Power Products Catalog 2001

Application Information and Technical Data for:

- Mobile Communications dc Sources
- dc Power Supplies
- dc Electronic Loads
- ac Power Solutions
- Solar Array Simulators

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Agilent Technologies

solutions

to match your new test and measurement challenges. From Power Supplies to Power Solutions

One quick browse through this catalog will convince you that Agilent power products offer so much more than simple power generation. In each product category, we've integrated the capabilities you need for a complete power solution, including extensive measurement and analysis capabilities.

The cost and performance benefits of the one-box approach

The central theme in all our power products is one-box integration–giving you a complete test solution for the price of a single instrument. The one-box approach improves test results while cutting costs, complexity and rack size. These solutions are much easier to integrate, program and maintain in ATE systems. Another major benefit is that we specify and guarantee performance for the entire integrated system, so you know what you're really dealing with–unlike the typical "rack-and-stack" setup.

Power you can count on year after year

We've been a leader in the power products business for more than four decades because engineers like you know they can count on Agilent performance and reliability. Even our least-expensive dc supplies offer low ripple and noise with tight load and line regulation. Our high-precision products give you exacting control over power output levels, with accurate readback measurements to match. Plus, every Agilent power product in this catalog is covered by a three-year warranty (except where noted).

We know you have more important things to do than shop around for power supplies. That's why we've made such a wide range of products available through Agilent. The experienced engineers at Agilent can help you select just the right solutions for your application and your budget, then arrange fast shipping so you can get to work in a hurry.

In the U.S.A. Call

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12 Factors to Consider when Selecting a System Power Supply

1) Does the power supply performance meet your requirements?

Agilent 6600, 6800, and 66000 Series offer low output noise - among the best in their power ranges - allowing you to make even the most critical measurements. Active circuits ensure fast up and down programming, regardless of the load.

2) How complete are the specifications?

Agilent specifications cover the total power supply system, including programmers, current shunt, and DVM. Agilent specifications and supplemental characteristics are very complete and cover a broad range of real operating conditions.

3) How much will the power supply cost you now and after it is purchased?

The competitive initial cost of the Agilent 6600, 6800, and 66000 Series power supplies is an important part of Agilent's lower total cost. However, there are other components in the total cost of ownership. Agilent power supplies cost less time, money, and expertise to integrate into your system, and their renowned reliability results in less downtime cost.

4) How long does it take to integrate the power supplies into your system?

With the Agilent "One-Box" Solution, current and voltage programmers, current shunt, and DVM are all part of the single power supply package. This not only takes less rack space, but eliminates external cabling and interconnections between units, greatly increasing ease of integration and reliability.

5) How long will it take to write a program?

With Agilent power supplies, you both program and read back in volts and amps; not binary, percent of full scale, or some other indirect representation. Most Agilent power supplies use the industry standard programming language, SCPI (Standard Commands for Programmable Instruments). Once these commands are learned for one instrument, programming any instrument is easy.

6) Can you find the information you need in the manual?

Complete programming, operating, and service documentation is available for each Agilent power supply.

7) Is the power supply flexible enough to meet your changing needs?

Agilent offers many choices for system configuration. These include a mainframe with easily removable modules, full-featured single-output power supplies, and preconfigured multiple-output power supplies. Power supply outputs can be connected in series and parallel to further increase product flexibility. These GPIB power supplies can also be controlled without a computer connected for easy system testing and troubleshooting.

8) Will you need additional GPIB interfaces?

Agilent multiple-output power supplies and modular power systems both use one GPIB address per mainframe. Most Agilent power supplies also are equipped with Agilent's serial link. This allows up to 16 power supply outputs to be programmed from one GPIB address.

9) How well is your load protected from potential failure?

In addition to overvoltage, overcurrent and overtemperature protection, Agilent power supplies offer hard-wired remote shutdown of the system independent of the GPIB. A user-defined fault condition anywhere in the system can trigger an alarm or shut down the power supply via the DFI/RI port.

10) How easy is it to verify proper operation?

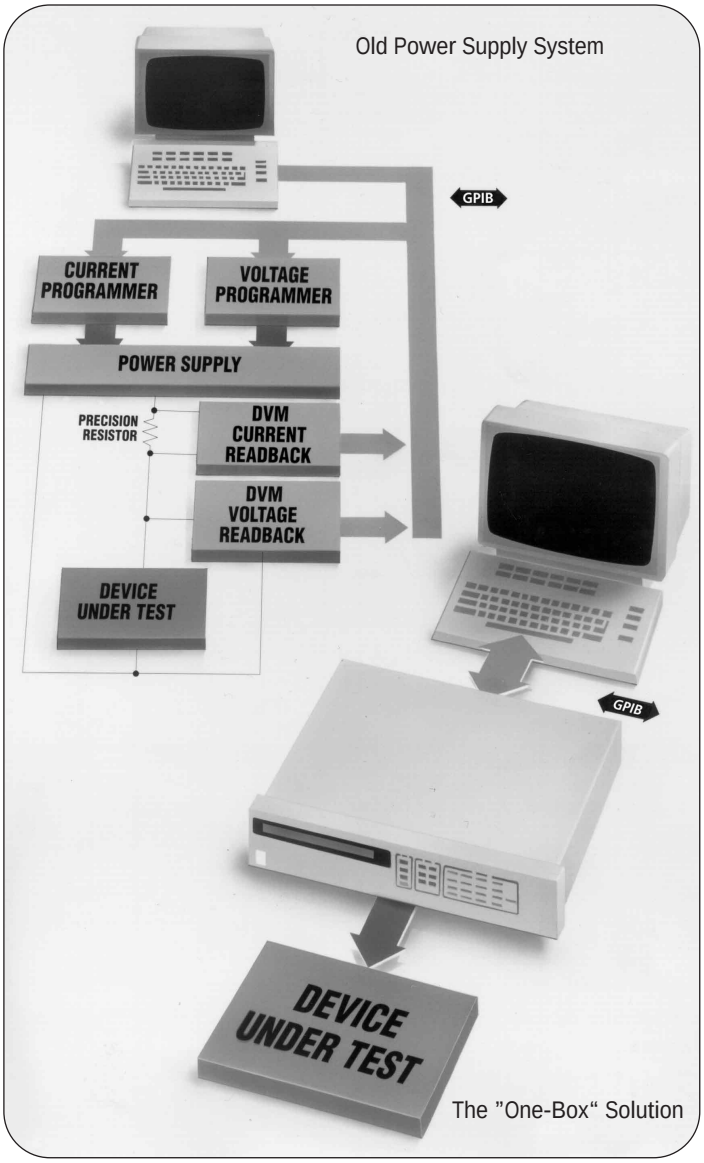
Agilent power supplies perform self-test at turn-on, with additional diagnostics available on program command. Some can even be calibrated without removing them from the rack.

11) How dependable is the power supply?

Agilent power supplies are subjected to extensive testing in grueling environmental conditions. This means that they will perform consistently and reliably in your most demanding application.

12) Where is the nearest sales and service office?

With hundreds of sales and service offices worldwide, Agilent provides extensive support when and where you need it. Please refer to the back cover of this catalog for the location nearest you.



Aerospace/defense	Automotive	Battery-powered products testing	Burn-in	Communications systems	Component testing	Computer systems	Consumer products testing	Electronic assembly testing	Lighting products testing	Opto-electronic	Power supply testing	Regulatory testing	Simulate elec. charact. of solar arrays	UPS Testing	Wireless communications testing	Agilent Model No.	Page No.
		•			•	•		•								6611C-6614C	9
		•													•	66309B/D, 66311B/D 66332A	10
		•			•			•								6631B-6634B	12
	•	•			•	•		•								E3632A-E3634A	13
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		•			•	•		•							•	E3640A-E3645A	8
		•			•	•		•								E3646A-E3649A	23
				•											•	E4356A	17

SINGLE OUTPUT GPIB System Power Supplies

Max volts (dc)	Max amps (dc)	Max watts	Output Operating Boundary	Agilent model number	page
5	875	4400	Rectangular	6680A	18
6.7	30	200	Autoranging	6033A	19
7	120	1000	Autoranging	6031A	19
8	5	40	Rectangular	6611C	9
8	10	80	Rectangular	6631B	12
8	20	160	Rectangular	6641A	14
8	50	400	Rectangular	6651A	15
8	220	1760	Rectangular	6671A	16
8	580	4600	Rectangular	6681A	18
8/20	3/1.5	30	Rectangular	E3640A	8
8/20	5/2.5	50	Rectangular	E3642A	8
8/20	8/4	50	Rectangular	E3644A	8
8/20	20/10	160/200	Rectangular	E3633A	13
15	3	45	Rectangular	66311B/D	10
15/12	3/1.5	45/18	Rectangular	66309B/D	10
15/12	3/1.5	45/18	Rectangular	66319B/D	10
15	3	45	Rectangular	66321B/D	10
15/30	7/4	105/120	Rectangular	E3632A	13
20	2	40	Rectangular	6612C	9
20	5	100	Rectangular	6632B	12
20	5	100	Rectangular	66332A	10
20	10	200	Autoranging	6033A	19
20	10	200	Autoranging	6038A	19
20	10	200	Rectangular	6642A	14
20	25	500	Rectangular	6652A	15
20	50	1000	Autoranging	6031A	19
20	50	1200	Autoranging	6032A	19
20	100	2000	Rectangular	6672A	16
21	240	5000	Rectangular	6682A	18
25/30	7/4	175/200	Rectangular	E3634A	13
32	160	5100	Rectangular	6683A	18
35	6	210	Rectangular	6643A	14
35	15	525	Rectangular	6653A	15
35	60	2100	Rectangular	6673A	16
35/60	0.8/0.5	30	Rectangular	E3641A	8
35/60	1.4/0.8	50	Rectangular	E3643A	8
35/60	2.2/1.3	80	Rectangular	E3645A	8
40	128	5100	Rectangular	6684A	18
50	1	50	Rectangular	6613C	9
50	2	100	Rectangular	6633B	12
50/25	4/7	200	Rectangular	E3634A	13
60	3.3	200	Autoranging	6038A	19
60	3.5	210	Rectangular	6644A	14
60	9	540	Rectangular	6654A	15
60	17	1200	Autoranging	6030A	19
60	17.5	1200	Autoranging	6032A	19
60	35	2100	Rectangular	6674A	16
65	8	480	Rectangular	E4350B	26
100	0.5	50	Rectangular	6614C	9
100	1	100	Rectangular	6634B	12
120	1.5	180	Rectangular	6645A	14
120	4	540	Rectangular	6655A	15
120	18	2160	Rectangular	6675A	16
130	4	480	Rectangular	E4351B	26
200	5	1000	Autoranging	6035A	19
200	5	1200	Autoranging	6030A	19
500	2	1000	Autoranging	6035A	19

Available on Special Order

SINGLE OUTPUT GPIB System Power Supplies

Max volts (dc)	Max amps (dc)	Max watts	Output Operating Boundary	Agilent model number
3.3	1000	3300	Rectangular	6680A-J04
5	250	1000	Rectangular	6671A-J14
6	60	360	Rectangular	6651A-J03
8	250	2000	Rectangular	6671A-J05
10	50	500	Rectangular	6651A-J01
10	200	2000	Rectangular	6671A-J04
14	150	2000	Rectangular	6671A-J03
15	30	450	Rectangular	6651A-J05
15	120	1800	Rectangular	6671A-J17
16.8	300	5000	Rectangular	6682A-J04
18	280	5000	Rectangular	6682A-J01
24	85	2000	Rectangular	6672A-J04
28	185	5000	Rectangular	6683A-J01
30	3.3	100	Rectangular	66332A-J01
30	17.5	500	Rectangular	6653A-J17
35	155	5000	Rectangular	6683A-J02
36	15	500	Rectangular	6653A-J09
36	55	2000	Rectangular	6673A-J04
38	55	2000	Rectangular	6673A-J07
40	5	200	Rectangular	6643A-J11
40	12.5	500	Rectangular	6653A-J04
40	50	2000	Rectangular	6673A-J08
45	12	500	Rectangular	6654A-J29
50	10	500	Rectangular	6654A-J05
50	42	2000	Rectangular	6674A-J07
50	100	5000	Rectangular	6684A-V50
54	9.6	480	Rectangular	E4350B-J01
55	90	5000	Rectangular	6684A-V55
56	38	2000	Rectangular	6674A-J03
60	80	5000	Rectangular	6684A-V60
70	3	200	Rectangular	6644A-J09
70	7.5	500	Rectangular	6654A-J04
70	30	2000	Rectangular	6674A-J06
80	6	500	Rectangular	6654A-J12
80	26	2000	Rectangular	6674A-J05
100	22	2000	Rectangular	6675A-J08
110	4.5	500	Rectangular	6555A-J11
110	20	2000	Rectangular	6675A-J09
135	16	2000	Rectangular	6675A-J06
150	1.2	150	Rectangular	6645A-J05
150	3.2	500	Rectangular	6655A-J05
150	15	2000	Rectangular	6675A-J11
156	3	500	Rectangular	6655A-J10
160	13	2000	Rectangular	6675A-J04
200	11	2000	Rectangular	6675A-J07

MODULES FOR: Agilent 66000 Modular Power System

Max volts (dc)	Max amps (dc)	Max watts	Agilent model number	Page
8	16	128	66101A	24
20	7.5	150	66102A	24
35	4.5	150	66103A	24
60	2.5	150	66104A	24
120	1.25	150	66105A	24
200	0.75	150	66106A	24

(Up to 8 per mainframe)

Available on Special Order

Max volts (dc)	Max amps (dc)	Max watts	Agilent model number
5.7	20	100	66101A-J03
12	12	150	66101A-J03
15	10	150	66102A-J05
24	6	100	66103A-J12
28	5	1400	66103A-J09
35	1.25	40	66105A-J01
37	4	150	66103A-J01
40	3.6	100	66103A-J02

If you don't find a model that meets your needs exactly, contact Agilent about its modification service. See page 75 for more information.

MULTIPLE OUTPUT GPIB System Power Supplies (with a Rectangular Output Operating Boundary)

Range 1		Range 2		Max.	Outputs for each Agilent model number													
Max. volts (dc)	Max. amps (dc)	Max. volts (dc)	Max. amps (dc)	watts per output	6621A page 22	6622A page 22	6623A page 22	6624A page 22	6625A page 21	6626A page 21	6627A page 22	6628A page 21	6629A page 21	E3631A page 20	E3646A page 23	E3647A page 23	E3648A page 23	E3649A page 23
6	5													Output 3				
7	0.015	50	0.5	25					Output 1	Outputs 1 & 2								
7	5	20	2	40			Output 1	Outputs 1 & 2										
7	10	20	4	80	Outputs 1 & 2		Output 3											
8	3	20	1.5	30											Outputs 1& 2			
8	5	20	2.5	50													Outputs 1 & 2	
16	0.2	16	2	50					Output 2	Outputs 3 & 4		Outputs 1 & 2	Outputs 1-4					
16	0.2	50	1	50					Output 2	Outputs 3 & 4		Outputs 1 & 2	Outputs 1-4					
20	2	50	0.8	40			Output 2	Outputs 3 & 4			Outputs 1-4							
20	4	50	2	100		Outputs 1 & 2												
±25	1			25										Outputs 1& 2				
35	0.8	60	0.5	30												Outputs 1& 2		
35	1.4	60	0.8	50														Outputs 1 & 2

SINGLE OUTPUT Manually Controlled and Analog-programmable Power Supplies

Max volts (dc)	Max amps (dc)	Max watts	Output Operating Boundary	Manually controlled analog-prog	Agilent model number	page
6.7	30	200	Autoranging	MC/AP	6023A	31
7	120	840	Autoranging	MC/AP	6011A	31
8	3	24	Dual-range	MC	E3610A	27
8	6	48	Rectangular	MC/AP	E3614A	27
8	20	160	Rectangular	MC/AP	6541A	28
8	50	400	Rectangular	MC/AP	6551A	29
8	220	1760	Rectangular	MC/AP	6571A	30
15	2	30	Dual-range	MC	E3610A	27
20	1.5	30	Dual-range	MC	E3611A	27
20	3	60	Rectangular	MC/AP	E3615A	27
20	10	200	Autoranging	MC/AP	6023A	31
20	10	200	Autoranging	MC/AP	6024A	31
20	10	200	Rectangular	MC/AP	6542A	28
20	25	500	Rectangular	MC/AP	6552A	29
20	50	1000	Autoranging	MC/AP	6011A	31
20	50	1000	Autoranging	MC/AP	6012B	31
20	100	2000	Rectangular	MC/AP	6572A	30
35	0.85	30	Dual-range	MC	E3611A	27
35	1.7	60	Rectangular	MC/AP	E3616A	27
35	6	210	Rectangular	MC/AP	6543A	28
35	15	525	Rectangular	MC/AP	6553A	29
35	60	2100	Rectangular	MC/AP	6573A	30
40	5.7	228	Autoranging	MC/AP	6028A	31
40	30	1200	Autoranging	MC/AP	6012B	31
60	0.5	30	Dual-range	MC	E3612A	27
60	1	60	Rectangular	MC/AP	E3617A	27
60	3.3	200	Autoranging	MC/AP	6028A	31
60	3.5	210	Rectangular	MC/AP	6544A	28
60	9	540	Rectangular	MC/AP	6554A	29
60	17	1020	Autoranging	MC/AP	6010A	31
60	17.5	1050	Autoranging	MC/AP	6012B	31
60	35	2100	Rectangular	MC/AP	6574A	30
120	0.25	30	Dual-range	MC	E3612A	27
120	1.5	180	Rectangular	MC/AP	6545A	28
120	4.5	540	Rectangular	MC/AP	6555A	29
120	18	2160	Rectangular	MC/AP	6575A	30
200	5	1000	Autoranging	MC/AP	6010A	31
200	5	1000	Autoranging	MC/AP	6015A	31
500	2	1000	Autoranging	MC/AP	6015A	31

MC = Manually controlled. AP = Analog programmable.

Available on Special Order

SINGLE OUTPUT Manually Controlled and Analog-Programmable Power Supplies

Max volts (dc)	Max amps (dc)	Max watts	Output Operating Boundary	Manually controlled analog-prog	Agilent model number
10	200	2000	Rectangular	MC/AP	6571A-J04
14	150	2000	Rectangular	MC/AP	6571A-J03
35	8	280	Rectangular	MC/AP	6553A-J21
36	55	2000	Rectangular	MC/AP	6573A-J04
40	12.5	500	Rectangular	MC/AP	6553A-J04
40	50	2000	Rectangular	MC/AP	6673A-J08
40	5	200	Rectangular	MC/AP	6543A-J11
50	10	500	Rectangular	MC/AP	6554A-J05
50	42	2000	Rectangular	MC/AP	6574A-J07
56	38	2000	Rectangular	MC/AP	6574A-J03
70	7.5	500	Rectangular	MC/AP	6554A-J04
70	30	2000	Rectangular	MC/AP	6574A-J06
100	22	2000	Rectangular	MC/AP	6575A-J08
110	20	2000	Rectangular	MC/AP	6575A-J09
135	16	2000	Rectangular	MC/AP	6575A-J06
150	1.2	150	Rectangular	MC/AP	6545A-J05
156	3	500	Rectangular	MC/AP	6555A-J10
160	13	2000	Rectangular	MC/AP	6675A-J04
200	11	2000	Rectangular	MC/AP	6575A-J07

MC = Manually controlled. AP = Analog programmable.

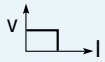
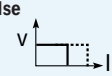
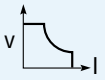
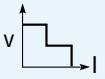
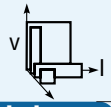
If you don't find a model that meets your needs exactly, contact Agilent about its modification service. See page 71 for more information.

MULTIPLE OUTPUT Manually Controlled and Analog-Programmable Power Supplies

Max. volts (dc)	Max. amps (dc)	Max. watts per output	Outputs for each Agilent model number	
			E3620A MC* Page 32	E3630A MC* Page 32
6	2.5	1.5		Output 1
±20	0.5	10		Outputs 2 & 3
25	1	25	Outputs 1 & 2	
40	0.3	25	Output 3	

*MC = Manually controlled. AP = Analog programmable.

FEATURE DESCRIPTIONS INDEX

dc Range	Max Power	6030 Series Autorangers	6610 Series Precision Measurement	6620 Series Multiple Output	6620 Series Precision Multiple Output	6630 Series Single Output	6640 Series Single Output	6650 Series Single Output	6670 Series Single Output	6680 Series Single Output	66000 Modular Power System	66300 Series Mobile Communications	E3640A Series Single & Dual Output
		200 - 1000 W	40 & 50 W	40 & 80 W	25 & 50 W	80 & 100 W	200 W	500 W	2000 W	5000 W	1200 W	40 - 100 W	30 - 100 W
	Max Voltage	500 V	100 V	50 V	50 V	100 V	120 V	120 V	120 V	40 V	200 V	20V	60V
	Max Current	120 A	5 A	10 A	2 A	10 A	20 A	50 A	220 A	875 A	16 A	5 A	8 A
	Page	**19**	**9**	**21**	**22**	**12**	**14**	**15**	**16**	**18**	**24**	**10**	**8, 23**
Configuration Features													
"One-box" solution To preserve rack space and interconnections, the voltage and current programmers, current shunt, and DVM are built-in to one package.		•	•	•	•	•	•	•	•	•	•	•	•
Modular power system (multiple reconfigurable outputs) Up to 8 modules can be installed into a mainframe, andconfiguration can be changed at any time.											•		
Multiple non-reconfigurable outputs Up to four outputs are included in one package, and they share one GPIB address.				•	•							66309 B/D	
Serial link Up to 16 power supply outputs can share one GPIB address when connected with a telephone-style cable.		•					•	•	•	•	•		
Relay connect, disconnect, and polarity reversal A=Optionally integrated with the power supply B=Operates with relay accessories listed on page 33 C=Optionally operates with relay accessories listed on page 33		B	A	C	C	A	B	B	B		A	A 66332A Only	
Auto-parallel, auto-series, parallel, and series operation When connected in auto-parallel or auto-series, only one unit has to be programmed to take advantage of the full power from all. AP=auto-parallel AS=auto-series S=series P=parallel		S AP		S P up to 2 identical outputs	S P up to 2 identical outputs		S AP	S AP	S AP	S AP	S, P		S, P
Analog programming and monitoring ports Analog programming ports allow the power supply to be used as a power amplifier, responding to an external voltage signal. Monitoring ports allow an external DMM to monitor the power-supply outputs.		•					•	•	•	•			
Output Voltage and Current Range Changing													
Single Range The output voltage is limited by a single maximum value. The output current is limited by a single maximum value.			•			•	•	•	•	•	•		
Single Range + Peak Current Pulse A limited amplitude and limited width current pulse can be sourced beyond the maximum static current limit.												•	
Autoranging A wide, continuous range of voltage and current combinations are available automatically at the maximum power level.		•											
Multiple-output range changing Automatic range changing gives maximum power to two different voltage and current combinations.				•									•
Precision multiple-output range changing Voltage and current ranges can be chosen independently to provide greater resolution.					•								
Performance Characteristics													
Output ripple and noise (Peak-to-peak, 20 Hz to 20 MHz)		30-160 mV	3-5 mV	3 mV	3 mV	3 mV (10 to 25 mV in fast mode)	3-7 mV	3-7 mV	7-16 mV	10 mV	5-50 mV	3-10 mV	5-8 mV
Output programming response time Rise and fall time with full resistive load (10 to 90% and 90 to 10%) Does not include command processing time.		200W: 100-200 ms 1000W: 300-2000 ms	2 ms	2-6 ms	6 ms	2 ms (0.4 ms in fast mode)	15 ms	15 ms	30-195 ms	9-60 ms	20-50 ms	0.4-2 ms	60 ms
Programming resolution (percent of full scale)		0.025%	0.025%	0.03%	0.007%	0.025%	0.025%	0.025%	0.025%	0.025%	0.03%	0.025%	0.025%

dc Range	Max Power	6030 Series Autorangers	6610 Series Precision Measurement	6620 Series Multiple Output	6620 Series Precision Multiple Output	6630 Series Single Output	6640 Series Single Output	6650 Series Single Output	6670 Series Single Output	6680 Series Single Output	66000 Modular Power System	66300 Series Mobile Communications	E3640A Series Single & Dual Output
	Max Power	200 - 1000 W	40 & 50 W	40 & 80 W	25 & 50 W	80 & 100 W	200 W	500 W	2000 W	5000 W	1200 W	40 - 100 W	30 - 100 W
	Max Voltage	500 V	100 V	50 V	50 V	100 V	120 V	120 V	120 V	40 V	200 V	20V	60V
	Max Current	120 A	5 A	10 A	2 A	10 A	20 A	50 A	220 A	875 A	16 A	5 A	8 A
	Page	**19**	**9**	**21**	**22**	**12**	**14**	**15**	**16**	**18**	**24**	**10**	**8, 23**
GPIB Programming Features													
GPIB programming of voltage and current Self-documenting programming commands mean that programming is done in units of volts and amps, not in percentages or binary representations.		•	•	•	•	•	•	•	•	•	•	•	•
Measured voltage and current read-back over the GPIB The output is read back in units of volts and amps.		•	•	•	•	•	•	•	•	•	•	•	•
Store-recall states Complete operating states can be stored in non-volatile memory. Each state specifies not only the output voltage and current, but also many of the programmable protection features.													
Number nonvolatile states (One of these states is automatically accessed on turn-on)		0	4	0	4	4	5	5	5	4	5	4	5
Number volatile states.		16/5	0	10	7	0	0	0	0	0	5	0	0
Standard Commands for Programmable Instruments (SCPI) SCPI is the standard language for test and measurement equipment. Standard codes make a software writing and maintenance more efficient. For example, using this standard, the output voltage of the power supply is measured with the same command (MEASURE: VOLTAGE?) by either a DMM or a power supply.		•	•			•	•	•	•	•	•	•	•
Protection Features													
GPIB programmable overvoltage protection Can be enabled to quickly down-program the output and set SRQ and/or DFI/RI. T=Can generate trigger. M=Overvoltage, the level is set manually with a front-panel control.		M	•	T	T	•	•	•	•	•	T	•	•
GPIB programmable overcurrent protection Can be enabled to quickly down-program the output and set SRQ and/or DFI/RI. T=Can generate trigger.		•	•	•	•	•	•	•	•	•	T	•	
Overtemperature protection Will down-program the output and can be enabled to set SRQ and/or DFI. T=Can generate trigger.		•	•	•	•	•	•	•	•	•	T	•	
Discrete fault indicator/remote inhibit (DFI/RI) Using these digital ports, power supplies can be connected independently of the GPIB. If any one experiences an error condition (overvoltage, for example), it can signal the other units to also down-program their outputs. O=Optional		•	•	O	O	•	•	•	•	•	•	•	
SRQ Almost any fault condition or change of state of the power supply can be enabled to generate an SRQ. This signals the computer to take the appropriate action.		•	•	•	•	•	•	•	•	•	•	•	
Local lockout Front-panel or keyboard control can be disabled. This keeps unauthorized operators from changing the programmed states.		•	•	•	•	•	•	•	•	•	•	•	•
Fan-speed control Controls the fan-speed to provide only the required cooling, reducing unnecessary acoustic noise. O=Optional			•			•	•	•	•	•	•	•	•
Active down-programming Active circuits quickly drain the energy from the output when unit is programmed to a lower voltage. This means that a unit under test can be safely removed from its test fixture without danger of arcing. F=Full-rated output current P=Less than 100% rated output current		P	P	F	F	F	P	P	P	P	P	P	
Maintenance Features													
Electronic calibration in the rack Calibration requires no internal adjustments.			•	•	•	•	•	•	•	•	•	•	•
Calibration security Units can be protected from accidental access to calibration routines by either a password (P) or an internal jumper (J) or switch (s).			P, S	J	J	P, S	P, J	P, J	P, J	P, J	P, S	P, S	P, J
Self-test Extensive self-test is triggered automatically on power-up. Additional tests can be initialed by user programming or front-panel control.		•	•	•	•	•	•	•	•	•	•	•	•

*A nonvolatile staus in SCPI mode only.

