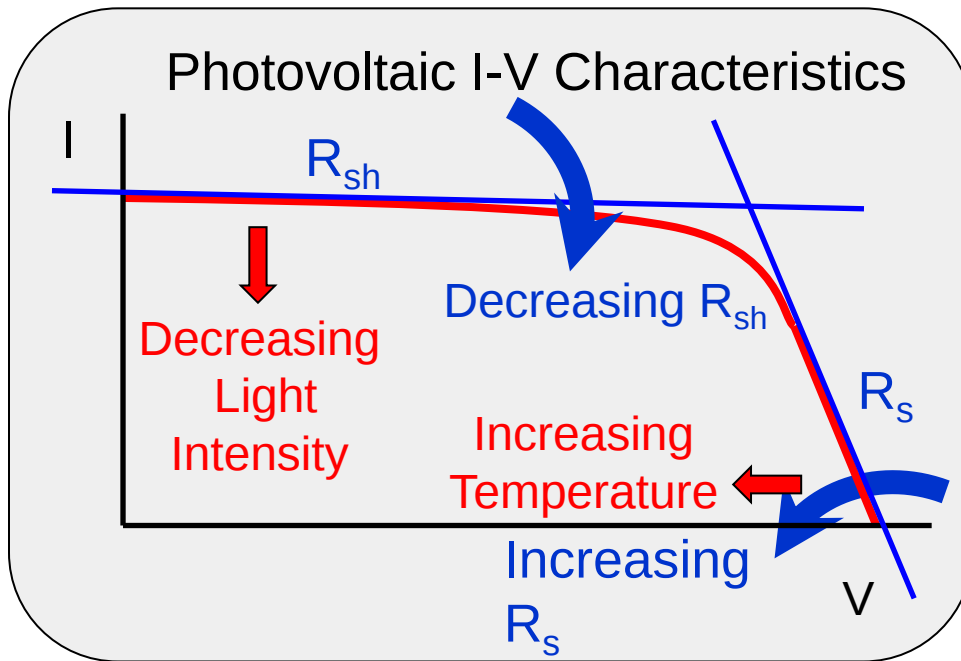


Page Down for more



Agilent Technologies

Solar cell characteristics



Agilent Solar Array Simulators act like a real solar array



Agilent's Power Products Offering

[Click for Overview of
Basic and Performance](#)



Basic System DC Supplies



DC Power Analyzer



Basic Bench Power Supplies



Mobile Communications
Power Supplies



High Performance
Modular Power System



High Performance
System DC Power Supplies



DC Electronic Loads



Source Measure Unit



AC Power Supplies

Click on image for
more details



Agilent Basic DC Power Supplies

Non-programmable (for Labs and Low-cost Manufacturing)



U8000A
90 W, 150 W



E3610A-17A
30 W - 60 W



E3620A
50 W

E3630A
35 W

\$290 *Single output* *11 models* *Multiple Output* **\$ 700**

Programmable (All have GPIB -- some include RS-232 or USB + LAN/LXI)



E3640A-45A
Single Output
30 W - 80 W



E3646A-49A
Dual Output
60 W - 100 W



E3631A
Triple Output
80 W



E3632A-34A
Single Output
120 W - 200 W



N5700
Single Output
750 W, 1500 W

N8700
Single Output
3200 W, 5200 W

\$ 700 **58 models** **\$ 6,000**

Page Down for more

BACK

Agilent Performance DC Power Supplies

Multiple Output for ATE and R&D Applications

N6700 Low-Profile
Modular Power System



N6705
DC Power Analyzer

\$ 8000

\$ 20,000

\$ 4000

\$ 15,000

Single Output DC, GPIB, Ideal for ATE, Accurate, Low Noise



6610

50 W



6630

100 W, 2Q



6640

200 W



6650

500 W



6670

2000 W



6680

5000 W



6690

6600 W

\$ 2000

33 models

\$ 8000

Page Down for more

←
BACK

Attributes of Agilent's Power Supply Types

Attribute	Basic	Performance	Precision	Specialty
Computer Interface	GPIB	GPIB, LAN, USB		
Device Protection	yes			
Output Measurements	yes			
Fully specified	yes			
Remote Sensing	Some models	yes		
Low Ripple & Noise <10 mVpp	yes	Some models	yes	
Fast Transient Resp <75 msec	no	Some models	yes	
LIST mode	no	Some models		
High Accuracy	no	no	yes	
Polarity Reversal and Disconnect	no	Some models		no
Analog control	Some models		no	no
Seamless measurement ranges	no	Some models	no	yes
Zero burden current measurements	no	Some models	no	yes
Battery emulation	no	Some models	no	yes



E3600 and U8000 Series Basic Power Supplies

When you need reliable power with minimal features, you can rely on the E3600 and U8000 Series basic power supplies.