Single-Output: 30 W to 80 W

- Single-Output, Dual-Range
- Low noise/excellent line and load regulation
- GPIB/RS-232 standard
- SCPI (Standard Commands for Programmable Instrument) compatible
- Front and rear output terminals
- Overvoltage protection
- Remote sense at rear output

E3640A, E3641A, E3642A, E3643A, E3644A, E3645A

Agilent E3640A – 45A Single Output

The new E3640A-series programmable dc power supplies are 30W/50W/80W single output dc power supplies with standard GPIB & RS-232 interface. For general-purpose use, these programmable power supplies offer the performance of system power supplies at a surprisingly affordable price.

Clean and Stable Output

All models deliver clean and reliable power, dependable regulation (0.01%) and fast transient response (<50usec to within 15mV). With 0.01% load and line regulation, Agilent E364xA power supplies keep output steady when power line and load changes occur. These linear supplies specify both normal mode voltage noise and common mode current noise to assure less interference with your DUT.

Standard remote interface

Standard GPIB and RS-232 interfaces, SCPI programming and *plug&play* drivers for Agilent VEE and NI LabView make it easy to program and integrate into automated test systems. You can monitor the output terminals for voltage and current, and a query command lets you read the programmed voltage and current.

Versatile Power

Agilent E364xA power supplies give you the flexibility to select from dual output ranges. Both front and rear output terminals are standard and output load is protected against over-voltage protection function. Remote sense is available to eliminate the errors due to voltage drops on the load leads. New front panel binding posts offer flexibility to use safety test leads, banana plugs or stripped wires. Store and recall key enables you to save and recall up to 5 frequently used operating states.

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

Agilent Model		E3640A	E3641A	E3642A	E3643A	E3644A	E3645A
Number of Outputs		1	1	1	1	1	1
dc outputs	Voltage/Current	0 to 8 V/3 A 0 to 20 V/1.5 A	0 to 35 V/0.8 A 0 to 60 V/0.5 A	0 to 8 V/5 A 0 to 20 V/2.5 A	0 to 35 V/1.4 A 0 to 60 V/0.8 A	0 to 8 V/8 A 0 to 20 V/4 A	0 to 35 V/2.2 A 0 to 60 V/1.3 A
Power (max)		30 W	30 W	50 W	50 W	80 W	80 W
Load and line regulation	Voltage/Current	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA
Ripple and noise (20 Hz to 20 MHz)	Normal-Mode Voltage Normal-Mode Current Common-Mode Current	<500 µVrms/5 mVp-p <4.0 mArms <1.5 µArms	<1 mVrms/8 mVp-p <4.0 mArms <1.5 µArms	<500 µVrms/5 mVp-p <4.0 mArms <1.5 µArms	<1 mVrms/8 mVp-p <4.0 mArms <1.5 µArms	<500 µVrms/5 mVp-p <4.0 mArms <1.5 µArms	<1 mVrms/8 mVp-p <4.0 mArms <1.5 µArms
Programming accuracy (at 25° C ± 5° C)	Voltage Current	<0.05% +10 mV <0.2% +10 mA	<0.05% +10 mV <0.2% +10 mA	<0.05% +10 mV <0.2% +10 mA	<0.05% +10 mV <0.2% +10 mA	<0.05% +10 mV <0.2% +10 mA	<0.05% +10 mV <0.2% +10 mA
Readback accuracy (at 25° C ± 5° C)	Voltage Current	<0.05% + 5 mV <0.15% + 5 mA	<0.05% + 5 mV <0.15% + 5 mA	<0.05% + 5 mV <0.15% + 5 mA	<0.05% + 5 mV <0.15% + 5 mA	<0.05% + 5 mV <0.15% + 5 mA	<0.05% + 5 mV <0.15% + 5 mA
Program resolution	Voltage/Current	5 mV/1 mA	5 mV/1 mA	5 mV/1 mA	5 mV/1 mA	5 mV/ 1 mA	5 mV/ 1 mA
Readback resolution	Voltage/Current	2 mV/1 mA	2 mV/1 mA	2 mV/1 mA	2 mV/1 mA	2 mV/ 1 mA	2 mV/ 1 mA
Meter resolution	Voltage/Current	10 mV/1 mA	10 mV/1 mA	10 mV/1 mA	10 mV/1 mA	10 mV/ 1 mA	10 mV/ 1 mA
Transient response time	<50 µs for output to recover within 15 mV following a change in output current from full load to half load or vice versa.						

dc Floating Voltage: Output terminals can be floated up to ±240Vdc from chassis ground.

Remote Sensing: Up to 1V can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Settling Time: Less than 90msec for the output voltage to change from 1% to 99% or vice versa following the receipt of VOLTage or APPLy command via direct GPIB or RS-232 interface.

Product Regulation: Designed to comply with UL3111-1; certified to CSA 22.2 No. 1010.1; conforms to IEC 1010-1; complies with EMC directive 89/336/EEC(Group1, Class A)

OVP accuracy: 0.5% + 0.5 V, activation time: ≥3 V, <1.5 ms, and <3 V, <10 ms

Isolation: +/- 240 Vdc

Stability: Voltage <0.02% + 2 mV; Current <0.1% + 1 mA

Temperature coefficient: <0.01% + 3 mV, <0.02% + 3 mA change per degree C over operating range 0-40 degree C after 30 minute warm-up

Warranty: Three years

Size: 254.4 mm W x 104 mm H x 374 mm D (10 in. x 4.1 in. x 14.8 in.)

Weight: E3640A, E3641A: 5.3 kg (11.7 lbs)
E3642A, E3643A: 6.2 kg (13.7 lbs)
E3644A, E3645A: 6 kg (13.2 lbs)

Ordering Information

STANDARD: 115 Vac +/- 10%, 47 to 63 Hz
Opt 0E3 230 Vac +/- 10%, 47 to 63 Hz
Opt 0E9 100 Vac +/- 10%, 47 to 63 Hz
Opt 1CM Rackmount Kit (p/n 5063-9240)
Opt 910 Extra Manual set

ACCESSORIES
E3619A 18 AWG power supply test leads

6611C - 6614C

Precision Measurement, Single-Output: 40 W and 50 W

- Precision low current measurement
- Low output noise
- High speed programming
- GPIB and RS-232 interface
- SCPI (Standard Commands for programmable instruments)
- VXI*plug&play* drivers

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

Single Output System

			6611C	6612C	6613C	6614C
Output Ratings	Voltage/Current		0 to 8 V/0 to 5 A	0 to 20 V/0 to 2 A	0 to 50 V, 0 to 1 A	0 to 100 V/0 to 0.5 A
Programming accuracy (at 25°C ±5°C)	Voltage/+Current	0.05% +	5 m V/2 m A	10 m V/1 m A	20 m V/0.75 m A	50 m V/0.5 m A
Ripple and noise 20 Hz to 20 MHz, with outputs ungrounded or with either terminal grounded	Voltage Normal mode	rms/p-p	0.5 mV/3 mV	0.5 mV/3 mV	0.5 mV/4 mV	0.5 mV/5 mV
		rms	2 mA	1 mA	1 mA	1 mA
dc measurement accuracy via GPIB or front-panel meters respect to actual output at 25°C ±5°C	Voltage	0.03% +	2 mV	3 mV	6 mV	12 mV
	Low current range -20 mA to + 20 mA	0.1% +	2.5 µA	2.5 µA	2.5 µA	2.5 µA
	High current range					
	+20 mA to + rated 1	0.2% +	0.5 mA	0.25 mA	0.2 mA	0.1 mA
	-20 mA to - rated 1	0.2% +	1.1 mA	0.85 mA	0.8 mA	0.7 mA
Load regulation	Voltage/Current		2 mV/1 mA	2 mV/0.5 mA	4 mV/0.5 mA	5 mV/0.5 mA
Line regulation	Voltage/Current		0.5 mV/ 0.5 mA	0.5 mV/0.5 mA	1 mV/0.25 mA	1 mV/0.25 mA
Transient response time	Less than 100 µs for the output to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of the output current rating of the supply					
Supplemental Characteristics	(Non-warranted characteristics determined by design and useful in applying the product)					
Average programming resolution	Voltage/Current		2 mV/1.25 mA	5 mV/0.5 mA	12.5 mV/0.25 mA	25 mV/0.125 mA
Sink current			3 A	1.2 A	0.6 A	0.3 A

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc maximum from chassis ground

Remote Sensing: Up to two volts dropped in each load lead. Add 2 mV to the voltage load regulation specification for each one volt change in the postive output lead due to load current change.

Command Processing Time: Average time required for the output voltage to begin to change following receipt of digital date is 4 ms for the power supplies connected directly to the GPIB.

Output Programming Response Time: The rise and fall time (10/90% and 90/10%) of the output voltage is less than 2 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 6 ms.

GPIB Interface Capabilities: IEEE-488.2, SCPI command set, and 6630A Series programming compatability

Input Power: (full load): 1.6 A, 100 W (6611C: 2.2 A, 120 W)

Regulatory Compliance: Complies with EMC directive 89/336/EEC (ISM 1B). See page 73 for more information.

Warranty Period: Three years

Size: 212.8 mm W x 88.1 mm H x 368.3 mm D (8.4 in x 3.5 in x 14.5 in)
See page 56 for more details

Weight: 8.2 kg (18.16 lb) net; 10.6 kg (23.5 lb) shipping

Ordering Information

STANDARD: 104 to 127 Vac, 47 to 63 Hz
Opt 100 87 to 106 Vac, 47 to 63 Hz
Opt 220 191 to 233 Vac, 47 to 63 Hz
Opt 230 207 to 253 Vac, 47 to 63 Hz
Opt 760 Isolation and Reversal relays
***Opt ICM** Rack-mount Kit (p/n 5063-9240)
***Opt AXS** Rack-mount Kit side-by-side mounting of two units, Lock-link Kit p/n 5061-9694; Flange Kit p/n 5062-3974
Opt OBN Service Manual, Extra Operating Guide and Programming Guide only.
*Support rails required

ACCESSORIES

Rack-mount and slide for two side-by-side units of different lengths p/n 1494-0015, 5063-9255 and filler panel 5002-3999

Rack-mount slide and support for one instrument p/n 1494-0015, 5063-9255 and filler panel 5002-3999

E3663AC Support rails for Agilent rack cabinets

Mobile Communications dc sources - 40 W to 100 W

Ideal for wireless/portable product test
Programmable output reisistance (66319B/D and 66321B/D only)
Dynamic pulse measurement
High-speed programming
SCPI (Standard Commands for Programmable Instruments)
GPIB interface[1], VXI*plug&play* drivers

66309B/D, 66311B/D

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

Agilent Mobile Communications dc Sources

Model		66309B/D	66311B/D	66319B/D (NEW)	66321B/D (NEW)	66332A
Number of outputs		2	1	2	1	1
Output ratings	Voltage	0 to 15V	0 to 15V	0 to 15V	0 to 15V	0 to 20V
	Current	0 to 3A	0 to 3A	0 to 3A	0 to 3A	0 to 5A
	Peak current for up to 7 ms	5 A	5 A	5 A	5 A	5 A
Programming accuracy at 25°C ±5°C (% of setting plus fixed)	Voltage 0.05%+	10 mV	10 mV	10 mV	10 mV	10 mV
	+Current 0.05%+	1.33 mA	1.33 mA	1.33 mA	1.33 mA	2 mA
Ripple and Noise (20Hz to 20 MHz)	Voltage(rms/p-p)	1 mV/6 mV	1 mV/6 mV	1 mV/6 mV	1 mV/6 mV	0.3 mV/3 mV
	Current (rms)	2 mA	2 mA	2 mA	2 mA	2 mA
dc measurement accuracy	Voltage 0.03%+	5 mV	5 mV	5 mV	5 mV	3 mV
	+20 mA to + rated current 0.2%+	0.5 mA[2]	0.5 mA[2]			0.5 mA
	-20 mA to - rated current 0.2%+	1.1 mA	1.1 mA			1.1 mA
	-3A to + 5A 0.2%			0.5 mA[2]	0.5 mA[2]	
	-1A to + 1A 0.1%			0.2 mA	0.2 mA	
	-20 mA to + 20 mA range 0.1%+	2.5 µA	2.5 µA	2.5 µA	2.5 µA	2.5 µA
Dynamic measurement system	Buffer size Sampling interval	4096 points 15 µs - 31,200 s	4096 points 15 µs - 31,200 s	4096 points 15 µs - 31,200 s	4096 points 15 µs - 31,200 s	4096 points 15 µs - 31,200 s
Transient response time		<35 µs[3]	<35 µs[3]	<20 µs[3]	<20 µs	<100 µs[4]
Transient voltage dip (typical with up to 15 feet 22 AWG wiring)		70 mV	70 mV	40 mV	40 mV	500 mV
Programmable output resistance	Range			-40 mΩ to +1Ω	-40 mΩ to +1Ω	
	Programming accuracy			0.5% + 2 mΩ	0.5% + 2 mΩ	
	Resolution			1 mΩ	1 mΩ	
Voltmeter input (66309D, 66319D, 66311D and 66321D only) Input range		-25 to +25 Vdc	-25 to +25 Vdc	-25 to +25 Vdc	-25 to +25 Vdc	N/A
dc readback accuracy (at 25°C ±5°C)		0.04% +5 mV	0.04% +5 mV	0.04% +5 mV	0.04% +5 mV	
ac + dc readback accuracy (at 25°C ±5°C) with dc plus a sinewave input > 25 mV rms		1% + 5 mV (60 Hz to 10 kHz)	1% + 5 mV (60 Hz to 10 kHz)	1% + 5 mV (60 Hz to 10 kHz)	1% + 5 mV (60 Hz to 10 kHz)	
Auxilary output (66309B/D and 66319B/D)			N/A		N/A	N/A
Output ratings	Voltage Current	0 to 12V 0 to 1.5 A		0 to 12V 0 to 1.5 A		
Programming accuracy	Voltage +Current	0.2% + 40 mV 0.2% + 4.5 mA		0.2% + 40 mV 0.2% + 4.5 mA		
dc measurement accuracy	Voltage +Current	0.2% + 15 mV 0.2% + 3 mA		0.2% + 15 mV 0.2% + 3 mA		
Ripple and Noise (20Hz to 20 MHz)	Voltage(rms/p-p) Current (rms)	1 mV/6 mV 2 mA		1 mV/6 mV 2 mA		

Notes:
[1] 66332A also has RS-232 interface.
[2] Applies with current detector set to dc.
[3] Time for the output voltage to recover to within 20 mV of final value after 0.1 to 1.5 A load change in high capacitance compensation range.
[4] Time for the output voltage to recover to within 20 mV or 0.1% of the voltage rating of the unit following a change in load current of up to 50% of the output current rating.

66309B/D
66311B/D
66319B/D
66321B/D
66332A

Mobile Communications dc sources-40 W to 100 W

NEW 66321B/D, 66319B/D

dc Floating Voltage: Output terminals can be floated up to ±50 Vdc maximum from chassis ground (±240 volts for 66332A).

Remote Sensing: 66332A, up to 2 V dropped in each load lead. Add 2 mV to the load regulation specification for each 1 V change in the positive output lead due to load current change. For 66309B/D, 66311B/D, up to 4 V can be dropped across each load lead add 2 mV to the voltage load regulation specification for each 1 V change in the positive output lead due to load current change. For 66319B/D, 66321B/D up to 3 V total in both load leads on the main output. For auxiliary output on the 66319B/D, up to 4 V in each load lead.

Command Processing Time: Average time required for the output voltage to begin to change following receipt of digital data is 4 ms for the power supplies connected directly to the GPIB. (Display disabled).

Output Programming Response Time: For 66332A the rise and fall time (10/90% and 90/10%) of the output voltage is: <2 ms (400 µs for the 66332A in fast mode); for 66311B/D, 66321B/D, Output 1- 66309B/D, 66319B/D: <200 µs. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value for 66332A in: <6ms (2 ms in fast mode); 66309B/D, 66311B/D: 2 ms.

Measurement Time: Average time to process query, calculate measurement parameter and return data is 50 ms (includes the default time of 30 ms for acquiring data, and a 20 ms data processing overhead.)

GPIB Interface Capabilities: IEEE-488.2, SCPI command set, and 6630A series programming capability (except 66309B/D, 66319B/D, 66321B/D).

Input (full load): 47-63 Hz @ 100 Vac mains: 66311B/D, 66321B/D: 1.7 A, 125 W; 66309B/D, 66319B/D: 2 A, 170 W; 66332A: 3.5 A, 250 W.

Regulatory Compliance: Complies with EMC directive 89/336/EEC (ISM 1B). See page 73 for more information.

Warranty Period: 3 years.

Size: 66309B/D, 66311B/D, 66319B/D, 66321B/D: 212.8 mm W x 88.1 mm H x 435 mm D (8.4 in x 3.5 in x 17.13 in). 66332A: 425.5 mm W x 88.1 mm H x 364.4 mm D (16.8 in x 3.5 in x 14.3 in). See page 56 for more details

Weight: 66309B/D, 66311B/D, 66319B/D, 66321B/D: 9.07 kg (20 lb) net, 11.1 kg (24.5 lb) shipping. 66332A: 12.7 kg (28 lb) net, 15.0 kg (33 lb) shipping.

Ordering Information

Standard: 104 to 127 Vac 47 to 63 Hz
Opt 100 87 to 106 Vac, 47 to 63 Hz
Opt 220 191 to 233 Vac, 47 to 63 Hz
Opt 230 207 to 253 Vac, 47 to 63 Hz
Opt 020 Front-panel Binding Posts (66332A only)
Opt 521 Solid State Relays (66309B/D, 66319B/D)
Opt 760 Isolation and Reversal Relays (66332A only)
***Opt 1CM** Rack-mount Kit 66309B/D, 66311B/D, 66319B/D, 66321B/D: p/n 5063-9240
66332A: p/n 5063-9212
***Opt 1CP** Rack-mount Kit with Handles, p/n 5063-9219 (66332A only)
***Opt AXS** Rack-mount Kit for side-by-side mounting, (N/A for 66332A) Locking Kit p/n 5061-9694; Flange Kit p/n 5063-9212
Opt OBN Service Manual, extra User's Guide and Programming Guide
* Support rails required

NEW

Agilent 66321B/D, 66319B/D Mobile Communications dc Source w/Battery Emulation

These four new high performance models offer wireless electronic device manufacturers, designers, and repairers all the capabilities to thoroughly test wireless phones and portable devices.

Performs like a battery

With its battery emulation feature, the Agilent 66321B/D and 66319B/D allows you to test your phones under the same power conditions as in actual use; detecting early product failures. These power supplies simulates the effects of the internal resistance in a battery, enabling them to emulate the operation of various battery types, as well as batteries in different charged states.Plus with their ability to simulate negative resistance, users can compensate for the voltage drop due to the wiring in a fixture.

Minimize test interruptions

Offering superior transient performance, unmatched in the market place, the Agilent Mobile Communications dc Sources w/Battery Emulation dramatically reduces the transient voltage drop (<40µs) due to the pulse loading characteristics of mobile phones and recovers very quickly to their original voltage. The Agilent 66321B/D and 66319B/D enables you to maximize test throughput by minimizing test interruption due to triggering of low voltage phone shutdown.

Dynamic Measurement Capability

For WCDMA, CDMA, TDMA, GSM, PCS, DECT, TETRA, PHS, NADC and other format phone, the advanced measurement subsystem of these power sources, allows you to rapidly perform peak and low-level current measurements with a high degree of accuracy.

Simplify test & analysis

With the Agilent 14565A Device Characterization Software testing, analyzing, and, troubleshooting mobile phone design and subsystem is made simple. The optional Agilent 14565A graphical user interface lets you easily control these power supplies. Plus it provides an oscilloscope-like view of the voltage or current waveform of the device under test, provides reference waveform save/recall, and oscilloscope-like waveform measurement and analysis (current or voltage measurements, triggering, markers, zoom control, and more).

Accessories

p/n 1494-0060 Rack Slide Kit (66332A only)
E3663AC Support rails for Agilent rack cabinets

Precision Measurement Single-Output: 80 W and 100 W

- Precision low current measurement
- Low-output noise
- High-speed programming
- GPIB and RS-232 interface
- SCPI (Standard Commands for Programmable Instruments)
- VXI*plug&play* drivers

6631B - 6634B

SPECIFICATIONS

(at 0˚ to 55˚ C unless otherwise specified)

		6631B	6632B	6633B	6634B
Output ratings	Voltage/Current	0 to 8 V/0 to 10 A	0 to 20 V/0 to 5 A	0 to 50 V/0 to 2 A	0 to 100 V/0 to 1 A
Programming accuracy at 25˚C ±5˚C	Voltage/+ Current 0.05% +	5 mV/4 mA	10 mV/2 mA	20 mV/1 mA	50 mV/0.5 mA
Ripple and noise (20 Hz to 20 MHz, with outputs ungrounded or with either terminal grounded)	Voltage Normal mode (rms/p-p)	0.3 mV/3 mV	0.3 mV/3 mV	0.5 mV/3 mV	0.5 mV/3 mV
	Fast mode (rms/p-p)	1 mV/10 mV	1 mV/10 mV	1 mV/15 mV	2 mV/25 mV
	Current (rms)	3 mA	2 mA	2 mA	2 mA
DC measurement accuracy: via GPIB or front panel meters with respect to actual output at 25˚C ±5˚C	Voltage 0.03% +	2 mV	3 mV	6 mV	12 mV
	Low current range –20 mA to +20 mA 0.1% +	2.5 µA	2.5 µA	2.5 µA	2.5 µA
	High current range				
	+20 mA to + rated I 0.2% +	1 mA	0.5 mA	0.25 mA	0.25 mA
	–20 mA to –rated I 0.2% +	1.6 mA	1.1 mA	0.85 mA	0.85 mA
Load regulation	Voltage	2 mV	2 mV	4 mV	5 mV
	Current	2 mA	1 mA	1 mA	1 mA
Line regulation	Voltage	0.5 mV	0.5 mV	1 mV	1 mV
	Current	1 mA	0.5 mA	0.25 mA	0.25 mA
Transient response time	Less than 100 µs (50 µs in the fast mode) for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV) following any step change in load current of up to 50% of the output current rating of the supply				
Supplemental Characteristics	(Non-warranted characteristics determined by design and useful in applying the product)				
Average programming resolution	Voltage	2 mV	5 mV	12.5 mV	25 mV
	Current	2.5 mA	1.25 mA	0.5 mA	0.25 mA
Sink current		10 A	5 A	2 A	1 A
Sink current tracking	SCPI mode	0.4% + 4 mA	0.4% + 2 mA	0.4% + 1 mA	0.4% + 0.5 mA
	Compatability mode	-500 mA	-250 mA	-100 mA	-50 mA
Minimum current in constant current mode*		40 mA	20 mA	8 mA	4 mA

* When programming in the 6630A Series language compatibility mode.

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc maximum from chassis ground

Remote Sensing: Up to two volts dropped in each load lead. Add 2 mV to the voltage load regulation specification for each one volt change in the positive output lead due to load current change.

Command-Processing Time: Average time required for the output voltage to begin to change following receipt of digital data is 4 ms for the power supplies connected directly to the GPIB. (Display disabled.)

Output-Programming Response Time: The rise and fall time (10/90% and 90/10%) of the output voltage is less than 2 ms (400 µs in fast mode). The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 6 ms (2 ms in the fast mode).

GPIB Interface Capabilities: IEEE-488.2, SCPI command set and 6630A Series programming compatability

Measurement Time: Average time to make a voltage or current measurement is 50 ms.

Input Power (full load): 3.5 A, 250 W

Regulatory Compliance: Complies with EMC directive 89/336/EEC (ISM 1B). See page 73 for more information.

Warranty Period: Three years

Size: 425.5 mm W x 88.1 mm H x 364.4 mm D (16.8 in x 3.5 in x 14.3 in). See page 57 for more information

Weight: Net, 12.7 kg (28 lb) net; 15.0 kg (33 lb) shipping

Ordering Information

STANDARD: 104 to 127 Vac, 47 to 63 Hz
- **Opt 100** 87 to 106 Vac, 47 to 63 Hz
- **Opt 220** 191 to 233 Vac, 47 to 63 Hz
- **Opt 230** 207 to 253 Vac, 47 to 63 Hz
- **Opt 020** Front-panel Binding Posts
- **Opt 760** Isolation and Reversal Relays (N/A on 6631B)
- ***Opt 1CM** Rack-mount Kit, p/n 5063-9212
- ***Opt 1CP** Rack-mount Kit with Handles, p/n 5063-9219
- **Opt 910** Service Manual, extra Operating Guide and Programming Guide

*Support rails required

ACCESSORIES
- **p/n 1494-0060** Rack Slide Kit
- **E3663AC** Support rails for Agilent rack cabinets

E3632A, E3633A, E3634A

Single-Output: 120 W to 200 W

E3632A Features:

105/120 watts of power
15 V, 7 A/30 V, 4 A single output dual range
Low noise/excellent regulation
Two digital meters
Remote sense, OVP & OCP capability
16-bit programming resolution and high accuracy
GPIB/RS-232 standard

E3633A and E3634A Features:

160/200 watts of power
Single-output, dual range
Front and rear output terminals
Low noise/excellent regulation
Remote sense, OVP & OCP capability
16-bit programming resolution and high accuracy
GPIB/RS-232 standard

E3632A, E3633A, E3634A Single-Output

The E3632A, E3633A, and E3634A are 120 watt/200 watt single-output dual range programmable dc power supplies designed to meet the most exacting engineering requirements with traditional Agilent quality and reliability designed in.

Low Noise/Excellent Regulation

0.01% load and line regulation keep the output steady. The linear supply specifies both normal mode voltage noise and common mode current noise. The low normal mode specification assures clean power for precision circuitry and the low common mode current provides isolation from power line current injection.

Remote Interface

These supplies come with GPIB and RS-232. They allow you program both voltage and current. You can monitor the output terminals for voltage and current, and a query command lets you read the programmed voltage and current. All programming is done in easy to use SCPI. VISA *plug&play* driver is available.

Front Panel Operation

Both voltage and current can be monitored simultaneously for output from the front panel on an easy to read vacuum flourescent display. A knob allows you to set the output at the resolution you need for the most exacting adjustments, quickly and easily. Store and recall key enables you to save and recall up to three frequently used operating states. The output on/off button enables/disables the output.

Isolated

All the outputs are isolated from the chassis ground and from the remote interface.

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

		E3632A (Low Range) / (High Range)	E3633A (Low Range) / (High Range)	E3634A (Low Range) / (High Range)
Output ratings	Voltage/Current	0 to 15 V, 7 A/0 to 30 V, 4 A	0 to 8 V, 20 A/0 to 20 V, 10 A	0 to 25 V, 7 A/0 to 50 V, 4 A
Load regulation	Voltage Current	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA
Line regulation	Voltage Current	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA
Ripple and noise (20 Hz to 20 mHz)	Normal-mode voltage Normal-mode current Common-mode current	<350 µVrms/2 mVpp <2 mA rms <1.5 µA rms	<350 µVrms/3 mVpp <2 mA rms <1.5 µA rms	<500 µVrms/3 mVp-p <2 mA rms <1.5 µA rms
Programming accuracy (25°C ±5°C)	Voltage Current	0.05% + 10 mV 0.2% +10 mA	0.05% + 10 mV 0.2% +10 mA	0.05% + 10 mV 0.2% +10 mA
Readback accuracy (25°C ±5°C)	Voltage Current	0.05% + 5 mV 0.15% + 5 mA	0.05% + 5 mV 0.15% + 5 mA	0.05% + 5 mV 0.15% + 5 mA
Resolution	Program/readback Meter	1 mV, 0.5 mA/0.5 mV, 0.1 mA 1 mV, 1 mA	1 mV, 1 mA/0.5 mV, 1 mA 1 mV, 1 mA (<10 A/10 mA (≥10 A)	3 mV, 0.5 mA/1.5 mV, 0.5 mA 1 mV, 1 mA (<10 A/10 mA (≥10 A)
Transient response	50 µsec for output to recover to within 15 mV following a change in output current from full load to half load or vice versa			

For off-the-shelf shipment

Supplemental Characteristics

ac Input:
100 Vac ± 10%, 47 to 63Hz (Opt 0E9)
115 Vac ± 10%, 47 to 63Hz (Standard)
230 Vac ± 10%, 47 to 63Hz (Opt 0E3)

Product Regulation: Designed to comply with UL1244, IEC 61010-1; certified with CSA 22.2
Meets requirements for CE regulation

Warranty: 3 years

Size:
E3632A, E3633A, E3634A 213 mmW x 132 mmH x 348 mmD (8.4 in. x 5.2 in. x 13.7in.)

Weight:
E3632A, E3633A, E3634A 9.5 kg (21 lbs)

Single-Output: 200 W

- Linear output regulation
- Fast up- and down-programming
- SCPI (Standard Commands for Programmable Instruments)
- Complete front-panel control calibration and display
- Remote programming and sensing
- Fan-speed control to minimize acoustic noise
- Low ripple and noise
- Over-voltage and over-current protection
- Serial link connects up to 16 units to one HP-IB address
- VXI*plug&play* drivers

6641A - 6645A

SPECIFICATIONS

(at 0˚ to 55˚ C unless otherwise specified)

		6641A	6642A	6643A	6644A	6645A
Output ratings	Output voltage	0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
	Output current (40˚ C)	0 to 20 A	0 to 10 A	0 to 6 A	0 to 3.5 A	0 to 1.5 A
	Maximum current (50˚ C/55˚ C)	18 A/17 A	9 A/8.5 A	5.4 A/5.1 A	3.2 A/3 A	1.4 A/1.3 A
Programming accuracy at 25˚C ±5˚C	Voltage 0.06% +	5 mV	10 mV	15 mV	26 mV	51 mV
	Current 0.15% +	26 mA	13 mA	6.7 mA	4.1 mA	1.7 mA
Ripple and noise from 20 Hz to 20 MHz	Voltage rms	300 µV	300 µV	400 µV	500 µV	700 µV
	peak-peak	3 mV	3 mV	4 mV	5 mV	7 mV
	Current rms	10 mA	5 mA	3 mA	1.5 mA	1 mA
Readback accuracy at 25˚C ±5˚C (percent of reading plus fixed)	Voltage 0.07% +	6 mV	15 mV	25 mV	40 mV	80 mV
	+Current 0.15% +	18 mA	9.1 mA	5 mA	3 mA	1.3 mA
	-Current 0.35% +	40 mA	20 mA	12 mA	6.8 mA	2.9 mA
Load regulation	Voltage	1 mV	2 mV	3 mV	4 mV	5 mV
	Current	1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
Line regualtion	Voltage	0.5 mV	0.5 mV	1 mV	1mV	2 mV
	Current	1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
Transient response time	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current					

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Average resolution	Voltage	2 mV	5 mV	10 mV	15 mV	30 mV
	Current	6 mA	3 mA	2 mA	1.2 mA	0.5 mA
	OVP	13 mV	30 mV	54 mV	93 mV	190 mV
OVP accuracy		160 mV	400 mV	700 mV	1.2 V	2.4 V

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Command Processing Time: Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB

Output Programming Response Time: The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

Down Programming: An active down programmer sinks approximately 20% of the rated output current

Modulation: (Analog programming of output voltage and current)
Input Signal: 0 to –5 V
Input Impedance: 10 k Ohm nominal

ac Input: (ac input frequency 47 to 63 Hz)

Voltage	100 Vac	120 Vac	220 Vac	240 Vac
Current	4.4 A	3.8 A	2.2 A	2.0 A

Input Power: 480 VA, 400 W at full load; 60 W at no load

GPIB Interface Capabilities SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, E1, and C0. IEEE-488.2 and SCPI-compatible command set

Regulatory Compliance: Complies with UL 3111-1, IEC 61010-1.

Size: 425.5 mm W x 88.1 mm H x 439 mm D (16.75 in x 3.5 in x 17.3 in)
See page 54 for more details.

Weight: Net, 14.2 kg (31.4 lb); shipping, 16.3 kg (36 lb)

Warranty Period: Three years

Ordering Information

Standard: 104 to 127 Vac, 47 to 63 Hz
Opt 100 87 to 106 Vac, 47 to 63 Hz
Opt 220 191 to 233 Vac, 47 to 63 Hz
Opt 240 209 to 250 Vac, 47 to 63 Hz
***Opt 908** Rack-mount Kit (p/n 5063-9212)
***Opt 909** Rack-mount Kit w/ Handles (p/n 5063-9219)
Opt 910 Service Manual, extra Operating Guide and Programming Guide
*Support rails required

Accessories
p/n 1494-0060 Accessory Slide Kit
p/n 1252-3698 7-pin Analog Plug
p/n 1252-1488 4-pin Digital Plug
p/n 5080-2148 Serial Link Cable 2 m (6.6 ft)
E3663AC Support rails for Agilent rack cabinets

6641A
6642A
6643A
6644A
6645A

6651A - 6655A

Single-Output: 500 W

- Complete front-panel control, calibration and display
- Remote programming and sensing
- Fan-speed control to minimize acoustic noise
- Low ripple and noise
- Over-voltage and over-current protection
- Linear output regulation
- Fast up-and down-programming
- SCPI (Standard Commands for Programmable Instruments)
- Serial link connects up to 16 units to one HP-IB address
- VXI*plug&play* drivers

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

			6651A	6652A	6653A	6654A	6655A
Output ratings	Output voltage		0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
	Output current (40° C)		0 to 50 A	0 to 25 A	0 to 15 A	0 to 9 A	0 to 4 A
	Maximum current (50° C/55° C)		45 A/42.5 A	22.5 A/21.3 A	13.5 A/12.8 A	8.1 A/7.7 A	3.6 A/3.4 A
Programming accuracy at 25°C ±5°C	Voltage	0.06% +	5 mV	10 mV	15 mV	26 mV	51 mV
	Current	0.15% +	60 mA	25 mA	13 mA	8 mA	4 mA
Ripple and noise from 20 Hz to 20 MHz	Voltage rms		300 µV	300 µV	400 µV	500 µV	700 µV
	peak-peak		3 mV	3 mV	4 mV	5 mV	7 mV
	Current rms		25 mA	10 mA	5 mA	3 mA	2 mA
Readback accuracy at 25°C ±5°C (percent of reading plus fixed) System models only	Voltage	0.07% +	6 mV	15 mV	25 mV	40 mV	80 mV
	+Current	0.15% +	67 mA	26 mA	15 mA	7 mA	3 mA
	–Current	0.35% +	100 mA	44 mA	24 mA	15 mA	7 mA
Load regulation	Voltage		1 mV	2 mV	3 mV	4 mV	5 mV
	Current		2 mA	1 mA	0.5 mA	0.5 mA	0.5 mA
Line regulation	Voltage		0.5 mV	0.5 mV	1 mV	1mV	2 mV
	Current		2 mA	1 mA	0.75 mA	0.5 mA	0.5 mA
Transient response time	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current						

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Average resolution	Voltage	2 mV	5 mV	10 mV	15 mV	30 mV
	Current	15 mA	7 mA	4 mA	2.5 mA	1.25 mA
	OVP	12 mV	30 mV	54 mV	93 mV	190 mV
OVP accuracy		160 mV	400 mV	700 mV	1.2 V	2.4 V

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Command Processing Time: Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB

Output Programming Response Time: The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

Down Programming: An active down programmer sinks approximately 20% of the rated output current

Modulation: (Analog programming of output voltage and current)
Input signal: 0 to –5 V
Input impedance: 10 k Ohm nominal

ac Input: (ac input frequency 47 to 63 Hz)

Voltage	100 Vac	120 Vac	220 Vac	240 Vac
Current	12 A	10 A	5.7 A	5.3 A

Input Power: 1,380 VA, 1,100 W at full load; 120 W at no load

GPIB Interface Capabilities: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, E1, and C0. IEEE-488.2 and SCPI-compatible command set.

Regulatory Compliance: Listed to UL 1244; conforms to IEC 61010-1. See page 73 for more information.

Size: 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in) See page 55 for more details

Weight: Net, 25 kg (54 lb); shipping, 28 kg (61 lb)

Warranty Period: Three years

Ordering Information

STANDARD 104 to 127 Vac, 47 to 63 Hz
Opt 100 87 to 106 Vac, 47 to 63 Hz
Opt 220 191 to 233 Vac, 47 to 63 Hz
Opt 240 209 to 250 Vac, 47 to 63 Hz
***Opt 908** Rack-mount Kit (p/n 5062-3977)
***Opt 909** Rack-mount Kit w/ Handles (p/n 5063-9221)
Opt 910 Service Manual, extra Operating Guide and Programming Guide
*Support rails required

ACCESSORIES
p/n 1494-0059 Accessory Slide Kit
p/n 1252-3698 7-pin Analog Plug
p/n 1252-1488 4-pin Digital Plug
p/n 5080-2148 Serial Link Cable 2 m (6.6 ft)
E3663AC Support rails for Agilent rack cabinets

Single-Output: 2,000 W

- Low ripple and noise
- Fast up- and down-programming
- SCPI (Standard Commands for Programmable Instruments)
- Complete front-panel control, calibration and display
- Remote programming and sensing
- Fan-speed control to minimize acoustic noise
- Low Ripple and Noise
- Over-voltage and over-current protection
- Serial link connects up to 16 units to one HP-IB address
- VXI*plug&play* drivers

6671A - 6675A

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

			6671A	6672A	6673A	6674A	6675A
Output ratings	Output voltage		0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
	Output current		0 to 220 A	0 to 100 A	0 to 60 A	0 to 35 A	0 to 18 A
Programming accuracy at 25°C ±5°C	Voltage	0.04% +	8 mV	20 mV	35 mV	60 mV	120 mV
	Current	0.1% +	125 mA	60 mA	40 mA	25 mA	12 mA
Ripple and noise from 20 Hz to 20 MHz	Voltage rms		650 µV	750 µV	800 µV	1.25 mV	1.9 mV
	peak-peak		7 mV	9 mV	9 mV	11 mV	16 mV
	Current rms		200 mA	100 mA	40 mA	25 mA	12 mA
Readback accuracy at 25°C ±5°C (percent of reading plus fixed)	Voltage	0.05% +	12 mV	30 mV	50 mV	90 mV	180 mV
	±Current	0.1% +	150 mA	100 mA	60 mA	35 mA	18 mA
Load regulation and Line regulation	Voltage 0.002%+		300 µV	650 µV	1.2 mV	2 mV	4 mV
	Current 0.005%+		10 mA	7 mA	4 mA	2 mA	1 mA
Transient response time	Less than 900 µs for the output voltage to recover 100 mV following a change in load from 100% to 50% or 50% to 100% of the output current rating of the supply						

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Average resolution	Voltage		2 mV	5 mV	10 mV	15 mV	30 mV
	Current		55 mA	25 mA	15 mA	8.75 mA	4.5 mA
	OVP		15 mV	35 mV	65 mV	100 mV	215 mV
Output voltage programming response time*	(excluding command processing time)		30 ms	60 ms	130 ms	130 ms	195 ms

* Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground

Output Common-Mode Noise Current: (to signal ground binding post) 500 µA rms, 4 mA peak-to-peak

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Command Processing Time: Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB.

Modulation: (Analog programming of output voltage and current)
Input Signal: 0 to –4 V for voltage, 0 to 7 V for current
Input Impedance: 60 k Ohm or greater

Input Power: 3,800 VA, 2,600 W at full load; 170 W at no load

GPIB Interface Capabilities: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, E1, and C0. IEEE-488.2 and SCPI-compatible command set

Regulatory Compliance: Listed to UL1244; certified to CSA556B; conforms to IEC 61010-1. See page 73 for more information.

Size: 425.5 mm W x 132.6 mm H x 640 mm D
(16.75 in x 5.22 in x 25.2 in)
See page 55 for more details

Weight: Net, 28.2 kg (62 lb); shipping, 31.8 kg (70 lb)

Warranty Period: Three years

Ordering Information

STANDARD: 191 to 250 Vac, 47 to 63 Hz
Opt 200 174 to 220 Vac, 47 to 63 Hz (Japan only)
***Opt 908** Rack-mount Kit (p/n 5062-3977)
***Opt 909** Rack-mount Kit w/ Handles (p/n 5063-9221)
Opt 910 Service Manual and extra Operating Guide and Programming Guide
A line cord option must be specified.
See page 44-47 for ordering information.
*Support rails required

ACCESSORIES
p/n 1494-0059 Accessory Slide Kit
p/n 1252-3698 7-pin Analog Plug
p/n 1252-1488 4-pin Digital Plug
p/n 5080-2148 Serial Link Cable 2 m (6.6 ft)
E3663AC Support rails for Agilent rack cabinets

Telecommunications dc source-2,000 W

E4356A

- Low ripple and noise
- Fast up-and down-programming
- SCPI (Standard Commands for Programmable Instruments)
- Complete front-panel control, calibration and display
- Remote programming and sensing
- Fan-speed control to minimize acoustic noise
- Over-voltage and over-current protection
- Serial link connects up to 16 units to one HP-IB address
- VXI *plug&play* drivers
- Also suitable for non-telecom applications

Agilent E4356A

The E4356A telecom dc power supply is a one-box solution that delivers the reliable capabilities of an integrated system. This power supply provides power at up to 80 Vdc and up to 30 A in two ranges and offers low noise output critical for telecom applications.

The E4356A is ideal for manufacturing and R&D engineers who build equipment for the telecom industry that operates from a 48V or higher dc rail. This telecom equipment includes: base stations, switches, public and private telephone network equipment, PBX systems, and dc/dc power supplies that provide power to this equipment.

Although targeted at the telecom industry where 80 V is a common requirement, the E4356A can also be used for other applications requiring 80 Vdc. The E4356A has all of the features found on our general-purpose system dc power supplies, such as the 667xA series of 2000 W system dc power supplies. Therefore it is well suited for both R&D and ATE applications where the features and performance of a one-box solution provide a complete test solution at the price of a single instrument.

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc maximum from chassis ground.

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Command Processing Time: Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB. (Display disabled.)

Output Voltage Rise Time/Fall Time: 100ms/200ms for output to change from 90% to 10% or from 10% to 90% of its total excursion with full resistive load (excludes command processing time).

Modulation: (Analog programming of output voltage and current)
Input Signal: 0 to -4 V for voltage and current
Input Impedance: 60 k Ohm nominal

Input Power: 3,800 VA, 2,600 W at full load; 100 W at no load

GPIB Interface Capabilities: SH1, AH1, TE6, LE4, SR1, RL1, PP0, DC1, DT1, E1 and C0. IEEE-488.2 and SCPI-compatible command set

Regulatory Compliance: Listed to UL1244; certified to CSA556B, conforms to EN61010.

Warranty Period: 3 years.

Size: 425.5 mm W x 132.6 mm H x 640 mm D
(16.75 in. x 5.22 in. x 25.2 in.)
See page 55 for more details

Weight: 27.7 kg (61 lb) net, 31.4 kg (69 lb) shipping.

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

Agilent Model		E4356A
Number of outputs		1
Output ratings	Voltage	0 to 70 V/0 to 80 V
	Current	0 to 30 A/0 to 26 A
Programming Accuracy at 25°C ±5°C (% of setting plus fixed)	Voltage	0.04% + 80 mV
	+Current	0.1% + 25 mA
Ripple and Noise (20Hz to 20 MHz)	Voltage(rms/p-p)	2 mV/16 mV
	Current (rms)	25 mA
dc measurement accuracy (via GPIB or front panel meters with respect to actual output at 25°C ±5°C	Voltage	0.05% + 120 mV
	Current	0.1% + 35 mA
Transient response time Time for the output voltage to recover to within 20 mV or 0.1% of the voltage rating of the unit following a change in load current of up to 50% of the output current rating.		<900µs

Ordering Information - E4356A

STANDARD: 191 to 250 Vac, 47 to 63 Hz
Opt 200 174 to 220 Vac, 47 to 63 Hz (Japan only)
***Opt 908** Rack-mount Kit (p/n 5062-3977)
***Opt 909** Rack-mount Kit w/Handles (p/n 5063-9221)
Opt 0BN Service Manual and extra operating/programming guide
See pages 44-47 for information on line cord options.
* Support rails required

ACCESSORIES
p/n 1494-0059 Accessory Slide Kit
p/n 1252-3698 7-pin Analog Plug
p/n 1252-1488 4-pin Digitial Plug
p/n 5080-2148 Serial Link Cable 2 m (6.6 ft)
E3663AC Support rails for Agilent rack cabinets

Single-Output: 5,000 W

6680A - 6684A

- "One Box" solution: includes V and I read-back
- Low ripple and noise
- Fast up-and down-programming
- High-accuracy current programming and read back
- Standard Commands for Programmable Instruments (SCPI)
- Selectable compensation for inductive loads
- Serial link connects up to 16 units to one HP-IB address
- VXI*plug&play* drivers

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

			6680A	6681A	6682A	6683A	6684A
Output ratings	Voltage		0 to 5 V	0 to 8 V	0 to 21 V	0 to 32 V	0 to 40 V
	Current (40° C then derate linearly 1%/° C from 40° to 55° C)		0 to 875 A	0 to 580 A	0 to 240 A	0 to 160 A	0 to 128 A
Programming accuracy at 25°C ±5°C	Voltage	0.04% +	5 mV	8 mV	21 mV	32 mV	40 mV
	Current	0.1% +	450 mA	300 mA	125 mA	85 mA	65 mA
Ripple and noise from 20 Hz to 20 MHz	Constant voltage	rms	1.5 mV	1.5 mV	1.0 mV	1.0 mV	1.0 mV
		peak-to-peak	10 mV	10 mV	10 mV	10 mV	10 mV
	Constant current	rms	290 mA	190 mA	40 mA	28 mA	23 mA
Readback accuracy at 25°C ±5°C (percent of reading plus fixed)	Voltage	0.05% +	7.5 mV	12 mV	32 mV	48 mV	60 mV
	Current	0.1% +	600 mA	400 mA	165 mA	110 mA	90 mA
Load and line regulation	Voltage	0.002% +	0.19 mV	0.3 mV	0.65 mV	1.1 mV	1.5 mV
	Current	0.005% +	65 mA	40 mA	17 mA	12 mA	9 mA
Transient response time	Less than 900 µs for the output voltage to recover within 150 mV following a change in load from 100% to 50%, or 50% to 100% of the output current rating of the supply						

Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying this product)

Average programming resolution	Voltage	1.35 mV	2.15 mV	5.7 mV	8.6 mV	10.8 mV
	Current	235 mA	155 mA	64 mA	43 mA	34 mA
	OVP	30 mV	45 mV	120 mV	180 mV	225 mV
Output voltage programming response time (excludes command-processing time)	Full-load programming rise or fall time (10 to 90% or 90 to 10%, resistive load)	9 ms	12 ms	45 ms	60 ms	60 ms
Output common-mode noise current (to signal-ground binding post)	rms	1.5 mA	1.5 mA	3 mA	3 mA	3 mA
	peak-to-peak	10 mA	10 mA	20 mA	20 mA	20 mA

6680A
6681A
6682A
6683A
6684A

dc Floating Voltage: Output terminals can be floated up to ±60 Vdc maximum from chassis ground

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Command Processing Time: Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for power supplies connected directly to the GPIB

Modulation: (analog programming of output voltage and current): Input Signal: 0 to –5 V for voltage, 0 to +5 V for current Input Impedance: 30 kΩ or greater

ac Input (47 to 63 Hz): 180 to 235 Vac (line-to-line, 3 phase), 27.7 A rms maximum; 360 to 440 Vac, 14.3 A rms maximum (maximum line current includes 5% unbalanced phase voltage condition.) Output voltage derated 5% at 50 Hz and below 200 Vac.

Input Power: 7350 VA and 6000 W maximum; 160 W at no load

GPIB Interface Capabilities: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, E1, and C0. IEEE-488.2 and SCPI command set.

Size: 425.5 mm W x 220 mm H x 675.6 mm D (16.75 in x 8.75 in x 26.6 in) See page 57 for more details

Weight: Net, 51.3 kg (113 lb); shipping, 63.6 kg (140 lb)

Warranty Period: Three years

Ordering Information

Opt 400 360 to 440 Vac, 3 phase, 47 to 63 Hz

Opt 601 Output bus bar, cover and spacer kit for bench applications where leads must be oriented vertically. (Order separately as p/n 5060-3515).

Opt 602 Two Bus Bar Spacers for paralleling power supplies (p/n 5060-3514)

***Opt 908** Rack-mount Kit (p/n 5062-3977 and p/n 5063-9212)

***Opt 909** Rack-mount Kit with Handles (p/n 5063-9221 and p/n 5063-9219).

Opt 910 Service Manual, extra Operating Guide and Programming Guide

*Support rails required

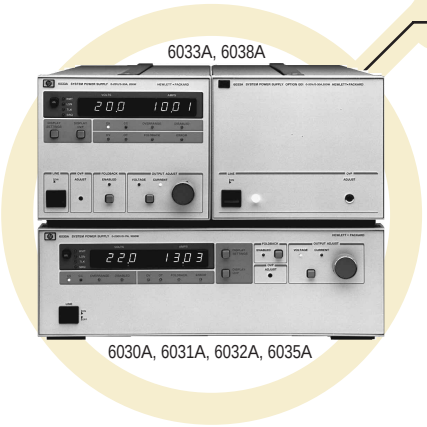
ACCESSORIES

p/n 5060-3513 Three 30-A Replacement Fuses for 180 to 235 Vac line

p/n 5060-3512 Three 16-A Replacement Fuses for 360 to 440 Vac line

E3663AC Support rails for Agilent rack cabinets

p/n 5080-2148 Serial link cable 2m (6.6 ft.)



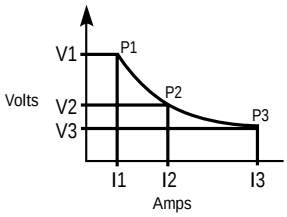
Single-Output, Autoranging: 200 W to 1,000 W

Features:

Standard Commands for Programmable Instruments

VXI*plug&play* drivers

Autoranging Output:



SPECIFICATIONS

(at 0° to 55° C unless otherwise noted)

System Autorangers		6030A	6031A	6032A	6033A	6035A	6038A
Output ratings	Voltage	0 to 200 V	0 to 20 V	0 to 60 V	0 to 20 V	0 to 500 V	0 to 60 V
	Current	0 to 17 A	0 to 120 A	0 to 50 A	0 to 30 A	0 to 5 A	0 to 10 A
Maximum power	Watts	1,200 W	1,064 W	1,200 W	242 W	1,050 W	240 W
Autoranging output	V1, P1	200 V, 5 A	20 V, 50 A	60 V, 17.5 A	20 V, 10 A	500 V, 2 A	60 V, 3.3 A
	V2, P2	120 V, 10 A	14 V, 76 A	40 V, 30 A	14 V, 17.2 A	350 V, 3 A	40 V, 6 A
	V3, P3	60 V, 17 A	7 V, 120 A	20 V, 50 A	6.7 V, 30 A	200 V, 5 A	20 V, 10 A
Programming accuracy at 25°C ±5°C	Voltage	0.035% +145 mV	0.035% +15 mV	0.035% +40 mV	0.035% +9 mV	0.25% +400 mV	0.035% +40 mV
	Current	0.2% +25 mA	0.25% +250 mA	0.2% +85 mA	0.15% +20 mA	0.3% +63 mA	0.09% +10 mA
Ripple and noise, 20 Hz to 20 MHz	Voltage rms	22 mV	8 mV	8 mV	3 mV	50 mV	3 mV
	p-p	50 mV	50 mV	40 mV	30 mV	160 mV	30 mV
	Current rms	15 mA	120 mA	25 mA	30 mA	50 mA	5 mA
Readback accuracy at 25°C ±5°C	Voltage	0.08% +80 mV	0.08% +7 mV	0.08% +20 mV	0.07% +6 mV	0.5% +300 mV	0.07% +50 mV
	Current	0.36% +15 mA	0.4% +100 mA	0.36% +35 mA	0.3% +25 mA	0.5% +50 mA	0.2% +11 mA
Load regulation	Voltage 0.01%+	5 mV	3 mV	5 mV	2 mV	40 mV	3 mV
	Current 0.01%+	10 mA	15 mA	10 mA	9 mA	35 mA	5 mA
Line regulation	Voltage 0.01%+	5 mV	2 mV	3 mV	1 mV	13 mV	2 mV
	Current 0.01%+	5 mA	25 mA	10 mA	6 mA	18 mA	2 mA
Transient response time	Time	2 ms	2 ms	2 ms	1 ms	5 ms	1 ms
10% step change	Level	150 mV	100 mV	100 mV	50 mV	200 mV	75 mV
Supplemental Characteristics	(Non-warranted characteristics determined by design that are useful in applying the product)						
Programming Resolution	Voltage	50 mV	5 mV	15 mV	5 mV	125 mV	15 mV
	Current	4.25 mA	30 mA	12.5 mA	7.5 mA	1.25 mA	2.5 mA
dc floating voltage	either terminal can be grounded or floated from chassis ground	±550 V	±240 V	±240 V	±240 V	±550 V	±240 V
ac input current	100 Vac	24 A	24 A	24 A	6 A	24 A	6 A
	120 Vac	24 A	24 A	24 A	6.5 A	24 A	6.5 A
	220 Vac	15 A	15 A	15 A	3.8 A	15 A	3.8 A
	240 Vac	14 A	14 A	14 A	3.6 A	14 A	3.6 A
Weight	Net	16.3 kg (36 lb)	17.2 kg (38 lb)	16.3 kg (36 lb)	9.6 kg (21 lb)	16.3 kg (36 lb)	9.6 kg (21 lb)
	Shipping	21.8 kg (48 lb)	22.7 kg (50 lb)	21.8 kg (48 lb)	11.4 kg (25 lb)	21.8 kg (48 lb)	11.4 kg (25 lb)

Remote Sensing: Up to 2 V drop in each lead. Voltage regulation specification met with up to 0.5 V drop, but degrades for greater drops.