The E3600 Series offers an extensive choice of voltages, programmability, and number of outputs. The U8000 Series offers more affordable DC power and provides features typical only in programmable power supplies, such as fully integrated overvoltage and overcurrent protection, capability to save and recall up to three states.



- 30 W to 200 W outputs, 6 V to 120 V, and 0.25 A to 20 A
- Single- to triple-output models in half-rack width size
- Low noise, linear regulation
- Dual range outputs to provide more current at lower voltage settings
- Computer control via GPIB on most E3600 models. Manual control only on the U8000 Series and some E3600 models



Agilent N5700 and N8700 System DC Power Supplies



High power density

- Up to 1560 W in 1U or up to 5200 W in 2U
- Leaves room for other critical instruments in a test system
- Affordable Basic Power



Simplify Test System Development

- GPIB, USB, and LAN (LXI C) standard on all models
- Built in V & I measurements
- Flexible AC input voltage options – run in any environment
- Full DUT protection: OV, OC, UVL
- Parallel up to 4 units for higher power

Page Down for more



N5700 and N8700 Basic System Supplies

Now get up to 5200 W in a compact, 2U package with the NEW N8700 Series or up to 1560 W in a compact, 1U package with the N5700 Series. Both series offers solid performance and a variety of basic and enhanced capabilities.

- **Remote programming via GPIB, LAN and USB interfaces with the SCPI command set (drivers available)**
- **Analog control and monitoring of output voltage and current**
- **Connect multiple supplies in parallel or series for greater output current or voltage respectively**
- **Built-in measurements**
- **Front panel control and advanced programmable features**
- **Built-in protection features such as OVP, UVL, and OT**
- **LXI Class C compliant**



Agilent N6700 Modular Power System



Small

- Size of a switching supply (1U) with the performance of a linear
- Choice of 3 mainframes in 1U, 400 W, 600 W, and 1200 W
- Up to 4 outputs in 1U at up to 300 W per output
- Parallel for more power



Flexible

- Select any combination of 25 different DC power modules, from basic to precision to (more modules to come)
- GPIB, USB, and LAN (LXI C) standard



Fast

- Command processing time of < 1 ms for max system throughput
- Built-in output sequencing for difficult power turn-on applications
- Built-in scope-like digitizer

Page Down for more



N6700 Modular Power Supply

The N6700 Series 1U-high, multiple-output programmable DC power supply system gives you the flexibility to optimize performance, power and price to match your test needs.

- **Small size: up to 4 outputs in 1U of rack space**
- **Mainframes are available with 400 W, 600 W, or 1200 W capability**
- **Mix and match from 22 different DC power modules, ranging 50 W, 100 W, or 300 W**
- **Streamline your tasks with built-in measurements, output sequencing, and optional LIST mode, built-in digitizer and disconnect relays**
- **Ultra fast command processing time (<1 ms) reduces test time**
- **Computer control via GPIB, USB, and LAN (LXI-C)**



Page Down for more



66000 Modular Power System

The 66000 Series modular DC power supplies give you up to eight outputs per mainframe. The modular design conserves rack space and simplifies system cabling and assembly.

- **Modular system permits up to 8 outputs of 150 W per output in 4U of rack space**
- **Modules are available with 150 W, 8 V to 200 V, 0.75 A to 16 A**
- **Simplify reconfiguration or repair with easily swappable modules**
- **Streamline your tasks with built-in measurements, LIST mode, and optional keyboard for manual control**
- **Full protection from over voltage and over current**
- **Computer control via GPIB**



N6705B DC Power Analyzer

Gain insight into your device's power consumption in minutes without writing a single line of code. The N6705A combines one to four DC power supplies, a DMM, an oscilloscope, an arbitrary waveform generator, and a data logger in one integrated package.