Modulation: (analog programming of output voltage and current) Input signal: 0 to 5 V or 0 to 4 k Ohms

Size: 6030A–32A, 6035A: 425.5 mm W x 132.6 mm H x 503.7 mm D (16.75 in x 5.25 in x 19.83 in).

6033A, 6038A:
212.3 mm W x 177.0 mm H x 516.4 mm D
(8.36 in x 6.97 in x 17.87 in).

See page 52 for more details.

Warranty: Three years

Ordering Information

STANDARD: 104 to 127 VAC, 48 to 63 Hz

Opt 001 Front panel has only line switch, line indicator, and OVP adjust (6030A–33A and 6038A only)

Opt 100 87 to 106 Vac, 48 to 63 Hz (power supply output is derated to 75%)

Opt 220 191 to 233 Vac, 48 to 63 Hz

Opt 240 209 to 250 Vac, 48 to 63 Hz

Opt 800 Rack-mount Kit for Two Half-rack Units Side by Side. Lock link Kit p/n 5061-9694 and 7 in Rack adapter Kit 5063-9215

***Opt 908** Rack-mount Kit for a Single Half-rack Unit 6033A and 6038A (with blank filler panel); p/n 5062-3960, 6030A–32A and 6035A; p/n 5062-3977

***Opt 909** Rack-mount Kit with Handles. For 6030A–32A, 6035A; p/n 5062-3983

*Support rails required

Opt 910 Service Manual and extra Operating Manual

A line cord option must be specified for 6030A–32A, 6035A. See pages 48-51 for ordering information.

ACCESSORIES

5080-2148 Serial Link Cable, 2 m (6.6 ft)

1494-0060 Rack Slide Kit

E3663AC Support rails for Agilent rack cabinets

Multiple-Output: 25 W and 30 W

E3631A

E3631A Features:

- Total 80 watts of power
- Triple outputs
- Dual voltage and current meters
- SCPI (Standard Commands for Programmable Instruments) compatible
- GPIB/RS-232 standard

E3631A Triple-Output

The E3631A is a triple-output programmable dc power supply designed to meet the most exacting engineering requirements with traditional Agilent quality and reliability designed in.

Low Noise/Excellent Regulation

0.01% load and line regulation keep the output steady. The linear supply specifies both normal mode voltage noise and common mode current noise. The low normal mode specification assures clean power for precision circuitry and the low common mode current provides isolation from power line current injection.

Remote Interface

The E3631A comes with GPIB and RS-232. This supply lets you program both voltage and current. You can monitor the output terminals for voltage and current, and a query command lets you read the programmed voltage and current. All programming is done in easy to use SCPI. VISA driver is available.

Front Panel Operation

Both voltage and current can be monitored simultaneously for output from the front panel on an easy to read vacuum flourescent display. A knob allows you to set the output at the resolution you need for the most exacting adjustments, quickly and easily. Store and recall key enables you to save and recall up to three frequently used operating states. The output on/off button enables/disables the output.

Isolated

In the E3631A 6 V supply is isolated from the ±25 V supply to minimize any interference between circuits under test.

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

		E3631A		
dc outputs	**Voltage/Current**	**0 to +25 V/0 to 1 A**	**0 to –25 V/0 to 1 A**	**0 to 6 V/0 to 5 A**
Load regulation	Voltage Current	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA
Line regulation	Voltage Current	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA	<0.01% + 2 mV <0.01% + 250 µA
Ripple and noise	Normal-mode voltage Normal-mode current Common-mode current	<350 µV rms/2 mV p-p <500 µA rms <1.5 µA rms	<350 µV rms/2 mV p-p <500 µA rms <1.5 µA rms	<350 µV rms/2 mV p-p <2 mA rms <1.5 µA rms
Programming accuracy (25°C ±5°C)	Voltage Current	0.05% + 20 mV 0.15% + 4 mA	0.05% + 20 mV 0.15% + 4 mA	0.1% + 5 mV 0.2% + 10 mA
Readback accuracy (25°C ±5°C)	Voltage Current	0.05% + 10 mV 0.15% + 4 mA	0.05% + 10 mV 0.15% + 4 mA	0.1% + 5 mV 0.2% + 10 mA
Resolution	Program/readback Meter	1.5 mV, 0.1 mA 10 mV, 1 mA	1.5 mV, 0.1 mA 10 mV, 1 mA	0.5 mV, 0.5 mA 1 mV, 1 mA
Transient response	50 µsec for output to recover to within 15 mV following a change in output current from full load to half load or vice versa			

For off-the-shelf shipment

Supplemental Characteristics

ac Input:
100 Vac ± 10%, 47 to 63Hz (Opt 0E9)
115 Vac ± 10%, 47 to 63Hz (Standard)
230 Vac ± 10%, 47 to 63Hz (Opt 0E3)

Product Regulation: Designed to comply with UL1244, IEC 1010-1; certified with CSA 22.2
Meets requirements for CE regulation

Warranty: 3 years

Size:
E3631A 213 mmW x 132 mmH x 360 mmD (8.4 in. x 5.2 in. x 14.2in.)

Weight:
E3631A 8.2 kg (18 lbs)

6625A, 6626A, 6628A, 6629A

Precision Measurement Multiple-Output: 25 W and 50 W

2 or 4 independent isolated outputs

Dual-range linear outputs

Low ripple and noise

Fast up- and down-programming

14-bit programming and readback of voltage and current

Current sourcing and sinking

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

		25-watt output	50-watt output
Output Power	Low-range volts, amps	0 to 7 V, 0 to 15 mA	0 to 16 V, 0 to 200 mA
	High range volts, amps	0 to 50 V, 0 to 500 mA	0 to 50 V, 0 to 1 A or 0 to 16 V, 0 to 2 A
Output combinations for each model (total number of outputs)	**6625A (2) Precision**	1	1
	6626A (4) Precision	2	2
	6628A (2) Precision	—	2
	6629A (4) Precision	—	4
Programming accuracy (at 25°C ±5°C)	Voltage	1.5 mV + 0.016% (low) 10 mV + 0.016% (high)	3 mV + 0.016% (low) 10 mV + 0.016% (high)
	Current	15 µA + 0.04% (low) 100 µA + 0.04% (high)	185 µA + 0.04% (low) 500 µA + 0.04% (high)
Ripple and noise (peak-to-peak, 20 Hz to 20 MHz; rms, 20 Hz to 10 MHz)	Constant voltage rms	500 µV	500 µV
	peak-to-peak	3 mV	3 mV
	Constant current rms	0.1 mA	0.1 mA
Load regulation	Voltage Current	0.5 mV 0.005 mA	0.5 mV 0.01 mA
Load cross regulation	Voltage Current	0.25 mV 0.005 mA	0.25 mV 0.01 mA
Line regulation	Voltage Current	0.5 mV 0.005 mA	0.5 mV 0.01 mA
Transient response time change within specfications	Less than 75 µs for the output to recover to within 75 mV of nominal value following a load		

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

		25-watt output	50-watt output
Average programming resolution	Voltage	460 µV (low) 3.2 mV (high)	1 mV (low) 3.2 mV (high)
	Current	1 µA (low) 33 µA (high)	13 µA (low) 131 µA (high)
	OVP	230 mV	230 mV
Output Programming response time	(time to settle within 0.1% of full scale output, after Vset command has been processed)	6 ms	6 ms

dc Floating Voltage: All outputs can be floated up to ±240 Vdc from chassis ground

Remote Sensing: Up to 10 V drop per load lead. The drop in the load leads is subtracted from the voltage available for the load.

Command Processing Time: 7 ms typical with front-panel display disabled

Input Power: 550 W max., 720 VA max.

GPIB Interface Capabilities: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT0, C0, E1.

Regulatory Compliance: Listed to UL 1244; conforms to IEC 61010-1. See page 73 for more information.

Size: 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in) See page 56 for more details

Weight: 6626A, 6629A: Net, 17.4 kg (38 lb); shipping, 22.7 kg (50 lb) 6625A, 6628A: Net, 15.5 kg (34 lb); shipping, 20.8 kg (46 lb)

Warranty Period: Three years

Ordering Information

STANDARD: 104 to 127 Vac, 47 to 66 Hz, 5.4 A
Opt 100 87 to 106 Vac, 47 to 66 Hz Input, 6.3 A (Japan only)
Opt 220 191 to 233 Vac, 47 to 66 Hz, 3.0 A
Opt 240 209 to 250 Vac, 47 to 66 Hz, 3.0 A
Opt 750 Relay Control and DFI/RI
***Opt 908** Rack-mount Kit (p/n 5062-3977)
***Opt 909** Rack-mount Kit w/Handles (p/n 5063-9221)
Opt 910 Service Manual and Extra Operating Manual
*Support rails required

ACCESSORIES
p/n 1494-0059 Rack Slide Kit
E3663AC Support rails for Agilent rack cabinets

Multiple-Output: 40 W and 80 W

- 2, 3, or 4 independent isolated outputs
- Dual-range linear outputs
- Low ripple and noise
- Fast up- and down-programming
- Readback of output voltage and current
- Current sourcing and sinking

6621A-6624A, 6627A

SPECIFICATIONS

(at 0° C to 55° C unless otherwise specified)

		40-watt output	40-watt output	80-watt output	80-watt output
Output Power	Low-range volts, amps	0 to 7 V, 0 to 5 A	0 to 20 V, 0 to 2 A	0 to 7 V, 0 to 10 A	0 to 20 V, 0 to 4 A
	High range volts, amps	0 to 20 V, 0 to 2 A	0 to 50 V, 0 to 0.8 A	0 to 20 V, 0 to 4 A	0 to 50 V, 0 to 2 A
Output combinations for each model (total number of outputs)	**6621A (2)**	—	—	2	—
	6622A (2)	—	—	—	2
	6623A (3)	1	1	1	—
	6624A (4)	2	2	—	—
	6627A (4)	—	4	—	—
Programming accuracy (at 25°C ±5°C)	Voltage	19 mV + 0.06%	50 mV + 0.06%	19 mV + 0.06%	50 mV + 0.06%
	Current	50 mA + 0.16%	20 mA + 0.16%	100 mA + 0.16%	40 mA + 0.16%
Ripple and noise (peak-to-peak, 20 Hz to 20 MHz; rms, 20 Hz to 10 MHz)	Constant voltage rms	500 µV	500 µV	500 µV	500 µV
	peak-to-peak	3 mV	3 mV	3 mV	3 mV
	Constant current rms	1 mA	1 mA	1 mA	1 mA
Load regulation	Voltage	2 mV	2 mV	2 mV	2 mV
	Current	1 mA	0.5 mA	2 mA	1 mA
Load cross regulation	Voltage	1 mV	2.5 mV	1 mV	2.5 mV
	Current	1 mA	0.5 mA	2 mA	1 mA
Line regulation	Voltage	0.01% + 1 mV	0.01% + 1 mV	0.01% + 1 mV	0.01% + 1 mV
	Current	0.06% + 1 mA	0.06% + 1 mA	0.06% + 1 mA	0.06% + 1 mA
Transient response time	Less than 75 µs for the output to recover to within 75 mV of nominal value following a load change within specfications				

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

		40-watt output	40-watt output	80-watt output	80-watt output
Average programming resolution	Voltage	6 mV	15 mV	6 mV 3.2 mV (high)	15 mV
	Current	25 mA	10 mA	50 mA 131 µA (high)	20 mA
	OVP	100 mV	250 mV	100 mV	250 mV
Output Programming response time	(time to settle within 0.1% of full scale output, after Vset command has been processed)	2 ms	6 ms	2 ms	6 ms

6621A
6622A
6623A
6624A
6627A

Visit our web site http://www.agilent.com/find/power

dc Floating Voltage: All outputs can be floated up to ±240 Vdc from chassis ground

Remote Sensing: Up to 1 V drop per load lead. The drop in the load leads is subtracted from the voltage available for the load.

Command Processing Time: 7 ms typical with front-panel display disabled

Down Programming: Current sink limits are fixed approximately 10% higher than source limits for a given operating voltage above 2.5 V

Input Power: 550 W max., 720 VA max.

GPIB Interface Capabilities: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT0.

Regulatory Compliance: Listed to UL1244; conforms to IEC 61010-1; carries the CE mark. See page 73 for more information

Size: 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in) See page 56 for more details

Weight: Net, 17.4 kg (38 lb); shipping, 22.7 kg (50 lb)

Warranty Period: Three years

Ordering Information

STANDARD: 104 to 127 Vac, 47 to 66 Hz, 5.4 A

Opt 100 87 to 106 Vac, 47 to 66 Hz Input, 6.3 A (Japan only)
Opt 220 191 to 233 Vac, 47 to 66 Hz, 3.0 A
Opt 240 209 to 250 Vac, 47 to 66 Hz, 3.0 A
Opt 750 Relay Control and DFI/RI
***Opt 908** Rack-mount Kit (p/n 5062-3977)
***Opt 909** Rack-mount Kit w/Handles (p/n 5063-9221)
Opt 910 Service Manual and extra Operating Guide
*Support rails required

ACCESSORIES

p/n 1494-0059
Rack Slide Kit

E3663A
Support rails for Agilent rack cabinets

E3646A, E3647A, E3648A, E3649A

Multiple-Output: 60 W to 100 W

Dual-Output, Dual-Range
Low noise/excellent line and load regulation
GPIB/RS-232 standard
SCPI (Standard Commands for Programmable Instrument) compatible
Front and rear output terminals
Overvoltage protection
Remote sense at rear output

Agilent E3646A – 49A Dual Output

The new E3640A-series programmable dc power supplies are 60W/100W dual output dc power supplies with standard GPIB & RS-232 interface. For general-purpose use, these programmable power supplies offer the performance of system power supplies at a surprisingly affordable price.

Clean and Stable Output

All models deliver clean and reliable power, dependable regulation (0.01%) and fast transient response (<50usec to within 15mV). With 0.01% load and line regulation, Agilent E364xA power supplies keep output steady when power line and load changes occur. These linear supplies specify both normal mode voltage noise and common mode current noise to assure less interference with your DUT.

Standard remote interface

Standard GPIB and RS-232 interfaces, SCPI programming and *plug&play* drivers for Agilent VEE and NI LabView make it easy to program and integrate into automated test systems. You can monitor the output terminals for voltage and current, and a query command lets you read the programmed voltage and current.

Versatile Power

Agilent E364xA power supplies give you the flexibility to select from dual output ranges. Both front and rear output terminals are standard, and output load is protected against over-voltage protection function. Remote sense is available to eliminate the errors due to voltage drops on the load leads. New front panel binding posts offer flexibility to use safety test leads, banana plugs or stripped wires. Store and recall key enables you to save and recall up to 5 frequently used operating states. For dual output models, two outputs are electrically isolated to each other and allows voltage tracking.

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

		E3646A	E3647A	E3648A	E3649A
Number of Outputs		**2**	**2**	**2**	**2**
dc outputs	Voltage/Current	0 to 8 V/3 A 0 to 20 V/1.5 A	0 to 35 V/0.8 A 0 to 60 V/0.5 A	0 to 8 V/5 A 0 to 20 V/2.5 A	0 to 35 V/1.4 A 0 to 60 V/0.8 A
Power (max)		60 W	60 W	100 W	100 W
Load and line regulation	Voltage/Current	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA	<0.01% + 3 mV <0.01% + 250 µA
Ripple and noise (20 Hz to 20 MHz)	Normal-Mode Voltage Normal-Mode Current Common-Mode Current	<500 µVrms/5 mVp-p <4.0 mArms <1.5 µArms	<1 mVrms/8 mVp-p <4.0 mArms <1.5 µArms	<500 µVrms/5 mVp-p <4.0 mArms <1.5 µArms	<1 mVrms/8 mVp-p <4.0 mArms <1.5 µArms
Programming accuracy (at 25° C ± 5° C)	Voltage Current	<0.05% + 10 mV (<0.1% + 25 mA for output 2) <0.2% + 10 mA			
Readback accuracy (at 25° C ± 5° C)	Voltage Current	<0.05% + 5 mV (<0.1% + 25 mV for output 2) <0.15% + 5 mA (<0.15% + 10 mA for output 2)			
Program resolution	Voltage/Current	5 mV/1 mA	5 mV/1 mA	5 mV/1 mA	5 mV/ 1 mA
Readback resolution	Voltage/Current	2 mV/1 mA	2 mV/1 mA	2 mV/1 mA	2 mV/ 1 mA
Meter resolution	Voltage/Current	10 mV/1 mA	10 mV/1 mA	10 mV/1 mA	10 mV/ 1 mA
Transient response time	<50 µs for output to recover within 15 mV following a change in output current from full load to half load or vice versa.				

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground.

Remote Sensing: Up to 1V can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Settling Time: Less than 90msec for the output voltage to change from 1% to 99% or vice versa following the receipt of VOLTage or APPLy command via direct GPIB or RS-232 interface.

Product Regulation: Designed to comply with UL3111-1; certified to CSA 22.2 No. 1010.1; conforms to IEC 61010-1; complies with EMC directive 89/336/EEC(Group1, Class A)

OVP accuracy: 0.5% + 0.5 V, activation time: ≥3 V, <1.5 ms, and <3 V, <10 ms

Isolation: ±240 Vdc

Stability: Voltage <0.02% + 2 mV; Current <0.1% + 1 mA

Temperature coefficient: 0.01% + 3 mV, 0.02% + 3 mA change per degree C over operating range 0-40 degree C after 30 minute warm-up (0.02% + 5 mV for output 2)

Warranty: Three years

Size: 213 mm W x 133 mm H x 348 mm D (8.4 in. x 5.2 in. x 13.7 in.)

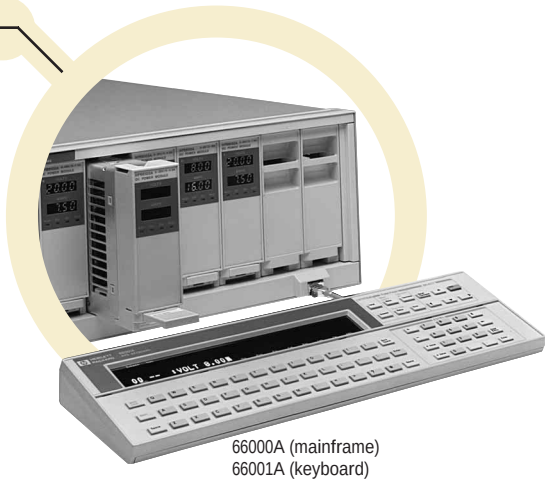
Weight: E3646A, E3647A: 7.4 kg (16.3 lbs)
E3648A, E3649A: 9.5 kg (20.9 lbs)

Ordering Information

STANDARD: 115 Vac +/- 10%, 47 to 63 Hz
Opt 0E3 230 Vac +/- 10%, 47 to 63 Hz
Opt 0E9 100 Vac +/- 10%, 47 to 63 Hz
Opt 1CM Rackmount Kit (p/n 5063-9243)
Opt 910 Extra Manual set

ACCESSORIES:
E3619A 18 AWG power supply test leads

Modular Power System: 1,200 W per mainframe



66000A (mainframe)
66001A (keyboard)

- High density: eight slots in 7 inches of rack space
- Output sequencing
- Low ripple and noise
- High-accuracy read-back of voltage and current over GPIB
- Standard Commands for Programmable Instruments (SCPI)
- Optional keyboard and display unit
- Serial link to connect two mainframes at one GPIB address
- Optional isolation and polarity-reversal relays
- Built-in self-test
- VXI*plug&play* drivers

66000 Modular Power System

The Agilent 66000 modular power system simplifies test-system assembly, cabling, programming, debugging and operation. It is ideal for ATE and production test environments, where it can supply bias power and stimulus to subassemblies and final products. The modular power system saves rack space, the 7-inch-high (4-EIA units) mainframe can accommodate up to eight dc power modules.

Key Features

- GPIB-programmable voltage and current
- Programmable over-voltage and over-current protection
- Self-test initiated at power-up or from GPIB command
- Electronic calibration over GPIB or from keyboard
- Over-temperature protection
- Discrete fault indicator/remote inhibit (DFI/RI)
- Five nonvolatile store-recall states per output
- User-definable power-on state

SPECIFICATIONS

(at 0° to 55° C unless otherwise noted)

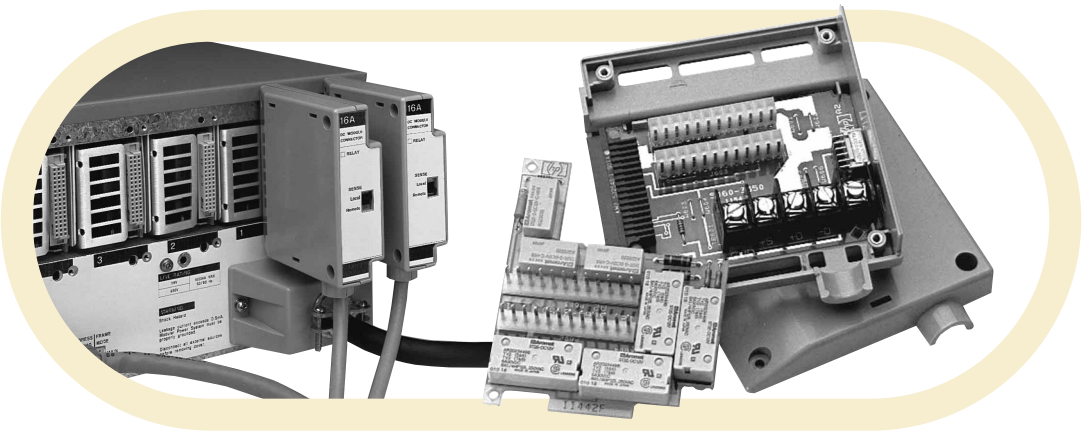
			66101A	66102A	66103A	66104A	66105A	66106A
Output ratings (at 40°C)	Output Voltage		0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V	0 to 200 V
	Output Current		0 to 16 A	0 to 7.5 A	0 to 4.5 A	0 to 2.5 A	0 to 1.25 A	0 to 0.75 A
	Output Power		128 W	150 W	150 W	150 W	150 W	150 W
Programming accuracy (at 25°C ±5°C)	Voltage	0.03%+	3 mV	8 mV	13 mV	27 mV	54 mV	90 mV
	Current	0.03%+	6 mA	3 mA	2 mA	1.2 mA	0.6 mA	0.4 mA
Readback accuracy (via GPIB or keyboard display at 25°C ±5°C)	Voltage	0.02%+	2 mV	5 mV	8 mV	16 mV	32 mV	54 mV
	Current	0.02%+	6 mA	3 mA	2 mA	1 mA	0.6 mA	0.3 mA
Ripple and noise (20 Hz to 20 MHz)	Constant voltage	rms	2 mV	3 mV	5 mV	9 mV	18 mV	30 mV
		peak to peak	5 mV	7 mV	10 mV	15 mV	25 mV	50 mV
	Constant current	rms	8 mA	4 mA	2 mA	1 mA	1 mA	1 mA
Line regulation	Voltage		0.5 mV	0.5 mV	1 mV	2 mV	3 mV	5 mV
	Current		0.75 mA	0.5 mA	0.3 mA	0.1 mA	50 µA	30 µA
Load regulation	Voltage		1 mV	1 mV	1 mV	2 mV	4 mV	7 mV
	Current		0.5 mA	0.2 mA	0.2 mA	0.1 mA	50 µA	30 µA
Transient response time	Less than 1 ms for the output voltage to recover within 100 mV of its previous level following any step change in load current up to 10 percent of rated current							

Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

Average resolution	Voltage		2.4 mV	5.9 mV	10.4 mV	18.0 mV	36.0 mV	60.0 mV
	Current		4.6 mA	2.3 mA	1.4 mA	0.75 mA	0.39 mA	0.23 mA
	Output voltage programming (OVP)		50 mV	120 mV	200 mV	375 mV	750 mV	1.25 mV
OVP accuracy			250 mV	500 mV	800 mV	1 V	1.5 V	2.5 V

66000A
66001A
66101A
66102A
66103A
66104A
66105A
66106A



dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground

Remote Sensing: Up to half the rated output voltage can be dropped across each load lead. Add 2 mV to the voltage load regulation specification for each 1–V change in the negative output lead caused by a load current change.

Command Processing Time: The average time for the output voltage to change after getting an GPIB command is 20 ms

Output Programming Response Time (with full resistive load): The rise and fall time (10% to 90% and 90% to 10%) of the output voltage is less than 20 ms. The output voltage change settles within 0.1% of the final value in less than 120 ms.

Down Programming: An active down-programmer sinks approximately 10% of the rated output current

Calibration Interval: One year

ac Input of System Mainframe

Voltage	100 Vac	120 Vac	200 Vac	220 Vac	230 Vac	240 Vac
Max. Current	29 A	25 A	16 A	16 A	15 A	15 A

Input Power of System Mainframe: 3200 VA (max.), 1800 W (max.), 1600 W (typ.)

GPIB Capabilities: SH1, AH1, TE6, LE4, SR1, RL1, PP0, DC1, DT1, E1, and C0, and a command set compatible with IEEE-488.2 and SCPI

Regulatory Compliance: Listed to UL 1244; certified to CSA 22.2 No. 231; conforms to IEC 61010-1. See page 73 for more information

Weight: Net, 66000A, 15 kg (33 lb); 66001A, 1.05 kg (2.3 lb); 66101-66106A, 2.8 kg (6 lb). Shipping, 66000A, 19 kg (42 lb); 66001A, 1.34 kg (2.95 lb); 66101–66106A, 4.1 kg (9 lb).

Size: 66000A: 425.7 mm W x 192 mm H x 677.93 mm D (16.76 in x 7.28 in x 26.69 in), including feet and rear connectors (See Page 58 for more details.)

Warranty Period: Three years

Multiple Mainframes at One GPIB Address

The Agilent serial link feature will allow you to control up to 16 outputs at one GPIB address by connecting an auxiliary mainframe. The serial link cable comes standard with the 66000 MPS mainframe. For applications with a broader range of power requirements, one 66000 mainframe can be connected with up to eight of the 6640, 6650, 6670, 6680, or 6030 series of system power supplies. This solution provides power ranges from 150 watts to 5,000 watts at one primary GPIB address.

Output Connections

System assembly is simplified thanks to a quick-disconnect connector assembly on each module. Once your wires are connected to the load, the connector design permits the modules to be removed from the front of the mainframe without disconnecting cabling or removing the mainframe from the rack. One connector assembly is shipped with each module.

Output Sequencing

Increase test throughput by using the output sequencing feature of the 66000 MPS. This powerful feature allows you to download up to 20 voltage, current, and dwell-time parameter sets per output. This sequence can be paced by the programmed dwell times. As an alternative, triggers can be used to step through the output list. The output sequences can be executed without controller intervention, thereby increasing overall test system throughput. More detailed information on the triggering and output sequencing capabilities can be obtained by ordering the 66000 Modular Power System Product Note (p/n 5091-2497E) described below.

Key Literature

66000 Modular Power System Product Note
p/n 5091-2497E

Ordering Information

66000A MPS Mainframe
***Opt 908** Rack-mount Kit (p/n 5063-9215)
***Opt 909** Rack-mount Kit with Handles (p/n 5063-9222)
***Note:** Options 908 and 909 require cabinet rails (E3663AC) or a slide kit (p/n 1494-0059) to support the loaded mainframe's weight.
Opt 910 Extra Manual Set (Standard unit is shipped with Installation Guide only.)
A line cord option must be specified. See pages 48-51.

66001A MPS Keyboard includes 2m (6 ft) cables
66002A Rack kit for 66001A keyboard

Module Options
66101A dc Power Module 8 V, 16 A
66102A dc Power Module 20 V, 7.5 A
66103A dc Power Module 35 V, 4.5 A
66104A dc Power Module 60 V, 2.5 A
66105A dc Power Module 120 V, 1.25 A
66106A dc Power Module 200 V, 0.75 A
Opt 760 Open/Close and Polarity Reversal Relays
Opt 910 Service Manual, Extra Programming Guide and Operating Guide

Accessories

p/n 5060-3351 Field-Installable Relay Kit
p/n 5060-3386 Standard Connector Assembly
p/n 5060-3387 Standard Connector Assembly with installed relays (Option 760)
p/n 66000-90001 Mainframe Installation Guide
p/n 5959-3360 dc Power Module User's Guide
p/n 5959-3362 dc Power Module Programming Guide
p/n 66000-90003 Mainframe Service Manual
p/n 5959-3364 dc Power Module Service Manual
p/n 1252-1488 4-Pin FLT/Inhibit Connector
E3663AC Support rails for Agilent rack cabinets

AGILENT SOLAR ARRAY SIMULATOR: 480 W

The E4350B/E4351B simulates the output characteristics of a satellite's solar panels as it moves from darkness to light.

E4350B, E4351B

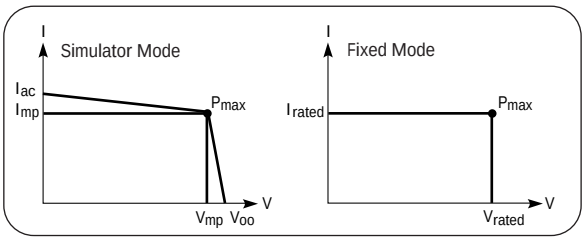
Agilent Solar Array Simulator

The Agilent one-box 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 and is capable of simulating the I-V curve of different arrays under different conditions (i.e., temperature, age etc.). The I-V curve is programmable over the IEEE-488.2 bus and is conveniently generated within the SAS.

The SAS provides three current operating modes:

1. Simulator Mode: An internal algorithm is used to approximate a SAS I-V curve. Four input parameters: Voc (open circuit voltage), Isc (short circuit current), Imp and Vmp (current and voltage at the peak power point on the curve) are needed to establish a curve in this mode.

2. Table Mode: For a fast and accurate I-V simulation, the SAS provides a table mode. The I-V curve is set by a user-defined table of points. A table can have any length up to 4000 points (a point corresponds to a specific value of I and V). As many as 30 tables may be stored in each of the SAS built-in volatile and non-volatile memory.



Non-volatile memory can store a maximum of 3500 points. The tables (I-V curves) are easily stored and recalled with an IEEE-488.2 command. The table(s) stored in this memory will be retained when the power is turned off. Volatile memory greatly increases the flexibility by saving up to 30,000 points. Multiple tables are easily accessed with IEEE-488.2 command. These tables will be erased after power is removed.

In Table Mode, current and voltage offsets can be applied to the selected table to simulate a change in the operating conditions of the solar array.

3. Fixed Mode: This is the default mode when the unit is powered on. The unit has the rectangular I-V characteristics of a standard power supply, when an output capacitor is added in this mode.

Programming Accuracy: at 25°C + 5°C (SAS and table Mode)
Voltage: (Fixed Mode)
0.075% + 10 mV (E4350B)
0.075% + 20 mV (E4351B)
Current: (Simulator and Fixed Mode)
0.2% + 20 mA (E4350B)
0.2% + 10 mA (E4351B)

Ripple and Noise: (20 Hz to 20 MHz) with outputs ungrounded or with either terminal grounded (Simulator and Table Mode)
Voltage: RMS: 16 mV (E4350B), 24 mV (E4351B);
P-P: 125 mV (E4350B), 195 mV (E4315B)
Current: RMS: 4 mA

ac Input: 104 to 127 Vac

Voltage	100 Vac	120 Vac	220 Vac	240 Vac
Current	12 A	10 A	5.7 A	5.3 A

Supplemental Characteristics

Load Switching Recovery Time: < 5 μs when switched from short circuit to variable load, to within 1.5A of an operating point on the I-V curve.

Remote Sensing: Up to 2 V+ (Voc-Vmp). Add 3 mV to the voltage load regulation specification for each 1 volt change in the positive output lead due to load current change.

Analog Programming of Output Current
Input Signal: 0 to -4.0V
Input Impedance: 20k Ohms nominal

Shunt Regulation: Switching frequency up to 50 kHz

Series Regulation: Switching frequency up to 50 kHz

OVP and OCP: Overvoltage and overcurrent protection triggers in ≤100 us

Capacitive Load: In fixed mode, the maximum load capacitance (without causing instability) is 2000uF. In simulator and table mode, it is unconditionally stable at all capacitive loads.

Inductive Load: The maximum load inductance (without causing instability) is 200μH

Regulatory Compliance: Listed to UL3101, certified to CSA 22.2 No. 1010.1, complies with EN 61010-1.

RFI Suppression: Complies with CISPR-11, Group 1, Class A

Size: 425.5 mm W x 132.6 mm H x 497.8mm d (16.75 in x 5.25 in x 19.6 in) See page 55 for more detail

Weight: Net, 25 kg (54 lb); shipping, 28 kg (61 lb)

Warranty: Three years

Specifications

	E4350B	E4351B
For Simulator and Table Modes		
Max. Power	480 W	480 W
Voc, Max.* Power	65 V	130 V
Isc, Max*	8 A	4 A
For mixed mode		
Max. Power	480 W	480 W
V rated*	0-60 V	0-120 V
I rated*	0-8 A	0-4 A

*Other voltage/current combinations may be configured to meet your unique requirements.

Ordering Information

Simulators can be ordered as individual modules or as fully customized system.

Opt 0BN Service Manual, Extra Programming Guide and Operating Guide
Opt 100 87 to 106 Vac, 47 to 63 Hz
Opt 220 191 to 233 Vac, 47 to 63 Hz
Opt 240 209 to 250 Vac, 47 to 63 Hz
Opt 908 Rackmount Kit, p/n 5062-3977
Opt 909 Rackmount Kit with Handles, p/n 5063-9221

Accessories
p/n 1252-3698 7-pin Analog Plug
p/n 1252-1488 4-pin Digital Plug
p/n 5080-2148 Serial Link Cable 2 m (6.6 ft)
p/n 1494-0059 Accessory Slide Kit

Single Output - 24 W to 60 W

E3610A-E3612A,
E3614A-E3617A

E3610A, E3611A, and E3612A features:

- Dual ranges
- Digital voltage and current meters
- 10-turn potentiometer
- Linear power supply

E3614A, E3615A, E3616A and E3617A features:

- Digital voltage and current meters
- Overvoltage protection
- Remote sensing
- Remote analog programming
- Linear power supply

E3610A, E3611A, E3612A

These popular low-cost CV/CC bench supplies are designed for general laboratory use. The constant-voltage, constant-current output allows operation as either a voltage source or current source. The changeover occurs automatically, based on the load. This feature also provides an adjustable current limit, for a particular DUT. Also, a CC set button lets you set the current limit without you having to short the output.

Each model has two ranges, allowing more current at a lower voltage. For a higher output voltage, supplies can be connected in series. Either the positive or negative terminal can be connected to ground, providing a positive or negative voltage output. Either terminal can also be floated up to 240 V from ground.

Dual digital meters monitor current and voltage simultaneously. Adjustments are made with the 10-turn voltage control and the 10-turn current control. Each power supply is 212 mm W x 88 mm H x 318 mm D (8.4 in x 3.5 in x 12.5 in) and weighs 3.8 kg (8.4 lbs).

E3614A, E3615A, E3616A, E3617A

These flexible single range CV/CC power supplies can be used as either voltage sources or current sources. The CC-set button allows you to quickly set the current limit when operating in the CV mode, without shorting the output. 10-turn controls allow accurate adjustment of voltage and current output settings. The output voltage and current can also be controlled with external 0-10 volt analog voltage or variable resistance.

Output connections can be made on either the front or rear panel. Remote sensing is available to eliminate the errors in voltage regulation due to voltage drops in the load leads. Either the positive or negative output terminal may be connected to ground to provide positive or negative output voltage. Either terminal can also be floated to a maximum of 240 volts. Multiple units can be combined in auto-parallel, auto-series and auto-tracking configurations to obtain more voltage or current output.

This load is protected with the overvoltage protection feature, which is easily monitored and adjusted from the front panel. The digital voltage and current meters provide continuous and accurate readings of the output levels. The E3614A-E3617A are 212 mmW x 88 mmH x 373 mm D (8.5 in x 3.5 in x 14.7 in).

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

		E3610A	E3611A	E3612A	E3614A	E3615A	E3616A	E3617A
Number of output ranges		2	2	2	1	1	1	1
Output ratings[1]	Range 1	0 to 8 V, 0 to 3 A[1]	0 to 20 V, 0 to 1.5 A[1]	0 to 60 V, 0 to 0.5 A[1]	0 to 8 V, 0 to 6 A	0 to 20 V, 0 to 3 A	0 to 35 V, 0 to 1.7 A	0 to 60 V, 0 to 1 A
	Range 2	0 to 15 V, 0 to 2 A[1]	0 to 35 V, 0 to 0.85 A[1]	0 to 120 V, 0 to 0.25 A[1]	-	-	-	-
	Power (max)	30 W	30 W	30 W	48 W	60 W	60 W	60 W
Load and line regulation		0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV
Ripple and noise (20 Hz to 20 MHz)	rms	200 µV	200 µV	200 µV	200 µV	200 µV	200 µV	200 µV
	peak-to-peak	2 mV	2 mV	2 mV	1 mV	1 mV	1 mV	1 mV

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product).

Control mode		CV/CC	CV/CC	CV/CC	CV/CC	CV/CC	CV/CC	CV/CC
Meter Resolution (minimum change using front-panel controls)	Voltage	10 mV	100 mV	100 mV	10 mV	10 mV (0-20V), 100mV (>20V)		
	Current	10 mA	10 mA	1 mA	10 mA	10 mA	1 mA	1 mA
Power	(115 Vac ± 10%)	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz

For 0ff-the-shelf shipment

[1]Maximum current is derated 1% per °C between 40° to 55°C.

Ordering Information

Opt 0E3
230 Vac ±10% operation, 47 to 63 Hz.
(Use with 220V input line.)

Opt 0E9
100 Vac ±10% operation; 47 to 63 Hz
(for use in Japan)

Single-Output Manually Controlled: 200 W

- Constant-voltage, constant-current operation
- Complete front-panel control calibration and display
- Remote programming and sensing
- Fan-speed control to minimize acoustic noise
- Low ripple and noise
- Over-voltage and over-current protection

6541A-6545A

SPECIFICATIONS

(at 0˚ to 55˚ C unless otherwise specified)

			6541A	6542A	6543A	6544A	6545A
Output ratings	Output voltage		0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
	Output current (40˚ C)		0 to 20 A	0 to 10 A	0 to 6 A	0 to 3.5 A	0 to 1.5 A
	Maximum current (50˚ C/55˚ C)		18 A/17 A	9 A/8.5 A	5.4 A/5.1 A	3.2 A/3 A	1.4 A/1.3 A
Programming accuracy at 25˚C ±5˚C	Voltage	0.06% +	5 mV	10 mV	15 mV	26 mV	51 mV
	Current	0.14% +	26 mA	13 mA	6.7 mA	4.1 mA	1.7 mA
Ripple and noise from 20 Hz to 20 MHz	Voltage rms		300 µV	300 µV	400 µV	500 µV	700 µV
		peak-peak	3 mV	3 mV	4 mV	5 mV	7 mV
	Current rms		10 mA	5 mA	3 mA	1.5 mA	1 mA
Load regulation	Voltage		1 mV	2 mV	3 mV	4 mV	5 mV
	Current		1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
Line regualtion	Voltage		0.5 mV	0.5 mV	1 mV	1mV	2 mV
	Current		1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
Transient response time	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current						
Supplemental Characteristics	(Non-warranted characteristics determined by design and useful in applying the product)						
Average resolution	Voltage		2 mV	5 mV	10 mV	15 mV	30 mV
	Current		6 mA	3 mA	2 mA	1.2 mA	0.5 mA
	OVP		13 mV	30 mV	54 mV	93 mV	190 mV
OVP accuracy			160 mV	400 mV	700 mV	1.2 V	2.4 V

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Output Programming Response Time: The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

Down Programming: An active down programmer sinks approximately 20% of the rated output current

Modulation: (Analog programming of output voltage and current)
Input Signal: 0 to –5 V
Input Impedance: 10 k Ohm nominal

ac Input: (ac input frequency 47 to 63 Hz)

Voltage	100 Vac	120 Vac	220 Vac	240 Vac
Current	4.4 A	3.8 A	2.2 A	2.0 A

Input Power: 480 VA, 400 W at full load; 60 W at no load

Regulatory Compliance: Conforms to UL 1244 and IEC 61010-1.
See page 73 for more information.

Size: 425.5 mm W x 88.1 mm H x 439 mm D (16.75 in x 3.5 in x 17.3 in)
See page 54 for more details

Weight: Net, 14.2 kg (31.4 lb); shipping, 16.3 kg (36 lb)

Warranty Period: Three years

Ordering Information

Standard: 104 to 127 Vac, 47 to 63 Hz
Opt 100 87 to 106 Vac, 47 to 63 Hz
Opt 220 191 to 233 Vac, 47 to 63 Hz
Opt 240 209 to 250 Vac, 47 to 63 Hz
***Opt 908** Rack-mount Kit (p/n 5063-9212)
***Opt 909** Rack-mount Kit w/ Handles (p/n 5063-9219)
Opt 910 Service Manual, extra Operating Guide and Programming Guide
*Support rails required

Accessories
p/n 1494-0060 Accessory Slide Kit
E3663AC Support rails for Agilent rack cabinets

Single-Output Manually Controlled: 500 W

6551A-6555A

- Constant-voltage, constant-current operation
- Complete front-panel control calibration and display
- Remote programming and sensing
- Fan-speed control to minimize acoustic noise
- Low ripple and noise
- Over-voltage and over-current protection

SPECIFICATIONS

(at 0˚ to 55˚ C unless otherwise specified)

			6551A	6552A	6553A	6554A	6555A
Output ratings	Output voltage		0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
	Output current (40˚ C)		0 to 50 A	0 to 25 A	0 to 15 A	0 to 9 A	0 to 4 A
	Maximum current (50˚ C/55˚ C)		45 A/42.5 A	22.5 A/21.3 A	13.5 A/12.8 A	8.1 A/7.7 A	3.6 A/3.4 A
Programming accuracy at 25˚C ±5˚C	Voltage	0.06% +	5 mV	10 mV	15 mV	26 mV	51 mV
	Current	0.15% +	60 mA	25 mA	13 mA	8 mA	4 mA
Ripple and noise from 20 Hz to 20 MHz	Voltage rms		300 µV	300 µV	400 µV	500 µV	700 µV
	peak-peak		3 mV	3 mV	4 mV	5 mV	7 mV
	Current rms		25 mA	10 mA	5 mA	3 mA	2 mA
Load regulation	Voltage		1 mV	2 mV	3 mV	4 mV	5 mV
	Current		2 mA	1 mA	0.5 mA	0.5 mA	0.5 mA
Line regulation	Voltage		0.5 mV	0.5 mV	1 mV	1mV	2 mV
	Current		2 mA	1 mA	0.75 mA	0.5 mA	0.5 mA
Transient response time	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current						

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Average resolution	Voltage		2 mV	5 mV	10 mV	15 mV	30 mV
	Current		15 mA	7 mA	4 mA	2.5 mA	1.25 mA
	OVP		12 mV	30 mV	54 mV	93 mV	190 mV
OVP accuracy			160 mV	400 mV	700 mV	1.2 V	2.4 V

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Output Programming Response Time: The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

Down Programming: An active down programmer sinks approximately 20% of the rated output current

Modulation: (Analog programming of output voltage and current)
Input signal: 0 to –5 V
Input impedance: 10 k Ohm nominal

ac Input: (ac input frequency 47 to 63 Hz)

Voltage	100 Vac	120 Vac	220 Vac	240 Vac
Current	12 A	10 A	5.7 A	5.3 A

Input Power: 1,380 VA, 1,100 W at full load; 120 W at no load

Regulatory Compliance: Listed to UL 1244; certified to CSA556B; conforms to IEC 61010-1. See page 73 for more information.

Size: 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in) See page 55 for more details

Weight: Net, 25 kg (54 lb); shipping, 28 kg (61 lb)

Warranty Period: Three years

Ordering Information

STANDARD 104 to 127 Vac, 47 to 63 Hz
Opt 100 87 to 106 Vac, 47 to 63 Hz
Opt 220 191 to 233 Vac, 47 to 63 Hz
Opt 240 209 to 250 Vac, 47 to 63 Hz
***Opt 908** Rack-mount Kit (p/n 5062-3977)
***Opt 909** Rack-mount Kit w/ Handles (p/n 5063-9221)
Opt 910 Service Manual, extra Operating Guide and Programming Guide
*Support rails required

ACCESSORIES
p/n 1494-0059 Accessory Slide Kit
E3663AC Support rails for Agilent rack cabinets

Single-Output Manually Controlled: 2000 W

- Constant-voltage, constant-current operation
- Complete front-panel control calibration and display
- Remote programming and sensing
- Fan-speed control to minimize acoustic noise
- Low ripple and noise
- Over-voltage and over-current protection

6571A-6575A

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

			6571A	6572A	6573A	6574A	6575A
Output ratings	Output voltage		0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
	Output current		0 to 220 A	0 to 100 A	0 to 60 A	0 to 35 A	0 to 18 A
Programming accuracy at 25°C ±5°C	Voltage	0.04% +	8 mV	20 mV	35 mV	60 mV	120 mV
	Current	0.1% +	125 mA	60 mA	40 mA	25 mA	12 mA
Ripple and noise from 20 Hz to 20 MHz	Voltage rms		650 µV	750 µV	800 µV	1.25 mV	1.9 mV
	peak-peak		7 mV	9 mV	9 mV	11 mV	16 mV
	Current rms		200 mA	100 mA	40 mA	25 mA	12 mA
Load regulation or Line regulation	Voltage 0.002%+		300 µV	650 µV	1.2 mV	2 mV	4 mV
	Current 0.005%+		10 mA	7 mA	4 mA	2 mA	1 mA
Transient response time	Less than 900 µs for the output voltage to recover 100 mV following a change in load from 100% to 50% or 50% to 100% of the output current rating of the supply						

Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Average resolution	Voltage		2 mV	5 mV	9 mV	15 mV	30 mV
	Current		55 mA	25 mA	15 mA	8.75 mA	4.5 mA
	OVP		15 mV	35 mV	65 mV	100 mV	215 mV
Output voltage programming response time*	* Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.		30 ms	60 ms	130 ms	130 ms	195 ms

dc Floating Voltage: Output terminals can be floated up to ±240 Vdc from chassis ground

Output Common-Mode Noise Current: (to signal ground binding post) 500 µA rms, 4 mA peak-to-peak

Remote Sensing: Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

Modulation: (Analog programming of output voltage and current)
Input Signal: 0 to –4 V for voltage, 0 to 7 V for current
Input Impedance: 30 k Ohm or greater

Input Power: 3,800 VA, 2,600 W at full load; 170 W at no load

Regulatory Compliance: Listed to UL1244; certified to CSA556B; conforms to IEC 61010-1. See page 73 for more information.

Size: 425.5 mm W x 132.6 mm H x 640 mm D
(16.75 in x 5.22 in x 25.2 in)
See page 55 for more details

Weight: Net, 28.2 kg (62 lb); shipping, 31.8 kg (70 lb)

Warranty Period: Three years

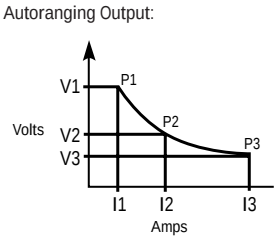
Ordering Information

STANDARD: 191 to 250 Vac, 47 to 63 Hz
Opt 200 174 to 220 Vac, 47 to 63 Hz (Japan only)
***Opt 908** Rack-mount Kit (p/n 5062-3977)
***Opt 909** Rack-mount Kit w/ Handles (p/n 5063-9221)
Opt 910 Service Manual and extra Operating Guide and Programming Guide
A line cord option must be specified.
See pages 48-51 for ordering information.
*Support rails required

ACCESSORIES
p/n 1494-0059 Accessory Slide Kit
E3663AC Support rails for Agilent rack cabinets

Single-Output, Autoranging: 200 W to 1,000 W

- Auto-series, auto-parallel operation
- Complete front panel control/display
- Constant-voltage, constant-current operation
- Remote programming and sensing
- Ten-turn voltage and current controls



6023A, 6028A

6010A, 6011A, 6012B, 6015A

SPECIFICATIONS

(at 0° to 55° C unless otherwise noted)

			6010A	6011A	6012B	6023A	6015A	6028A
Output ratings	Voltage		0 to 200 V	0 to 20 V	0 to 60 V	0 to 20 V	0 to 500 V	0 to 60 V
	Current		0 to 17 A	0 to 120 A	0 to 50 A	0 to 30 A	0 to 5 A	0 to 10 A
Maximum power	Watts		1,200 W	1,064 W	1,200 W	242 W	1,050 W	240 W
Autoranging output	V1, P1		200 V, 5 A	20 V, 50 A	60 V, 17.5 A	20 V, 10 A	500 V, 2 A	60 V, 3.3 A
	V2, P2		120 V, 10 A	14 V, 76 A	40 V, 30 A	14 V, 17.2 A	350 V, 3 A	40 V, 6 A
	V3, P3		60 V, 17 A	7 V, 120 A	20 V, 50 A	6.7 V, 30 A	200 V, 5 A	20 V, 10 A
Ripple and noise, 20 Hz to 20 MHz	Voltage rms		22 mV	8 mV	8 mV	3 mV	50 mV	3 mV
	p-p		50 mV	50 mV	40 mV	30 mV	160 mV	30 mV
	Current rms		15 mA	120 mA	25 mA	15 mA	50 mA	5 mA
Load regulation	Voltage Current	0.01%+ 0.01%+	5 mV 10 mA	3 mV 15 mA	5 mV 10 mA	2 mV 9 mA	40 mV 35 mA	3 mV 5 mA
Transient response time 10% step change	Time		2 ms	2 ms	2 ms	1 ms	5 ms	1 ms
	Level		150 mV	100 mV	100 mV	50 mV	200 mV	75 mV
Supplemental Characteristics	(Non-warranted characteristics determined by design that are useful in applying the product)							
Programming Resolution	Voltage		50 mV	5 mV	15 mV	5 mV	125 mV	15 mV
	Current		4.25 mA	30 mA	12.5 mA	7.5 mA	1.25 mA	2.5 mA
dc floating voltage	either terminal can be grounded or floated from chassis ground		±550 V	±240 V	±240 V	±240 V	±550 V	±240 V
ac input current	100 Vac		24 A	24 A	24 A	6 A	24 A	6 A
	120 Vac		24 A	24 A	24 A	6.5 A	24 A	6.5 A
	220 Vac		15 A	15 A	15 A	3.8 A	15 A	3.8 A
	240 Vac		14 A	14 A	14 A	3.6 A	14 A	3.6 A
Weight	Net		16.3 kg (36 lb)	17.2 kg (38 lb)	16.3 kg (36 lb)	9.6 kg (21 lb)	16.3 kg (36 lb)	9.6 kg (21 lb)
	Shipping		21.8 kg (48 lb)	22.7 kg (50 lb)	21.8 kg (48 lb)	11.4 kg (25 lb)	21.8 kg (48 lb)	11.4 kg (25 lb)

Remote Sensing: Up to 2 V drop in each lead. Voltage regulation specification met with up to 0.5 V drop, but degrades for greater drops.

Modulation: (analog programming of output voltage and current) Input signal: 0 to 5 V or 0 to 4 k Ohms

Regulatory Compliance: Certified to CSA556B; conforms to IEC 61010-1. See page 73 for more information.

Inductive Load: 6023A, 6028A are stable in CC mode for loads up to 1 H.

Size: 6023A, 6028A: 212.3 mm W x 177.0 mm H x 516.4 mm D (8.36 in x 6.97 in x 17.87 in).

6010A–12B, 6015A: 425.5 mm W x 132.6 mm H x 516.4 mm D (16.75 in x 5.25 in x 20.33 in). See page 52 for more details

Warranty: One year

Ordering Information

STANDARD: 104 to 127 VAC, 48 to 63 Hz

Opt 002 Provides extra programming and monitoring capabilities

Opt 220 191 to 233 Vac, 48 to 63 Hz

Opt 240 209 to 250 Vac, 48 to 63 Hz

***Opt 908** Rack-mount Kit for a Single Half-rack Unit 6023A, 6028A, (with blank filler panel); p/n 5062-3960 6010A–12B, 6015A; p/n 5062-3977

***Opt 909** Rack-mount Kit with Handles. For 6010A–12B, 6015A; p/n 5062-3983

Opt 910 Service Manual and extra Operating Manual

A line cord option must be specified for 6010A–12B, 6015A. See pages 48-51 for ordering information.

*Support rails required

ACCESSORIES

1494-0060 Rack Slide Kit

E3663AC Support rails for Agilent rack cabinets

Multiple-Output: 35 W and 50 W

E3620A Features:
Low noise, excellent regulation
Two isolated power supplies
Two digital meters
Linear power supply
10-turn potentiometer

E3630A Features:
Low noise,
excellent regulation
Auto-tracking
Two digital meters
Linear power supplies
Triple Outputs

E3620A, E3630A

E3620A, E3630A

These multiple output power supplies have 0.01% load and line regulation which keep the outputs steady with changes of the power line and load. This supply specifies both normal mode voltage noise and common mode current noise. The low normal mode noise specification of 350 µV rms assures clean power for precision circuitry, and the low common mode current specification of 1 µA rms minimizes line frequency current injection.

Both power supplies have separate digital panel meters to monitor both the voltage and current of any output simultaneously. An LED indicator for each output lets the user know when any supply is overloaded. All the outputs on these models are protected against overload and short-circuit damage. Protection circuits prevent output voltage overshoot when supply is turned on and off. + 6 V output of E3630A employs current foldback, all others are current limited.

E3630A

This general purpose power supply provides three outputs, one 0 to 6 V output to power logic or other circuitry and one 0 to +20 V and 0 to -20 V to power linear circuits. The 0 to +20 V and 0 to -20 V outputs track to within 1%. The 0 to -20 V output can be set to any value less than the 0 to +20 V output. One voltage control may be used to vary both simultaneously.