Integrates multiple instrument functions into a single box:

- 1 to 4 advanced power supplies; >22 different models available
- Digital voltmeter and ammeter
- Arbitrary waveform generator
- Oscilloscope
- Long term data logger
- Full functionality from front panel



GAIN INSIGHT IN MINUTES, NOT HOURS



6500 and 6600 Series Performance Power Supplies

The 6500 and 6600 Series high-performance power supplies are designed to meet your most demanding requirements. With an extensive feature set, the 6600 Series can help you reduce test time and simplify your test system design.

- **40 W to 6600 W outputs, up to 120 V, and up to 875 A**
- **Fast, low-noise outputs increase your test throughput**
- **Extensive programming capability for flexible system design (6600 only)**
- **Built-in measurements and advance programming features simplify system design**
- **Computer control via GPIB on the 6600 Series. GPIB not available on the 6500 Series**



E4360 Series Solar Array Simulators

The modular solar array simulator (SAS) is a DC power source that simulates the output characteristics of a solar array. The SAS is primarily a current source with very low output capacitance. It is capable of simulating the I-V curve of different arrays under different environmental conditions (temperature, age, etc.). You can set the I-V curve from the front panel or program it over GPIB, LAN or USB.



- **Accurate simulation of any type of solar array**
- **Small size: up to 2 outputs in 2U of rack space**
- **High output power—up to 600 W per output**
- **Fast I-V curve changes to simulate eclipse or spin**
- **14360A System Control Tools software included to simplify control of multiple solar array simulators in a system**
- **Custom turn-key system or individual instruments available**

Two modules per mainframe



N6705/N6780 Source Measure Unit

Specialized DC power supply modules for battery operated devices:

- For use in the N6705 mainframe
- Settable battery emulation characteristics
- Fast transient response for pulsed loads
- Auxiliary DVM input port for battery run-down testing
- Up to 200 KSa/sec digitizing rate

Seamless measurement ranging for accurate measurement of battery drain spanning wide dynamic ranges



Uses N6705 DC Power Analyzer Mainframe



N6781A 2-Quadrant SMU for Battery Drain Analysis



N6782A 2-Quadrant SMU for Functional Test



N6783A
Battery Charge/Discharge
and Mobile Comms PS



N6782A 4-Quadrant SMU



Mobile Communications Power Supplies

66300 mobile communications power supplies are designed and optimized to help you test mobile wireless devices. They provide the DC sourcing, current sinking, and measurement capabilities to address the unique challenges of simulating batteries and battery packs and measuring the current drawn by your device under test.

- **Fast DC power source to replace and simulate the battery during testing**
- **Fast voltage transient response ensures maximum test-system throughput by minimizing device shutdowns**
- **Dynamic measurement system enables accurate current measurement from μA to A**
- **When the 66319B/D and 66321B/D are coupled with the 14565B Software, it gives you a powerful analysis tool to optimize your device designs for long battery life**
- **LXI Class C compliant**



DC Loads

The N3300 and 6060 Series DC electronic loads give you flexibility for testing power supplies and other devices requiring a load. The built-in measurement system provides both accuracy and convenience and eliminates the need for a DMM, external shunts and wiring.

The N3300 multiple-input models are fast, accurate, and ideal for high-volume manufacturing, while single input 6060 models are ideal for evaluation of DC power sources and power components on your bench.



N3300 Modular Load

- Increase test throughput with short command processing time and stored command sequences
- Test multiple power supply outputs with up to 6 modules with 150 W to 600 W capability
- Operate in constant current, constant voltage, or constant resistance modes
- Measure voltage and current simultaneously
- Use in parallel for greater current sinking capability

6060 Single Input DC Load

- Cost effective load for single input applications
- Ideal for bench applications, provides optional front panel connection
- Computer control via GPIB



AC Source/Power Analyzer

The Agilent AC power source/power analyzer provides precise, accurate measurements and efficient analysis of AC power. These “one-box” solutions let you generate, measure and analyze AC power. Agilent’s AC power sources are ideal for power-supply testing, AC-mains CE-mark testing, UPS testing and much more.

- **Variety of power levels:**
375 VA, 750 VA, and 1750 VA
- **Built in measurements**
for power analysis
- **GPIB computer interface included**