E3620A

This general purpose power supply provides two separate, independent and isolated power supplies in one small package. Each output has a ten turn potentiometer for fine adjustment. Convenient meter selection allows the user to read voltage and current of either output. Each output can deliver up to 25 watts.

SPECIFICATIONS

(at 0° to 55° C unless otherwise specified)

		E3620A	E3630A
Number of outputs		2	3
Output ratings			
Output 1		0 to 25 V, 0 to 1 A	0 to 6 V, 0 to 2.5 A*
Output 2		0 to 25 V, 0 to 1 A	0 to +20 V, 0 to 0.5 A
Output 3		-	0 to -20 V, 0 to 0.5 A
Power (max)		50 W	35 W
Load regulation		0.01% + 2mV	0.01% + 2mV
Ripple and noise	Normal mode voltage rms	350 µV	350 µV
(20 Hz to 20 MHz)	peak-to-peak	1.5 mV	1.5 mV
Common mode current		1 µArms	1 µArms
Control mode		CV/CL	CV/CL (±20V), CV/CF (6V)
Meter resolution	Voltage	10 mV (0-20V), 100 mV, (>20V)	10 mV
(minimum change using front-panel controls)	Current	1 mA	10 mA
Input power		115 Vac ± 10%, 47 to 63 Hz	115 Vac, ± 10%, 47 to 63 Hz
Size and Weight		213mm W x 91mm H x 401mm D (8.4 in x 3.6 in x 15.8 in) 5.5 kg (12.1 lbs)	213mm W x 92mm H x 320mm D (8.4 in x 3.6 in x 12.6 in) 3.8 kg (8.4 lbs)

*Derate max, output current from 2.5 A at 6 V to 1 A at 0 V

For off-the-shelf shipment

Ordering Information

(See tables for which options are available on specific models)
Opt 0E3 230 Vac ± 10 %, 47- to 63-Hz Input
Opt 0E9 100 Vac ± 10%, 47- to 63-Hz Input
For use in Japan.

59510A, 59511A

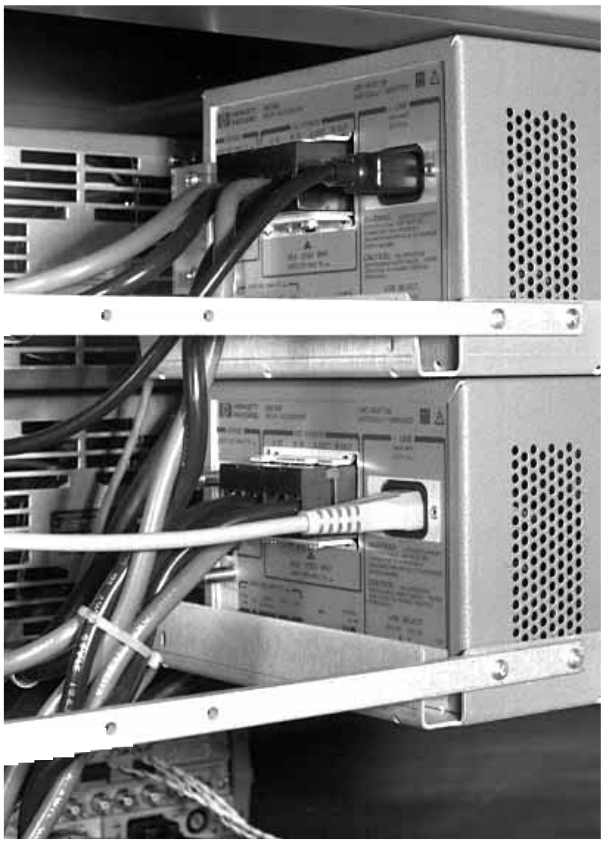
Relay Devices

Relay accessories to isolate load from dc output
Switch and sequence power and sense leads
dc output polarity reversal (59511A)

Agilent Technologies 59510A and 59511A are relay devices designed for control from 66xxA and 603xA power supplies. These power supply accessories can be configured to switch dc power to multiple test fixtures, or can be used to provide an extra measure of protection in the case of a fault condition where emergency shutdown is required. The 59511A has all the features of the 59510A, and also provides relays for polarity reversal. Each box switches one power supply output. They can be used with any dc power supply which falls within the voltage and current limits.

The internal microprocessor sequences the switching of power and sense leads. This protects the load by minimizing possible voltage overshoots. When used with Agilent system power supplies that have been configured appropriately, the relays can be controlled through the power supply GPIB port. For other applications, the 59510A and 59511A are controlled through a TTL port.

Both relay accessory models can be mounted on any one of three sides to a flat surface with the PEM fasteners provided. The Rack Mount Kit (Option 850) eases mounting behind the power supply or towards the front of the equipment rack.



Operating Ranges: 200 V at 20 A, 120 V at 30 A, or 48 V at 60 A
dc Floating Voltage: Input to output, 200 Vdc; input or output to ground, 500 Vdc; TTL control to ground, 240 Vdc
Settling Time (TTL control): Connect, 440 ms; disconnect, 160 ms; polarity reversal, 600 ms
dc Voltage Drop (at 60 A): 0.5 V maximum on each relay
ac Input: Can be set for 100, 120, 200, or 240 Vac (-13%, +6%) at 48 to 63 Hz
Weight:
59510A: Net, 2.3 kg (5 lb); shipping, 3.6 kg (8 lb); shipping with Opt 850, 4.1 kg (9 lb)
59511A: Net, 3.6 kg (8 lb); shipping, 5.0 kg (11 lb); shipping with Opt 850, 5.5 kg (12 lb)
Mounting Orientation: Within ±10∞ from vertical
Size: 185.4 mm W x 130.6 mm H x 198.6 mm D (7.26 in x 5.14 in x 7.81 in)

Ordering Information

59510A Output Isolation, Relay Accessory
59511A Output Isolation, Polarity Reversal Accessory

Options
Opt 850 Rack Mount Kit (side-by-side mounting of two units requires two kits)
Opt 910 Extra Operating and Service Manual

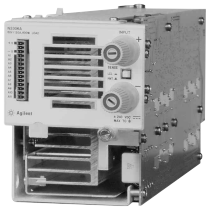
Not for use on 6680A, 6681A, 6682A, 6683A, 6684A, or 6035A.

The relay accessories can be mounted behind power supplies using the Option 850 Rack Mounting Kit.

The device can be orientated in any horizontal position on the tray. The orientation shown can be used in shallow racks which do not have space to run cables from the relay accessory towards the rear of the rack.

AGILENT dc ELECTRONIC LOADS

N3300A



Features for Increased Test Throughput:

Program load input values more than 10 times faster.

Load commands can be stored in the instrument, so they can be executed at maximum rate during runtime.

Triggers can be used to begin preloaded test routines without any computer interaction.

Multiple load modules can be simultaneously triggered to assume individual preprogrammed levels.

Measurement data can be buffered in the load, and read back to the computer in one array.

Rising and falling slew rates are separately controllable.

Features for Increased Measurement Accuracy & Flexibility

- Dual simultaneous voltage and current measurements
- RMS measurements
- Waveform digitization, which is especially valuable for transient response testing.
- Programmable sampling rate and sampling window

Other Key Features

- Constant current, constant voltage, and constant resistance operating modes
- Transient generator can provide one-time or repetitive pulses.
- GP-IB (IEEE-488.2) and RS-232 standard
- Industry standard SCPI programming commands
- Full control of all operating features from the front panel keypad
- Analog programming allows custom waveforms
- Analog monitoring port
- Parallel modules in constant current mode for more power
- Full protection from overcurrent, overvoltage, overtemperature, overpower, and reverse polarity.
- Remote voltage sense in constant voltage mode.
- Standard 3-year warranty
- Electronic calibration
- VXI *Plug&Play* drivers

These electronic loads have what is needed to test today's dc power supplies. The new N3300A family is optimized for power supply test in high volume manufacturing environments. These loads provide significant operating speed improvements, and also have many additional features that allow the system designer to further reduce test time. Maximize throughput of your product through your manufacturing facility, without increasing floorspace.

The N3300A Series of electronic loads contributes to lower system cost, reduced test system complexity, lower cost of ownership and support, less rack space, and less floor space. They provide measurement functions tailored for the testing of dc sources, which normally would only be achieved via additional equipment in a test system. Using these flexible built-in functions, many system designers will be able to reduce the usage of DMMs, oscilloscopes, and the connecting switches and cabling. A simpler more reliable system will result.

With increased accuracy and resolution, in both programming and measurement, these dc electronic loads provide the precision needed for testing today's dc sources.

Optimizing System Throughput

The N3300A Series electronic loads are Agilent Technologies' fastest electronic loads. In addition, there are many new features that will allow the system designer to further increase throughput.

Sequences of input settings can be downloaded to the load during system set-up. Then they can be repetitively accessed during run-time. The commands execute at maximum speed because there is no GP-IB interaction, and the commands are already decoded.

Measurement Flexibility

Measurement speed or measurement accuracy can be optimized for each application. Up to 4096 measurement samples can be taken and averaged to maximize accuracy and noise rejection. Or fewer samples can be taken for each measurement, and speed is enhanced.

Waveform digitization with minimum 10 microsecond sample rate can be accomplished by using the 4096 wide buffer.

All measurement features apply to both voltage and current, which are measured with dual simultaneous A/D's.

Since each module has its own built-in dmm and digitizer, all modules can be measured simultaneously. System speed is enhanced, because there is no wait for a multiplexer to switch a dmm or oscilloscope between inputs.

System or Manual Application

These Agilent electronic loads are suitable for use in large test systems, small-scale automated testing, and manual use from the front panel. The easy to read display can be used to monitor voltage, current, and power readings. Almost all programmable functions are available from the front panel. Four non-volatile storage states allow you to easily save settings for later recall. A complete 50-step list can be stored in each of these four storage states, along with the immediate settings. RS-232 is standard, in addition to GP-IB. RS-232 provides an easy way to set up a test with a desktop computer, without the need for a GP-IB interface card.

Mainframe Configuration

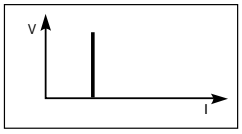
The Agilent N3300A mainframe has six slots. The 150 watt, 250 watt, and 300 watt modules require one slot each. The 500 watt and 600 watt modules require two slots each. Any combination of modules can be used, up to using the full six slots. The half-rack width mainframe, the Agilent N3301A, has two slots.

Operating Agilent Loads Below the Minimum Input Voltage Specification

Agilent electronic loads meet all specifications when operated above 3.0 V; however, the dc operating characteristics also extend below this minimum-input voltage for static tests. Because of the FET technology used in the power input circuits, these electronic loads have a low minimum- input resistance allowing them to sink high currents even at low voltages.

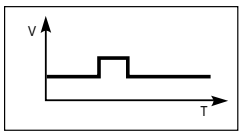
Figure A shows the operating range of a typical Agilent dc electronic load. Notice that low-voltage operation, down to zero volts, is possible at correspondingly-reduced current levels, depending on the minimum resistance of the load. These electronic loads, therefore, can be used in many applications that previously required zero-volt loads.

Constant Current



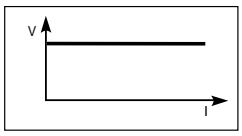
Power Supply Load Regulation Testing
Battery Capacity Testing
Capacitor Discharging

Pulse and Dynamic Loading



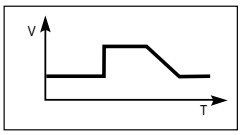
Power Supply Load Transient Response
Power Component Testing
Pulse Electroplating

Constant Voltage



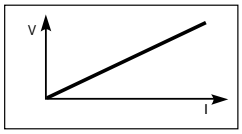
Current Source Testing
Current Limit Testing
Shunt Regulator

Separately Programmable Slew Rate



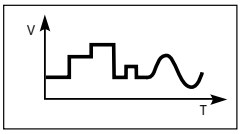
Power Supply Testing
Power Component Testing
Power Supply Load Transient Response

Constant Resistance



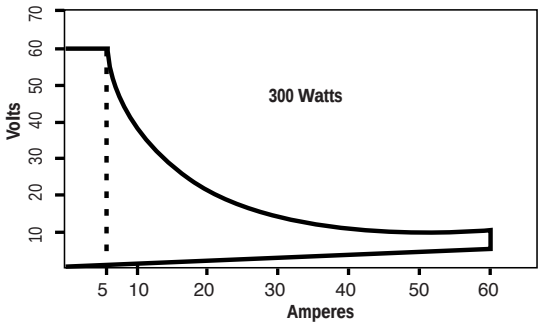
Characterizing Power Supply Crossover
Power Supply Start-Up Delay
Power Resistor Emulation

Analog Programming



Battery Capacity Testing
"Real-life" Load Simulation

Figure A



SPECIFICATIONS

(at 0˚ to 55˚ C unless otherwise specified)

		N3302A	N3303A	N3304A	N3305A	N3306A
Amperes		0 to 30 A	0 to 10 A	0 to 60 A	0 to 60 A	0 to 120 A
Volts		3 to 60 V	3 to 240 V	3 to 60 V	3 to 150 V	3 to 60 V
Maximum Power	(at 40˚C)	150 W	250 W	300 W	500 W	600 W
Constant Current Mode						
Low Range / High Range		3 A / 30 A	1 A / 10 A	6 A / 60 A	6 A / 60 A	12 A / 120 A
	Regulation	10mA	8mA	10mA	10mA	10mA
	Low Range Accuracy	0.1% + 5 mA	0.1% + 4 mA	0.1% + 7.5 mA	0.1% + 7.5 mA	0.1% + 15 mA
	High Range Accuracy	0.1% + 10 mA	0.1% + 7.5 mA	0.1% + 15 mA	0.1% + 15 mA	0.1% + 37.5 mA
Constant Voltage Mode	Low Range / High Range	6 V / 60 V	24 V / 240 V	6 V / 60 V	15 V / 150 V	6 V / 60 V
	Regulation	5 mV	10 mV	10 mV	10 mV	20 mV
	Low Range Accuracy	0.1% + 3 mV	0.1% + 10 mV	0.1% + 3 mV	0.1% + 10 mV	0.1% + 3 mV
	High Range Accuracy	0.1% + 8 mV	0.1% + 40 mV	0.1% + 8 mV	0.1% + 20 mV	0.1% + 8 mV
Constant Resistance Mode	Range 1	0-4 Ω	0-24 Ω	0-2 Ω	0-2.5 Ω	0-1 Ω
	Range 2	2-40 Ω	24-240 Ω	1-20 Ω	2.5-25 Ω	0.5-10 Ω
	Range 3	20-400 Ω	240-2400 Ω	10-200 Ω	25-250 Ω	5-100 Ω
	Range 4	200-4000 Ω	N/A	100-2000 Ω	250-2500 Ω	50-1000 Ω
Transient Generator	Frequency Range	0.25 Hz to10 kHz	0.25 Hz to10 kHz	0.25 Hz to10 kHz	0.25 Hz to10 kHz	0.25 Hz to10 kHz
	Accuracy	0.5%	0.5%	0.5%	0.5%	0.5%
Duty Cycle Range	0.25Hz to1kHz	3% to 97%	3% to 97%	3% to 97%	3% to 97%	3% to 97%
	1khz to 10kHz	6% to 94%	6% to 94%	6% to 94%	6% to 94%	6% to 94%
	Accuracy**	1%	1%	1%	1%	1%
Measurement Current Measurement	Low Range / High Range	3 A / 30 A	1 A / 10 A	6 A / 60 A	6 A / 60 A	12 A / 120 A
	Low Range Accuracy	0.05% + 3 mA	0.05% + 2.5 mA	0.05% + 5 mA	0.05% + 5 mA	0.05% + 10 mA
	High Range Accuracy	0.05% + 6 mA	0.05% + 5 mA	0.05% + 10 mA	0.05% + 10 mA	0.05% + 20 mA
Voltage Measurement	Low Range / High Range	6 V / 60 V	24 V / 240 V	6 V / 60 V	15 V / 150 V	6 V / 60 V
	Low Range Accuracy	0.05% + 3 mV	0.05% + 10 mV	0.05% + 3 mV	0.05% + 8 mV	0.05% + 3 mV
	High Range Accuracy	0.05% + 8 mV	0.05% + 20 mV	0.05% + 8 mV	0.05% + 16 mV	0.05% + 8 mV
Power Measurement	Accuracy	0.1% + 0.5 W	0.1% + 1.2 W	0.1% + 0.5 W	0.1% + 1.5 W	0.1% + 1.2 W

* Special modifications are available to change input voltage, current, and accuracy specifications. Please ask.

** Duty cycle accuracy is 1%. For example, if the setting is 40% duty cycle, the actual duty cycle would be in the range of 39%-41%.

Notes: 1. Operating temperature range is 0 to 55˚C. All specifications apply for 25˚C +/-5% unless otherwise noted
2. Maximum continuous power available is derated linearly from 40˚C to 75% of maximum at 55˚C.
3. DC Current Accuracy specifications apply 30 seconds after input is applied.

Supplemental Characteristics

		N3302A	N3303A	N3304A	N3305A	N3306A
Programming Resolution	Constant Current Mode	0.05mA/0.5mA	0.02mA/0.2mA	0.1 mA/1 mA	0.1mA /1 mA	0.2 mA/2 mA
	Constant Voltage Mode	0.1 mV/1 mV	0.4 mV/4 mV	0.1 mV/1 mV	0.25 mV/2.5 mV	0.1 mV/1 mV
	Constant Resistance Mode	0.07/0.7/7/70 m Ω	0.82/8.2/82 m Ω	0.035/0.35/3.5/35 m Ω	0.085/0.85/8.5/85 m Ω	0.0175/0.175/1.75/17.5 m Ω
Readback Resolution	Current	0.05 mA/0.5 mA	0.02 mA/0.2 mA	0.1 mA/1 mA	0.1 mA/1 mA	0.2 mA/2 mA
	Voltage	0.1 mV/1 mV	0.4 mV/4 mV	0.1 mV/1 mV	0.25 mV/2.5 mV	0.1 mV/1 mV
Programmable Slew Rate	Current	0.2 A/ms to	0.017 A/ms to	0.1 A/ms to	0.1 A/ms to	0.2 A/ms to
		2.5 A/µs	0.83 A/µs	5 A/µs	5 A/µs	10 A/µs
	Voltage	0.1 V/ms to	1 V/ms to	0.1 V/ms to	1 V/ms to	0.1 V/ms to
		0.5 V/µs	2 V/µs	0.5 V/µs	1.25 V/µs	0.5 V/µs
Ripple and Noise (20 Hz to 10 MHz)						
	Current	2 mA rms	1 mA rms	4 mA rms	4 mA rms	6 mA rms
		20 mA p-p	10 mA p-p	40 mA p-p	40 mA p-p	60 mA p-p
	Voltage	5 mV rms	12 mV rms	6 mV rms	10 mV rms	8 mV rms

Note: Specifications subject to change.

Supplemental Characteristics Continued

Analog Programming Bandwidth:
10 kHz (-3db frequency)
Analog Programming Voltage:
Voltage: 0-10V
Current: 0-10V
Analog Monitor Ports:
Voltage: 0-10V
Current: 0-10V
Remote Sensing:
5 V dc between sense and load input
Digital Inputs
Vil=0.9V max at Iil=-1mA
Vih-3.15V min (pull-up resistor on input)
Digital Outputs
Vol=0.72V max at Iol=1mA
Voh=4.4V min at Ioh=-20µA
Net Weight:
N3300A: 11.8kg (26lb); N3301A: 7.8kg (17lb)
N3302A, N3303A or N3304A: 3.2kg (7lb);
N3305A or N3306A: 5.4kg (13lb)
Shipping Weight:
N3300A: 15.9kg (35lb); N3301A: 9.8kg (22lb)
N3302A, N3303A, or N3304A: 4.5kg (10lb)
N3305A or N3306A: 7.3kg (16lb)

Option Descriptions

Opt. 800: Rack-mount kit for two N3301A Mainframes mounted side-by-side (p/n 5061-9694 and 5063-9215).
Opt. 908: Rack-mount kit (p/n 5063-9212 for a N3300A, and p/n 5063-9245 for a N3301A)
Opt. 909: Rack-mount handles for N3300A (p/n 5062-3984)
Opt. 910: Extra manual set, including one each of the operating manual, programming reference manual, and service manual. The programming manual is available with the mainframes, and therefore not the modules.

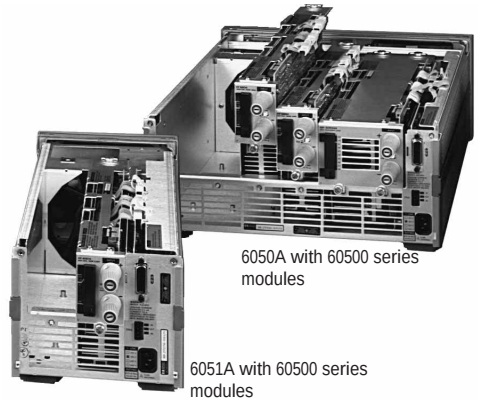
Note: Options 908, 909, and 800 require either the slide kit (p/n 1494-0059) or slide rails to support the weight of the load mainframe.

Accessory
p/n 34398A RS-232 Cable
p/n 5061-9694 Lock link Kit

AGILENT dc ELECTRONIC LOADS

- GPIB control of current, voltage, and resistance
- GPIB readback of current, voltage, and power
- Built-in pulse waveform generation with programmable amplitude, frequency, duty cycle, and slew rate
- Continuous and pulse modes
- Full protection from overcurrent, overvoltage, overpower, overtemperature, and reverse polarity
- Electronic calibration
- Trigger for external synchronization
- Analog voltage control in constant current mode
- Parallel units in constant current mode for higher power
- Remote voltage sense in constant voltage mode
- Loads available for up to 240 V
- Standard three-year warranty
- VXI*plug&play* drivers

6060B and 6063B



6050A with 60500 series modules

6051A with 60500 series modules

Agilent dc Electronic Loads

Agilent dc electronic loads are ideal for the test and evaluation of dc power sources and power components and are well-suited for applications in areas such as manufacturing, research and development, and incoming inspection.

The Agilent One-Box Solution

Agilent single-input loads and load mainframes are equipped with standard GPIB interfaces. This built-in IEEE-488 interface allows complete control of all load functions as well as readback of input voltage, current, power, and detailed operating status. Each stand alone load or load module also includes programming inputs that allow control of load current via an analog voltage. Other system features contributing to the one-box solution concept are internal voltage and current monitors and an internal transient generator with programmable amplitudes, frequency, duty cycle, and slew rate. The one-box solution saves space, cost, and time while making these dc electronic loads easy to integrate into automated test systems.

Agilent dc electronic loads are optimized to address a broad range of dynamic loading applications. They are specifically designed for stability in applications where fast transients are applied to the load inputs, such as during dc power supply startup characterization or transient response testing. Dynamic load performance can be further tailored to specific application needs with the programmable slew rate feature.

Fully-Compatible Operation

These dc electronic loads respond to instructions from the industry-standard SCPI command set. Moreover, the features of these dc electronic loads are fully compatible with one another. For example, test programs developed for 6060B 300 W single-input electronic load or 60502B 300 W single-input load module are interchangeable.

The dc electronic load family is also fully compatible with the 59510A relay accessory (see page 33). The 59510A provides physical isolation of the dc electronic load from the device under test or any other test instrument by switching power and sense leads. Capable of switching up to 60 A and 200 Vdc, the 59510A can be controlled by rear-panel signals on the electronic load.

Battery Testing

The 6050A Option J10, 6051A Option J10 and 6060B Option J10 electronic loads are modified for battery testing. These products provide tri-level pulse loading, to simulate accurate conditions on batteries. They also feature a programmable minimum battery voltage threshold (measured at load terminal). If the voltage of the battery under test falls below this threshold, the load will automatically turn off.

System or Manual Applications

Agilent dc electronic loads are equally suitable for manual use on the bench. The front-panel LCD meters indicate voltage, current, and power readings. The full-function front-panel keypad allows easy, repeatable, and reliable control of the load when it is used manually. Six volatile user-definable states allow you to easily save settings for later recall. An additional user-definable power-up state allows you to define settings that are remembered when the unit is switched off and then recalled when it is switched on again.

Specifying System Performance

Because Agilent electronic loads feature an integrated GPIB programmer, pulse generator, current shunt, DMM, and cabling, their performance is specified as a system. Specifications cover all the integrated functions as one unit, which eliminates the need to calculate the actual performance of the automated test system based on each component's specification. The one-box solution makes the integration and documentation of your test system fast and easy.

Single-Input Products

The 6060B and 6063B are single-input loads with standard rear-panel inputs. They are also available with optional front-panel inputs in addition to the rear-panel inputs. Front-panel inputs (Option 020) make input connections to the electronic load convenient for bench applications. These front-panel terminals are capable of handling the entire current rating of the load and can accept wire gauges up to AWG#4 (22 mm^2). They require no tools to tighten, making the connections quick and easy.

Mainframe Products

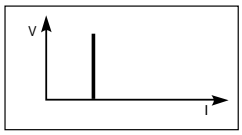
The 6050A 1,800-W and 6051A 600-W electronic load mainframes accept the user-installable load modules for easy system configuration and future reconfiguration, if desired. The 6050A holds up to six 60501B, 60502B, and 60503B load modules, or three 60504B and 60507B load modules, allowing up to 1,800 W of total maximum power. The 6051A holds up to two 60501B, 60502B, 60503B modules, or one 60504B or 60507B module allowing up to 600 W of total maximum power. One GPIB address is all you need for complete control and readback of all load modules within a single mainframe.

Operating Agilent Loads Below the Minimum Input Voltage Specification

Agilent electronic loads meet all specifications when operated above 3.0 V; however, the dc operating characteristics also extend below this minimum-input voltage for static tests. Because of the FET technology used in the power input circuits, these electronic loads have a low minimum- input resistance allowing them to sink high currents even at low voltages.

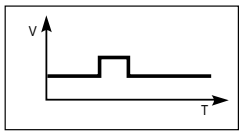
Figure A shows the operating range of a typical Agilent dc electronic load. Notice that low-voltage operation, down to zero volts, is possible at correspondingly-reduced current levels, depending on the minimum resistance of the load. These electronic loads, therefore, can be used in many applications that previously required zero-volt loads.

Constant Current



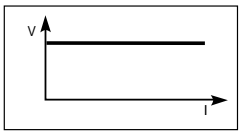
Power Supply Load Regulation Testing
Battery Capacity Testing
Capacitor Discharging

Pulse and Dynamic Loading



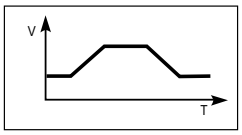
Power Supply Load Transient Response
Power Component Testing
Pulse Electroplating

Constant Voltage



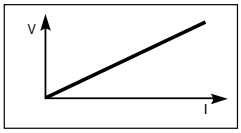
Current Source Testing
Current Limit Testing
Shunt Regulator

Programmable Slew Rate



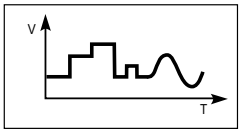
Power Supply Testing
Power Component Testing
Power Supply Load Transient Response

Constant Resistance



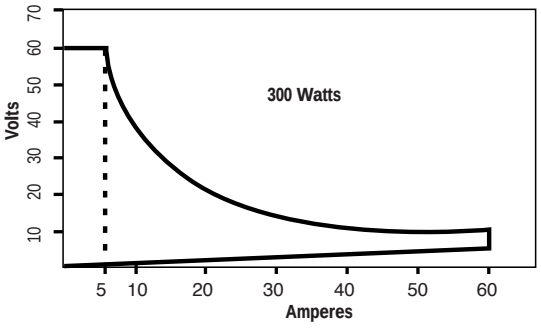
Characterizing Power Supply Crossover
Power Supply Start-Up Delay
Power Resistor Emulation

Analog Programming



Battery Capacity Testing
"Real-life" Load Simulation

Figure A



SPECIFICATIONS

	6060B, 60502B	6063B, 60503B	60501B	60504B	60507B
Amperes	0 to 60 A	0 to 10 A	0 to 30 A	0 to 120 A	0 to 60 A
Volts	3 to 60 V	3 to 240 V	3 to 60 V	3 to 60 V	3 to 150 V
Maximum power (at 40˚ C)	300 W	250 W	150 W	600 W	500 W
Constant current mode					
Ranges	0 to 6 A, 0 to 60 A	0 to 1 A, 0 to 10 A	0 to 3 A, 0 to 30 A	0 to 12 A, 0 to 120 A	0 to 6 A, 0 to 60 A
Accuracy	0.1% ±75 mA	0.15% ±10 mA	0.1% ±40 mA	0.12% ±130 mA	0.1% ±80 mA
Regulation	10 mA	8 mA	10 mA	10 mA	10 mA (w/ ≥3 V at the point)
Constant voltage mode					
Accuracy	0.1% ±50 mV	0.12% ±120 mV	0.1% ±50 mV	0.1% ±50 mV	0.1% ±125 mV
Regulation (w/remote sense)	10 mV	10 mV	5 mV	20 mV	10 mV
Constant resistance mode	0.033 to 1.0 Ω	0.20 to 24.0 Ω	0.067 to 2 Ω	0.017 to 0.5 Ω	0.033 to 2.5 Ω
Ranges	1 to 1,000 Ω 10 to 10,000 Ω	24 to 10,000 Ω 240 to 50,000 Ω	2 to 2,000 Ω 20 to 10,000 Ω	0.5 to 500 Ω 5 to 5,000 Ω	2.5 to 2,500 Ω 25 to 10,000 Ω
Accuracy	1 Ω: 0.8% ±8 mΩ (with ≥6 A at input) 1 KΩ: 0.3% ±8 mS (with ≥6 V at input) 10 KΩ: 0.3% ±8 mS (with ≥6 V at input)	24 Ω: 0.8% ±200 mΩ (with ≥1 A at input) 10 KΩ: 0.3% ±0.3 mS (with ≥24 V at input) 50 KΩ: 0.3% ±0.3 mS (with ≥24 V at input)	2 Ω: 0.8%, ±16 mΩ (with ≥3 A at input) 2 KΩ: 0.3% ±5 mS (with ≥6 V at input) 10 KΩ: 0.3% ±5 mS (with ≥6 V at input)	0.5 Ω: 0.8% ±5 mΩ (with ≥12 A at input) 500 Ω: 0.3% ±18 mS (with ≥6 V at input) 5 KΩ: 0.3% ±18 mS (with ≥6 V at input)	2.5 Ω: 0.8% ±16 mΩ (with ≥6 A at input) 2.5 KΩ: 0.3% ±5 mS (with ≥15 V at input) 10 KΩ: 0.3% ±5 mS (with ≥15 V at input)
Transient generator					
Frequency range	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz
Accuracy	3%	3%	3%	3%	3%
Duty cycle range	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)
Accuracy	6% of setting ±2%	6% of setting ±2%	6% of setting ±2%	6% of setting ±2%	6% of setting ±2%
Current level high range	60-A range:	10-A range:	30-A range:	120-A range:	60-A range:
Accuracy	0.1% ±350 mA	0.18% ±50 mA	0.1% ±200 mA	0.15% ±700 mA	0.1% ±350 mA
Current level low range	6-A range:	1-A range:	3-A range:	12-A range:	6-A range:
Accuracy	0.1% ±80 mA	0.18% ±13 mA	0.1% ±40 mA	0.15% ±160 mA	0.1% ±85 mA
Voltage level	3 to 60 V	3 to 240 V	3 to 60 V	3 to 60 V	3 to 150 V
Voltage level accuracy	0.1% ±300 mV	0.15% ±1.1 V	0.1% ±300 mV	0.15% ±300 mV	0.15% ±750 mV
Readback specifications					
Current readback accuracy	0.05% ±65 mA	0.12% ±10 mA	0.06% ±40 mA	0.1% ±110 mA	0.1% ±65 mA
Voltage readback accuracy	±(0.05% + 45 mV)	±(0.1% + 150 mV)	±(0.5% + 45 mV)	±(0.1% + 45 mV)	±(0.17% + 90 mV)
Ripple and noise					
(20-Hz to 10-MHz noise)	4 mA rms	1 mA rms	2 mA rms	6 mA rms	4 mA rms
Current	40 mA peak-to-peak	10 mA peak-to-peak	20 mA peak-to-peak	60 mA peak-to-peak	40 mA peak-to-peak
Voltage	6 mV rms	6 mV rms	5 mV rms	8 mV rms	10 mV rms
Supplemental Characteristics	(Non-warranted characteristics determined by design that are useful in applying the product)				
Constant current mode	60-A range: 16 mA	10-A range: 2.6 mA	30-A range: 8 mA	120-A range: 32 mA	60-A range: 16 mA
Resolution	6-A range: 1.6 mA	1-A range: 0.26 mA	3-A range: 0.8 mA	12-A range: 3.2 mA	6-A range: 1.6 mA
Temperature coefficient	100 ppm/˚C ±5 mA/˚C	150 ppm/˚C ±1 mA/˚C	100 ppm/˚C ±3 mA/˚C	120 ppm/˚C ±8 mA/˚C	120 ppm/˚C ±5 mA/˚C
Constant voltage mode					
Resolution	16 mV	64 mV	16 mV	16 mV	40 mV
Temperature coefficient	100 ppm/˚C ±5 mV/˚C	120 ppm/˚C ±10 mV/˚C	100 ppm/˚C ±5 mV/˚C	100 ppm/˚C ±5 mV/˚C	100 ppm/˚C ±5 mV/˚C
Constant resistance mode	1 Ω: 0.27 mΩ	24 Ω: 6 mΩ	2 Ω: 0.54 mΩ	0.5 Ω: 0.14 mΩ	2.5 Ω: 0.67 mΩ
Resolution	1 KΩ: 0.27 mS 10 KΩ: 0.027 mS	10 KΩ: 0.011 mS 50 KΩ: 0.001 mS	2 KΩ: 0.14 mS 10 KΩ: 0.014 mS	500 Ω: 0.54 mS 5 KΩ: 0.054 mS	2.5 KΩ: 0.10 mS 10 KΩ: 0.01 mS
Temperature coefficient	1 Ω: 800 ppm/˚C ±0.4 mΩ/˚C 1 KΩ: 300 ppm/˚C ±0.6 mS/˚C 10 KΩ: 300 ppm/˚C ±0.6 mS/˚C	24 Ω: 800 ppm/˚C ±10 mΩ/˚C 10 KΩ: 300 ppm/˚C ±0.03 mS/˚C 50 KΩ: 300 ppm/˚C ±0.03 mS/˚C	2 Ω: 800 ppm/˚C ±0.8 mΩ/˚C 2 KΩ: 300 ppm/˚C ±0.5 mS/˚C 10 KΩ: 300 ppm/˚C ±0.5 mS/˚C	0.5 Ω: 800 ppm/˚C ±0.2 mΩ/˚C 500 Ω: 300 ppm/˚C ±1.2 mS/˚C 5 KΩ: 300 ppm/˚C ±1.2 mS/˚C	2.5 Ω: 800 ppm/˚C ±0.8 mΩ/˚C 2.5 KΩ: 300 ppm/˚C ±0.3 mS/˚C 10 KΩ: 300 ppm/˚C ±0.3 mS/˚C
Transient generator					
Frequency range	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz
Resolution	4% or less	4% or less	4% or less	4% or less	4% or less
Duty cycle range	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)
Resolution	4%	4%	4%	4%	4%
Current level high range	60-A range:	10-A range:	30-A range:	120-A range:	60-A range:
Resolution	260 mA	43 mA	130 mA	520 mA	260 mA
Current level low range	6-A range:	1-A range:	3-A range:	12-A range:	6-A range:
Resolution	26 mA	4 mA	13 mA	52 mA	26 mA
Current temperature coefficient	100 ppm/˚C ±7 mA/˚C	180 ppm/˚C ±1.2 mA/˚C	100 ppm/˚C ±5 mA/˚C	150 ppm/˚C ±10 mA/˚C	150 ppm/˚C ±5 mA/˚C
Voltage level resolution	260 mV	1 V	260 mV	260 mV	650 mV
Voltage temperature coefficient	150 ppm/˚C ±5 mV/˚C	120 ppm/˚C ±10 mV/˚C	150 ppm/˚C ±5 mV/˚C	150 ppm/˚C ±5 mV/˚C	150 ppm/˚C ±5 mV/˚C
Programmable slew rate	60-A range: 1 A/ms to 5 A/µs 6-A range: 0.1 A/ms to 0.5 A/µs	10-A range: 0.17 A/ms to 0.83 A/µs 1-A range: 17 A/ms to 83 A/ms	30-A range: 0.5 A/ms to 2.5 A/µs 3-A range: 0.2 A/ms to 0.25 A/µs	120-A range: 2 A/ms to 10 A/µs 12-A range: 0.2 A/ms to 1 A/µs	60-A range: 1 A/ms to 5 A/µs 6-A range: 0.1 A/ms to 0.5 A/µs
Rise/fall time	12 µs to 8 ms	16 µs to 8 ms	12 µs to 8 ms	12 µs to 8 ms	18 µs to 8 ms

Supplemental Characteristics (cont'd)

	6060B, 60502B	6063B, 60503B	60501B	60504B	60507B
Analog programming bandwidth	10 kHz (–3 dB frequency)	10 kHz (–3 dB frequency)	10 kHz (–3 dB frequency)	10 kHz (–3 dB frequency)	10 kHz (–3 dB frequency)
Analog programming accuracy					
Current (low range)	4.5% ±75 mA	3% ±8 mA	4.5% ±40 mA	4% ±200 mA	4.5% ±75 mA
Current (high range)	4.5% ±250 mA	3% ±20 mA	4.5% ±130 mA	4% ±400 mA	4.5% ±200 mA
Temperature coefficient	100 ppm/˚C ±6 mA/˚C	150 ppm/˚C ±1 mA/˚C	100 ppm/˚C ±3 mA/˚C	100 ppm/˚C ±12 mA/˚C	150 ppm/˚C ±6 mA/˚C
Voltage	0.8% ±200 mV	0.5% ±150 mV	0.8% ±200 mV	0.8% ±200 mV	0.8% ±375 mV
Temperature coefficient	100 ppm/˚C ±1 mV/˚C	120 ppm/˚C ±10 mV/˚C	100 ppm/˚C ±1 mV/˚C	100 ppm/˚C ±1 mV/˚C	120 ppm/˚C ±12.5 mV/˚C
Analog programming voltage	0 to 10 V	0 to 10 V	0 to 10 V	0 to 10 V	0 to 10 V
Readback specifications	17 mA (via HP-IB)	2.7 mA (via HP-IB)	9 mA (via HP-IB)	34 mA (via HP-IB)	17 mA (via HP-IB)
Current readback resolution	20 mA (front panel)	10 mA (front panel)	10 mA (front panel)	100 mA (front panel)	20 mA (front panel)
Temperature coefficient	50 ppm/˚C ±5 mA/˚C	100 ppm/˚C ±1 mA/˚C	65 ppm/˚C ±3 mA/˚C	100 ppm/˚C ±8 mA/˚C	100 ppm/˚C ±5 mA/˚C
Voltage readback resolution	17 mV (via HP-IB) 20 mV (front panel)	67 mV (via HP-IB) 100 mV (front panel)	17 mV (via HP-IB) 20 mV (front panel)	20 mV (via HP-IB) 20 mV (front panel)	40 mV (via HP-IB) 100 mV (front panel)
Temperature coefficient	50 ppm/˚C ±1.2 mV/˚C	100 ppm/˚C ±8 mV/˚C	50 ppm/˚C ±1.2 mV/˚C	100 ppm/˚C ±2 mV/˚C	100 ppm/˚C ±5 mV/˚C
Analog monitor accuracy					
Current monitor (0 to 10 V out)	4% ±85 mA	3% ±10 mA	4% ±40 mA	4% ±170 mA	3% ±85 mA
Temperature coefficient	50 ppm/˚C ±6 mA/˚C	100 ppm/˚C ±1 mA/˚C	60 ppm/˚C ±3 mA/˚C	100 ppm/˚C ±10 mA/˚C	100 ppm/˚C ±6 mA/˚C
Voltage monitor (0 to 10 V out)	0.25% ±40 mV	0.4% ±240 mV	0.25% ±40 mV	0.4% ±60 mV	0.4% ±120 mV
Temperature coefficient	50 ppm/˚C ±0.2 mV/˚C	70 ppm/˚C ±1.2 mV/˚C	50 ppm/˚C ±0.2 mV/˚C	100 ppm/˚C ±2 mV/˚C	100 ppm/˚C ±5 mV/˚C
Remote sensing	5-Vdc maximum between sense and load input				
Minimum operating voltage (at full rated current)	2 volts (1.2 V typical)	2 volts (1.2 V typical)	2 volts (1.2 V typical)	2 volts (1.4 V typical)	2 volts (1.4 V typical)
Programmable short	0.033 Ω (0.020 Ω typical)	0.20 Ω (0.10 Ω typical)	0.066 Ω (0.040 Ω typical)	0.017 Ω (0.012 Ω typical)	0.033 Ω (0.025 Ω typical)
Programmable open (typical)	20 kΩ	80 kΩ	20 kΩ	20 kΩ	20 kΩ
Drift (over 8-hour interval)					
Current	0.03% ±10 mA	0.03% ±15 mA	0.03% ±5 mA	0.03% ±20 mA	0.03% ±10 mA
Voltage	0.01% ±10 mV	0.01% ±20 mV	0.01% ±10 mV	0.01% ±10 mV	0.01% ±25 mV
dc isolation voltage	±240 Vdc, between any input and chassis ground				
Digital inputs	V_{IL} = 0.9 V max at I_{IL} = –1 mA / V_{IH} = 3.15 V min (pull-up resistor on input)				
Digital outputs	V_{OL} = 0.72 V max at I_{OL} = 1 mA / V_{OH} = 4.4 V min at I_{OH} = –20 µA				
Net weight (approx.)	6060B: 6.12 kg (13.5 lb) 60502B: 3.2 kg (7 lb)	6063B: 6.12 kg (13.5 lb) 60503B: 3.2 kg (7 lb)	3.2 kg (7 lb)	5.4 kg (13 lb)	5.4 kg (13 lb)
Shipping weight	6060B: 8.16 kg (18 lb) 60502B: 4.5 kg (10 lb)	6063B: 8.16 kg (18 lb) 60503B: 4.5 kg (10 lb)	4.5 kg (10 lb)	7.3 kg (16 lb)	7.3 kg (16 lb)

Notes: 1. Operating temperature range is 0˚ to 55˚ C. All specifications apply for 25˚ C ±5˚ C, except as noted.
2. Maximum continuous power available is derated linearly from 40˚ C to 75% of maximum at 55˚ C.
3. DC current accuracy specifications apply 30 seconds after input is applied.

Net Weight: 6050A: 9.5 kg (21 lb); 6051A: 5.5 kg (12 lb)
Shipping Weight: 6050A: 13.6 kg (30 lb); 6051A: 7.5 kg (17 lb)
Size:
6050A: 425.5 mm W x 177 mm H x 624.7 mm D (16.75 in x 7 in x 24.6 in)
6051A: 213 mm W x 177 mm H x 624.7 mm D (8.4 in x 7 in x 24.6 in)
6060B, 6063B: 425.5 mm W x 88.1 mm H x 396 mm D (16.75 in x 3.5 in x 13.7 in).

See pages 49 and 50 for dimension drawings

GPIB Interface Capabilities

The following GPIB functions are implemented: SH1, AH1, L4, SR1, DC1, DT1, and RL1

Regulatory Compliance: Listed to UL 1244; certified to CSA556B; conforms to IEC 61010-1. See page 69 for more information.

Option Descriptions

Opt 020 Front-Panel Inputs (for 6060B and 6063B only)
Opt 100 87 to 106 Vac, 47 to 66 Hz input (for Japan only)
Opt 220 191 to 233 Vac, 47 to 66 Hz input
Opt 240 209 to 250 Vac, 47 to 66 Hz input
* **Opt 800** Rack-mount Kit for two units (for 6051A) mounted side-by-side (p/n 5061-9694 and 5063-9215)
* **Opt 908** Rack-mount Kit (p/n 5063-9215 with 6050A, p/n 5063-9245 with 6051A, and p/n 5063-9212 with 6060B and 6063B)
* **Opt 909** Rack-mount Kit with Handles (p/n 5063-9222 when mounting 6050A and p/n 5063-9219 when mounting 6060B and 6063B)
Opt 910 Extra manual set, including one each of the operating manual, programming reference manual, and service manual. The programming manual is available with the mainframe, and therefore not with individual modules.

*** Options 908 and 909 for the 6050A, and Options 800 and 908 for the 6051A, require either the slide kit (p/n 1494-0059) or support rails (p/n E3663AC) to support the weight of the load mainframe.**

375 VA - 4800 VA

Ready to use “one-box” ac power source/analyzer
ac mains design verification system for sourcing and measuring
Capable of compliance-grade regulatory tests
High peak current capability
Programmable output impedence*
Graphical user interface software
Three year warranty
Built-in GPIB and RS232 interfaces (SCPI programming)
VXI *plug&play* drivers, HP VEE, NI LabView
Built-in harmonic analysis capability
400 Hz power disturbances (115 Vrms, 28 Vdc*, 270 Vdc*)
RTCA-D0160/Mil-std 704 testing capability
2 measurement ranges (increases sensitivity by 10:1)
26 Vrms/0.1 A auxiliary output (optional) for Avionics
Dual power analyzer (optional) for UPS Testing
Built-in PIP E9012 compatability mode
*6811B, 6812B, 6813B only

(Top) 6811B, 6812B, 6813B
(Bottom) 6814B, 6834B

Total ac power solutions

Whether you’re in a design lab, on the manufacturing floor, or in a test lab, the 6800 series ac power solution is the right fit for your ac power needs.

The 6800 series are “one-box” solutions that are embedded with virtual programmable instruments (function generator, dc power supply, digitizing oscilloscope/waveform generator, power analyzer, flickermeter, and more!) that help you reduce time spent on getting your instruments and tools together and give you more time to perform your tests. The functionality of these instruments is accessible right from the front panel – just add a PC and our free ac source graphical user interface (GUI) and it gets even easier.

6811B: 300 Vrms, 375 VA; Single phase model; panel height: 5.25"
6812B: 300 Vrms, 750 VA; Single phase model; panel height: 5.25"
6813B: 300 Vrms, 1750 VA: Single phase model; panel height: 5.25"
6814B: 300 Vrms, 3000 VA; Single-phase model; panel height: 10.5"
6834B: 300 Vrms, 4500 VAtotal; Single/three phase model; panel height: 10.5"

Predictability

The environment around is constantly changing – requirements change, products change – you want your instruments to accommodate those changes but perform predictably. The speed and ease of programming these instruments facilitate the changing requirements you face, but the quality and design of our products give you the repeatability and reliability that keeps you in business.

ac Power Solutions (cont'd)

Key Features

Sine, square, and up to 12 user-defined waveforms
Programmable voltage, current limit, frequency, phase, and distortion (clipped sinewave)
Programmable dc output (6811B, 6812B, 6813B)
Programmable output impedance (6811B, 6812B, 6813B)
Voltage and frequency slew control
Power line disturbance simulation (sag, surge, dropout, clipping, and event programming)
Independent phase control (6834B only)
Measurement of rms voltage, rms current, peak current, neutral current (6834B), frequency, phase, real power, reactive power, apparent power, total 3 phase power (6834B), and power factor
Harmonic analysis of voltage and current with magnitude and phase results up to the 50th harmonic
THD measurement of voltage and current
Over-current, over-voltage, over-power, over-temperature, and RI/DFI protection
Built-in output isolation relays
Sixteen non-volatile store and recall states
User-definable power-on state
Self-test at power up
HP VEE support, NI LabView drivers
Electronic calibration via the GPIB bus or front panel

When your customers demand more, are you ready to deliver?

From avionics to electronic ballast to uninterruptible power supplies, customers are demanding products that can use power efficiently while handling all kinds of ac line disturbances. To make sure your products meet these growing expectations, test them with the 6800 series. It's easy to simulate either clean or distorted ac power to evaluate how your products respond.

All the tools you need for ac product testing

These "one-box" solutions provide everything you need to generate, measure and analyze ac power. Use the built-in sine, clipped sine and square waves or create your own with the arbitrary waveform generator. Three transient modes (step, pulse and list with up to 100 sequenced output changes) simulate surges, sags, brownouts and other power quality problems. The 6811B, 6812B, and 6813B also include dc capability.

The built-in 16-bit power meter/analyzer precisely measures all important parameters, including rms voltage, peak and rms current, inrush currents, frequency, phase, real and apparent power, and power factor. You can analyze harmonic distortion up to the 50th harmonic with both magnitude and phase results.

The 14760A series Regulatory Test Solution software modules give you compliance grade testing capabilities at a real attractive price for any phase of product design. Designing a product to comply to the regulations is an integral way of ensuring that it doesn't become an end-of-the-line hurdle. The advanced diagnostic capabilities can give you a jump-start on any necessary design changes. Ultimately, you can save time and money by performing your own compliance tests whenever you need.

Easy ATE integration

More and more engineers are choosing the 6800 series because it's easy to operate from the front panel and easy to program. Even creating a sequenced transient is as simple as entering values in a list. Both GPIB and RS232 ports are standard, and Standard Commands for Programmable Instruments (SCPI) and VXI *plug&play* drivers simplify the programming task.

Extensive protection to prevent load damage

In addition to overcurrent, overvoltage, overpower and overtemperature protection, the 6800 series offers output disconnect relays and remote inhibit capability (quickly disabling the output of the ac source via a TTL signal) to protect the device under test.

The 6800 series is backed by a three-year warranty and Agilent's worldwide network of support and service centers.

Application info

The 6800 series can help you test and improve your products. You can easily perform:

1. Static testing–generating and measuring voltage, frequency, and line current for meeting worldwide specifications.
2. Dynamic testing– generating ac line transients for limit testing and design verification.
3. Specialty testing–measuring current harmonic content and creating custom ac power waveforms (such as a combined ac + dc signal to simulate a telephone ring).
4. Regulatory testing–measuring current harmonics, voltage fluctuations and flicker emissions and generating voltage and frequency disturbances and interharmonics to determine product immunity.

Development engineers and test professionals in a wide variety of industries use ac power source/analyzers. Here are a few examples:

Avionics
Instrumentation
ATE test stations

Computer products
Computers
Monitors
Peripherals

Consumer Products
Home appliances
Audio and video equipment
Heating/cooling controls

Electrical Products
Relays
Transformers
Power components
Fire alarms

Lighting products
Electronic ballasts
Compact flourescent bulbs
Timers

Motors
ac motors
Electronic controllers

Power Products
ac/dc adapters
ac/dc power supplies
PBX power supplies
Uninterruptible power supplies

Telecom Products
RF amplifiers
CATV devices
MUX's, routers, switches

ac Power Solutions (cont'd)

SPECIFICATIONS

(per phase for a sine wave with a resistive load at 0º to 40º C, within an output frequency range of 45 Hz to 1000Hz, and in ac coupled mode after a 30 minute warm-up unless otherwise noted. Note: For 6814B and 6834B output voltage must be at least 50% of range.)[1]

		6811B	6812B	6813B	6814B	6834B
Number of phases		1	1	1	1	1/3
Output ratings (Maximum)	Power	375 VA	750 VA	1750 VA	3000 VA	4500 VA/1500 VA
	rms voltage	300 V	300 V	300 V	300 V (high range) 150 V (low range)	300 V (high range) 150 V (low range)
	rms current	3.25 A	6.5 A	13 A	[2]10 A (300 V range) [2]20 A (150 V range)	[2]15 A/5 A (300 V range) [2]30 A/10 A (150 V range)
	Repetitive & non-repetitive peak current	40 A	40 A	80 A	40 A (300 V range) 80 A (150 V range)	60 A/20A (300 V range) 120 A/40 A (150 V range)
	Crest factor	12	6	6	4	4
	Load Power factor capability	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1
	dc power	285 W	575 W	1350 W	N/A	N/A
	dc voltage	±425 V	±425 V	±425 V	N/A	N/A
	dc current	2.5 A	5.0 A	10.0 A	N/A	N/A
Output frequency range		dc; 45 Hz to 1 kHz	dc; 45 Hz to 1 kHz	dc; 45 Hz to 1 kHz	45 Hz to 5 kHz	45 Hz to 5 kHz
Constant voltage ripple and noise	(20 kHz to 10 MHz)	-60 dB (relative to full scale)	-60 dB (relative to full scale)	-60 dB (relative to full scale)	-60 dB (relative to full scale)	-60 dB (relative to full scale)
Line regulation	(% of full scale)	0.1%	0.1%	0.1%	0.1%	0.1%
Load regulation	(% of full scale)	0.5%	0.5%	0.5%	0.5%	0.5%
Maximum total harmonic distortion		0.25% at 50/60 Hz 1% worst case 45 to 1 kHz	0.25% at 50/60 Hz 1% worst case 45 to 1 kHz	0.25% at 50/60 Hz 1% worst case 45 to 1 kHz	1% (45-1000 Hz) 1% + 1%/kHz (>1 kHz - 5 kHz)	1% (45-1000 Hz) 1% + 1%/kHz (>1 kHz - 5 kHz)

SPECIFICATIONS (CONTINUED)

(per phase for a sine wave with a resistive load at 0º to 40º C, within an output frequency range of 45 Hz to 1000Hz, and in ac coupled mode after a 30 minute warm-up unless otherwise noted. Note: For 6814B and 6834B output voltage must be at least 50% of range.)[1]

	6811B	6812B	6813B	6814B	6834B
Programming accuracy (25°± 5° C)					
Number of Phases	1	1	1	1	1/3
RMS Voltage (% of output + offset)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 1000 Hz)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 1000 Hz)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 1000 Hz)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 5000 Hz)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 5000 Hz)
DC voltage	0.1% + 0.5 V	0.1% + 0.5 V	0.5% + 0.3 V	N/A	N/A
Frequency	0.01% + 10µHz	0.01% + 10µHz	0.01% + 10µHz	0.01% + 10µHz	0.01% + 10µHz
3 Phase Mode (6834B only)	N/A	N/A	N/A	N/A	0.1° (45 - 100 Hz) 1° (>100 - 1kHz) 1° + 1°/ kHz (>1 kHz - 5kHz)

For a complete list of specifications for Agilent's ac power solutions, please see the operating manual on our web site at http:// www.agilent.com/find/manuals

ac Power Solutions (cont'd)

SPECIFICATIONS (CONTINUED)

(per phase for a sine wave with a resistive load at 0º to 40º C, within an output frequency range of 45 Hz to 1000Hz, and in ac coupled mode after a 30 minute warm-up unless otherwise noted. Note: For 6814B and 6834B output voltage must be at least 50% of range.)[1]

	6811B	6812B	6813B	6814B	6834B
Measurement accuracy (25˚± 5˚ C)					
Rms. voltage (45 - 100 Hz)	0.03% + 100 mV[3]	0.03% + 100 mV[3]	0.03% + 100 mV[3]	0.05% + 250 mV	0.05% + 250 mV
dc Voltage	0.05% + 150 mV[3]	0.05% + 150 mV[3]	0.05% + 150 mV[3]	N/A	N/A
RMS Current (45 - 100 Hz)[4]					
high range	0.05% + 10 mA	0.05% + 10 mA	0.05% + 10 mA	0.1% + 50 mA	0.1% + 50 mA (1Φ) 0.1% + 25 mA (3Φ)
low range	0.05% + 1.5 mA	0.05% + 1.5 mA	0.05% + 1.5 mA	N/A	N/A
Power (VA) (45-100 Hz)[4]	0.1% + 1.5 VA +	0.1% + 1.5 VA +	0.1% + 1.5 VA +	0.15% + 5 VA	0.15% + 5 VA (1Φ)
high range	12 mVA/V	12 mVA/V	12 mVA/V		0.15% + 3 VA (3Φ)
low range	0.1% + 1.5 VA +1.2 mVA/V	0.1 % +1.5 VA +1.2 mVA/V	0.1% + 1.5 VA +1.2 mVA/V	N/A N/A	N/A N/A
Power (watts) (45-100 Hz)[4]	0.1% + 0.3 W +	0.1% + 0.3 W +	0.1% + 0.3 W +	0.15% + 5 W	0.15% + 5 W (1Φ)
high range	12 mW/V	12 mW/V	12 mW/V	N/A	0.15% + 3 W (3Φ)
low range	0.1% + 0.3 W + +1.2 mW/V	0.1% + 0.3 W + +1.2 mW/V	0.1% + 0.3 W + +1.2 mW/V	N/A N/A	N/A N/A
Frequency	0.01% + 0.01 Hz	0.01% + 0.01 Hz	0.01% + 0.01 Hz	0.01% + 0.01 Hz	0.01% + 0.01 Hz
Power Factor	0.01	0.01	0.01	0.01	0.01
Regulatory Test Solutions IEC mode measurement system characteristics (6812B and 6813B only)					
Output frequency range	N/A	50 /60 Hz	50 /60 Hz	N/A	N/A
Reference impedence accuracy	N/A	3% (at 0.4 Ω and 796 mH) 1% (at 0.4 Ω and 796 mH at 25˚)	3% (at 0.4 Ω and 796 mH) 1% (at 0.4 Ω and 796 mH at 25˚)	N/A	N/A
Output voltage harmonic content	N/A	Compliant withIEC 868 and IEC 61000-3-2	Compliant with IEC 868 and IEC 61000-3-2	N/A	N/A
Measurment accuracy					
Current magnitude (low range)	Fundamental Harmonics 2-49	0.03% + 1.5 mA 0.03% + 1mA + 0.2%/kHz	0.03% + 1.5 mA 0.03% + 1mA + 0.2%/kHz	N/A	N/A
Current magnitude (high range)	Fundamental Harmonics 2-49	0.05% + 5 mA 0.05% + 3 mA + 0.2%/kHz	0.05% + 5 mA 0.05% + 3 mA + 0.2%/kHz	N/A	N/A
Flicker	N/A	Compliant with IEC 868	Compliant with IEC 868	N/A	N/A
Flicker Perceptibility (PST)	N/A	Compliant with IEC 868	Compliant with IEC 868	N/A	N/A
Synchronization accuracy	N/A	<1ppm	<1ppm	N/A	N/A
Current shunt burden	N/A	0 volts	0 volts	N/A	N/A
Current harmonic smoothing filter time constant	N/A	1.5 seconds	1.5 seconds	N/A	N/A
Pst integration time	N/A	1, 5, 10 or 15 minutes	1, 5, 10 or 15 minutes	N/A	N/A

IEC Mode Measurement System Characteristics

	Sample Rate	Window Width	Acquisition Overlap
50 Hz Operation			
Rectangular measurement window	12.8 kHz	16 cycles	None
Hanning measurement window	8.533 kHz	24 cycles	50%
50 Hz Operation			
Rectangular measurement window	15.360 kHz	16 cycles	None
Hanning measurement window	7.680 kHz	24 cycles	50%

Notes:
1 It is possible to program the output frequency of the 6812B and 6813B from dc to 45 Hz (please see note 3).
2 Full current is available at voltages between 50% and 100% of the output voltage range.
3 Product may be operated between dc and 45 Hz subject to the following conditions:
Measurements may be extended to 4.5 Hz at full accuracy only by selecting a digitization rate of 250 µ seconds per point
Frequency content of the measured signal must be limited to 4 k Hz or less to avoid aliasing effects
4 Select low measurement range for improved accuracy (10:1) for lower power measurements.
5 Single-phase operation.

ac Power Solutions (cont'd)

SUPPLEMENTAL CHARACTERISTICS

(non-warranted characteristics determined by design that are useful in applying the product)

	6811B	6812B	6813B	6814B	6834B
Average programming accuracy (% of output + offset) rms current	1.2% + 50 mA	1.2% + 50 mA	1.2% + 50 mA	0.2% + 80 mA	0.2% + 80 mA (1Φ) 0.2% + 40 mA (3Φ)
Average programming resolution					
rms voltage	125 mV	125 mV	125 mV	80 mV	80 mV
dc voltage	250 mV	250 mV	250 mV	N/A	N/A
Overvoltage programming (OVP)	2 V peak	2 V peak	2 V peak	2 V peak	2 V peak
rms current	2 mA	4 mA	4 mA	5 mA	7.5 mA (1Φ), 2.5 mA (3Φ)
peak current	12.5 mA	25 mA	25 mA	N/A	N/A
output frequency	10 µHz	10 µHz	10 µHz	10 µHz	10 µHz
phase	N/A	N/A	N/A	N/A	N/A
Average measurement resolution					
rms voltage	10 mV	10 mV	10 mV	10 mV	10 mV
rms current	2 mA	2 mA	2 mA	3 mA	2 mA (1Φ)/6 mA (3Φ)
Programmable output impedance					
resistance	0-1 Ω	0-1 Ω	0-1 Ω	N/A	N/A
inductance	20 µh - 1 mh	20 µh - 1 mh	20 µh - 1 mh	N/A	N/A
Remote sense capability	Up to 1 Vrms can be dropped across each load lead.		Up to 10 Vrms can be dropped across each load lead.		
Isolation to ground	300 Vrms/425 Vdc	300 Vrms/425 Vdc	300 Vrms/425 Vdc	300 Vrms	300 Vrms
Net Weight	28.2 kg (62 lb)	28.2 kg (62 lb)	32.7 kg (72 lb)	79.5 kg (175 lb)	87.7 kg (193 lb)
Shipping Weight	31.8 kg (70 lb)	31.8 kg (70 lb)	36.4 kg (80 lb)	119.1 kg (262 lb)	127.3 kg (280 lb)
Dimensions	See drawings on page 54			See drawings on page 55	

ac INPUT RATINGS

	6811B	6812B	6813B	6814B	6834B
Voltage range (Vac) *default factory setting	87 to 106 Vac *104 to 127 Vac 174 to 220 Vac 191 to 254 Vac	87 to 106 Vac *104 to 127 Vac 174 to 220 Vac 191 to 254 Vac	174 to 220 Vac *191 to 254 Vac	*180 to 235 L-L (3Φ) 360 to 440 L- L (3Φ) (requires option 400)	*180 to 235 L-L (3Φ) 360 to 440 L-L (3Φ) (requires option 400)
Maximum input current (rms)[1]	12 A (100 Vac) 10 A (120 Vac) 7.5 A (200/208 Vac) 6.5 A (230 Vac)	28 A (100 Vac) 24 A (120 Vac) 15 A (200/208 Vac) 13 A (230 Vac)	22 A (200/208 Vac) 20 A (230 Vac)	18 A (208 Vac) 10 A (380 Vac)	24 A (208 Vac) 15 A (380 Vac)
Input power (max)[2]	1000 VA/700 W	2500 VA/1400 W	3800 VA/2600 W	5800 VA/4100 W	8900 VA/5900 W
Input frequency	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz

[1] Measured at low line [2] Measured at high line [3] Measured at high line

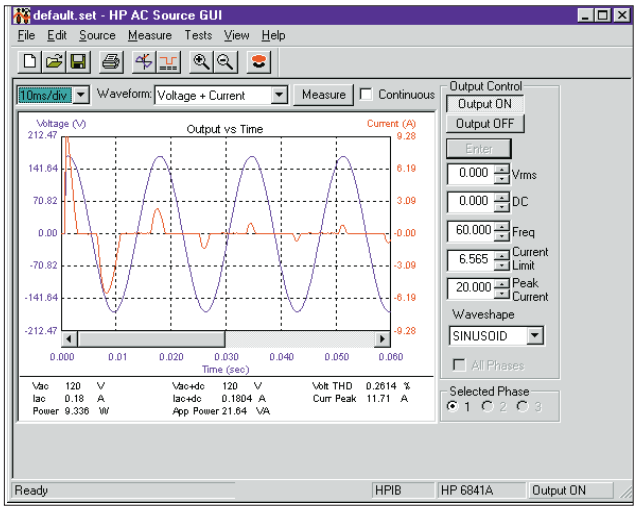
Ordering Information

Opt 019 2000 VA AC Power source/analyzer (6813B only)
Opt 020 Dual power analyzer option (6811B, 6812B, 6813B only)
Opt 022 2000 VA AC Source w/dual power analyzers (6813B only)
Opt 026 26 Volt, 0.1A auxiliary reference output (6812B only)
Opt 0BN Service Manual, extra Operating Guide, and Programming Guide
Opt 1CM Rack-mount Kit, p/n 5062-3977 (quantity 2) (support rails required) ***E3664AC Cabinet Rails must be ordered when rack mounting the 6814B and 6834B Opt 1CM***
Opt 1CP Rack-mount Kit with Handles, p/n 5062-3983 (support rails required) 6811B, 6812B, 6813B only ***Support rails, p/n 12679B, required when rack mounting the 6811B, 6812B, and 6813B Opt 1CM and Opt 1CP***

Opt 100 87 to 106 Vac, 48 to 63 Hz input (6811B, 6812B only) Japan only
Opt 200 174-220 Vac, 48-63 Hz input (6813B only) Japan only
Opt 230 191 to 254 Vac, 48-63 Hz input (6811B, 6812B only)
Opt 400 360 to 440 Vac, 3-phase, 47 to 63 Hz input (6814B, 6834B only) required for Europe
Opt 831 12 AWG, 200 to 240 Vac, unterminated (6812B, 6813B only)
Opt 832 4 mm^2 wire size, unterminated (6813B only)
Opt 833 1.5 mm^2 wire size, 200 to 240 Vac, unterminated (6812B only)
Opt 834 10 AWG, 100 to 120 Vac, unterminated (6812B only)
Opt 841 Line Cord with NEMA L6-20P; 20 A 250 V Plug (6812B only)
Opt 842 Line Cord with IEC 309; 32 A 220 V plug (6813B only)
Opt 844 Line Cord with NEMA L6-30P; 30 A 250 V Locking Plug (6813B only)
Opt 845 Line Cord with IEC 309; 16 A 220 V Plug (6812B only)
Opt 846 Line Cord with NEMA L6-30P; 30 A 120 V Plug (6812B only)
Opt 847 Line Cord with CEE 7/7; 16 A 220 V Plug (6812B only)
Opt 848 Line Cord with BS 546; 15 A 240 V Plug (6812B only)

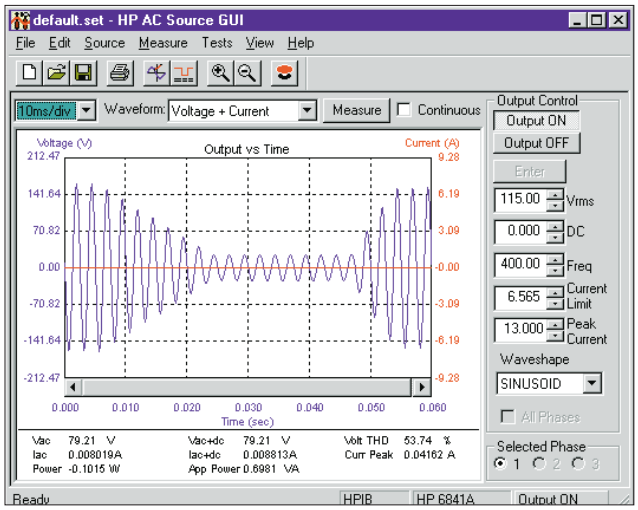
For ac Line Cord and Cord Options information see pages 48-51.
For Dimension Drawings see pages 58 and 59.

6814B and 6834B Accessories
p/n 5060-3513 Three 30 A replacement fuses for 180 to 440 Vac line
p/n 5063-2310 Heavy duty rack slide kit

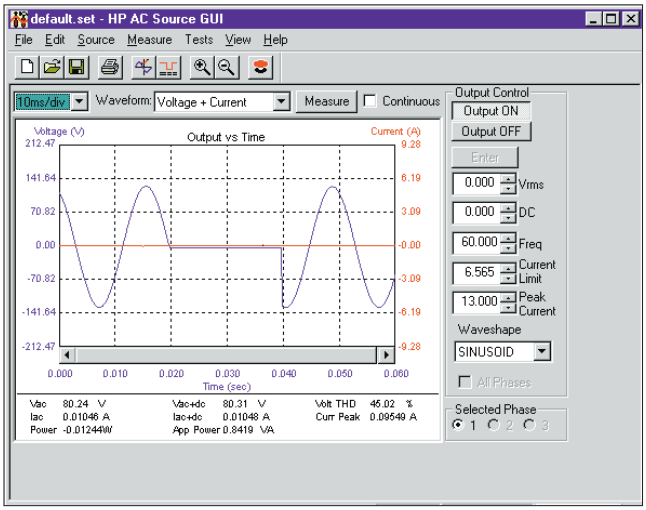


Inrush Current Measurement

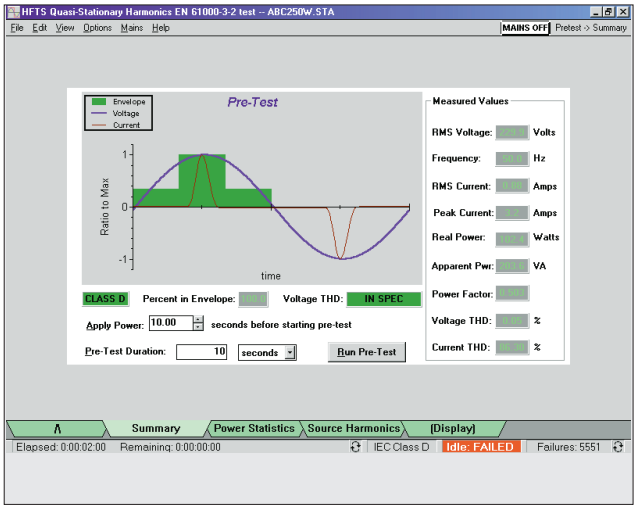
Ringer Voltage (dc + ac) Generation



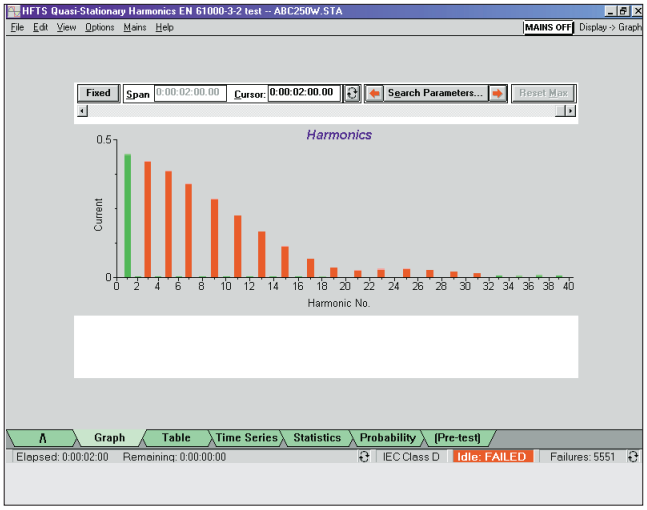
Voltage Slew Control (Blownout)



One cycle ac Mains Dropout



Quasi-Stationary Harmonics Summary



Harmonic Measurement Result

Choosing ac Line Voltage and Cord Options for your Agilent Power Products

7 EASY STEPS FOR CHOOSING LINE CORD OPTIONS

Determine the voltage option

STEP 1
Go to table 1a. Find the model number of the product you are ordering. Note the standard line voltage. If it is correct you do not need to specify a line voltage option. Go to step 4

STEP 2
If the standard line voltage is not correct, use table 1b to determine which of the available options best matches the available line voltage.

STEP 3
Add the line voltage option to your purchase order.

Line cords for low power products

STEP 4
Go to table 1a. Find the correct line cord option series for the product you are ordering. If your model # requires an 800 series, go to step 6.

STEP 5
If your model # requires a 900 series line cord, the correct one will automatically be shipped for the destination country on the purchase order. DONE!

Line cords for high power products

STEP 6
If your model number requires an 800 series line cord, determine if there is a line cord with plug that matches your outlet receptacle in tables 3a and b.

If not, choose the appropriate unterminated line cord.

STEP 7
Add the option number for the appropriate line cord to your purchase order. DONE!

NOTE
If no line cord option is specified for products which require 800 series line cords, an unterminated line cord will be shipped automatically for the destination country on your purchase order.

Choosing ac Line Voltage and Cord Options for your Power Product

Power distribution systems, regulations, and connection techniques vary greatly among geographic regions as a result of local ac electrical standards. Most Agilent products, including power products which draw less than 500 watts of power from the ac line, can be readily adjusted to accept different line voltages or frequencies.

Line voltage and frequency for certain Power Products may not be field changeable. Choosing the correct voltage option for these products requires care. This is especially true for higher power products. Line voltage / frequency options and method of change are summarized in Table 1a below. Voltages for Europe and Asia Pacific vary widely from country to country. Europe is moving toward harmonization, with countries standardizing on 230 Vac instead of 220 or 240 Vac. Some older products don't offer a 230 Vac option. For countries operating on 230 Vac, option 240 with a range of +6% / -13% (a range of 208 to 254 Vac) generally offers the best match. See table 1b for further information. The specifications listed for each product indicate the range of voltage and frequency that each option accomodates. If in doubt, contact your local Agilent Field Engineer for assistance.

TABLE 1A - AC LINE VOLTAGE/FREQUENCY OPTIONS

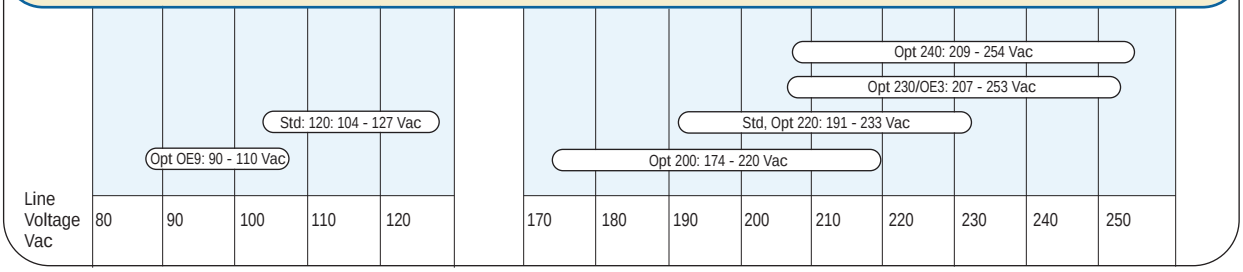
Model Number	Standard Line Voltage	Line Voltage Options	50 HZ Operation	Field Changeable; Method	Line Cord Series
6010A, 6011A, 6012A, 6015A	120	100, 220, 230, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	800
6023A, 6028A	120	100*, 220, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	900
6030A, 6031A, 6032A, 6035A	120	100*, 220, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	800
6033A, 6038A	120	100*, 220, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	900
605XA, 606XA	120	100*, 220, 240	Yes	Yes; internal switches	900
654XA	120	100, 220, 240	Yes	Yes; internal board mounted switches	900
655XA	120	100, 220, 230, 240	Yes	Yes; internal quick connect jumpers	900
657XA	230	200*	Yes	Yes; internal board mounted switch	800
66000A	100-240	none	Yes	Not necessary; automatic wide ranging input	800
6610XA	100-120, 200-240	none	Yes	Yes; bottom panel switch	n.a.
661XC	120	100, 220, 230	Yes	Yes; internal quick connect jumpers	900
662XA	120	100, 220, 230, 240	Yes	Yes; moveable insert on rear panel mounted line cord module	900
663XXA	120	100, 220, 230	Yes	Yes; internal quick connect jumpers	900
663XB	120	100, 220, 230	Yes	Yes; internal quick connect jumpers	900
664XA	120	100, 220, 230, 240	Yes	Yes; internal board mounted switch	900
665XA	120	100, 220, 230, 240	Yes	Yes; internal quick connect jumpers	900
667XA, E4356A	230	200	Yes	Yes; internal board mounted switch	800
668XA	220 3Ø	400 3Ø	Yes	Yes; internal connector mounted jumpers	3Ø; unterminated only
6811B	120	100, 230	Yes	Yes; internal connector mounted jumpers	900
6812B	120	100, 230	Yes	Yes; internal connector mounted jumpers	800
6813B	230	200	Yes	Yes; internal connector mounted jumpers	800
6814B, 6834B	230 3Ø	400 3Ø	Yes	**NO! Board change required, 3 phase input; return to factory**	3Ø; unterminated only
E3610A, E3611A, E3612A	115	ØE3 (230 V), ØE9 (100 V)	Yes	**NO! Transformer change required; return to factory**	line cord hardwired
E3614A, E3615A, E3616A, E3617A, E3620A, E3630A	115	ØE3 (230 V), ØE9 (100 V)	Yes	Yes; internal board mounted switch	
E3631A, E3632A, E3633A, E3634A	115	ØE3 (230 V), ØE9 (100 V)	Yes	Yes: moveable insert on rear panel mounted ac receptacle	
E364XA	115	ØE3 (230 V), ØE9 (100 V)	Yes	Yes, internal board mounted switch	

Notes: 100*, 200*: for Japan only; derating required, product see specifications

Choosing ac Line Voltage and Cord Options for your Agilent Power Products

TABLE 1B - LINE VOLTAGE COVERAGE OF VARIOUS SINGLE PHASE OPTIONS

Note: Consult specific product listing above for options availability.



Low Power Products

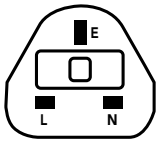
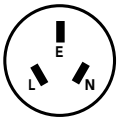
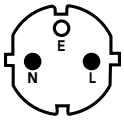
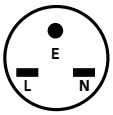
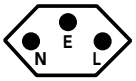
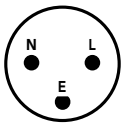
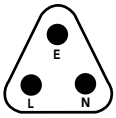
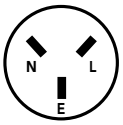
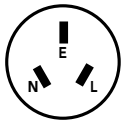
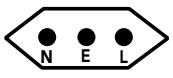
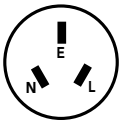
For lower power products, a universal receptacle on the rear panel accepts a wide range of line cords to meet local regulatory requirements. Table 2 shows a range of standard line cords that Agilent offers, with option numbers and part numbers.

Part numbers are needed to order a line cord separately.

For products which use the 900 series line cords, the appropriate type is automatically selected at time of shipment, based on the country to which the product is being shipped. If you plan to use your power products in a different country or region than the country to which the product is being shipped, you will need to specify the appropriate line voltage and line cord options on your order, so that we can provide the appropriate configuration. Contact your local Agilent Field Engineer for assistance.

TABLE 2 - 900 SERIES LINE CORD OPTIONS

Available for low power products

Option # / Part No.				
	900 / 8120 - 1351C (8120 - 8605 for 6811B)  **United Kingdom**	**901** / 8120 - 1369C (8120 - 5412 for 655xA /665xA, 8120 - 8606 for 6811B)  **Australia, New Zealand**	**902** / 8120 - 1689C (8120 - 5413 for 655xA/665xA, 8120 - 8607 for 6811B)  **Europe**	**903** / 8120 - 4383 (8120 - 4383 for 655xA/665xA, 8120 - 8609 for 6811B)  **United States, Canada**
Option #/ Part No.	**904** / 8120 - 0698C (8120 - 5421 for 665xA / 665xA, 8120 - 8610 for 6811B)  **United States, Canada**	**906** / 8120 - 2104C  **Switzerland**	**912** / 8120 - 2956C (8120 - 8608 for 6811B)  **Denmark**	**917** / 8120 - 4211 (8120 - 5414 for 655xA, 665xA, 8120 - 8611 for 6811B)  **South Africa, India**
Option #/ Part No.	**918** / 8120 - 4753C (8120 - 4383 for 655xA/ 665xA, 8120 - 8609 for 6811B)  **Japan**	**919** 8120 - 6800  **Israel**	**920** 8120 - 6869  **Argentina**	**921** 8120 - 6980  **Chile**
Option #/ Part No.	**922** 8120 - 8376 (8120 - 8800 for 6611B)  **China**			

L = Line or Active Conductor (also called "live" or "hot")
N = Neutral or identified Conductor
E = Earth or Safety Ground

Choosing ac Line Voltage and Cord Options for your Agilent Power Products

High Power Products

There are several factors which limit the amount of power which can be readily drawn from a normal branch circuit. For example, in the U.S., the typical 115/120 Vac branch circuit has a circuit breaker rated for 15 A. For industrial applications, 20 A service is commonly available. Current draw for an appliance is further restricted to 80% of the breaker rating unless the circuit is dedicated to only one appliance. The line cord can also represent a limiting factor based on the wire gauge used. Finally, the power supply with a rectifier and capacitive input filter represents a non-sinusoidal current load. Thus, the maximum input current drawn by the power supply is higher than if the input were a resistive load.

The practical result of this is that linear power supplies with outputs over 500 watts and switching supplies rated over 750 watts will generally exceed the capability of a 15 A branch circuit. Connecting power products above these power levels will require installing either a higher voltage or higher current service. Some practical examples are:

- standard line voltage for 2KW products such as the 667XA is 230 Vac; they can not be powered off a 120 Vac line
- the 1KW 601XA and 603XA products cannot be powered off a standard 15 A / 120 Vac circuit; they can operate off a 30 A / 120 Vac service, or they can be configured for 230 Vac operation
- the 66000A mainframe requires a 30 A / 120 Vac service or 230 Vac operation; although each module is 150 watts, the maximum input current is based on the total requirement of 8 modules.

Agilent offers a range of line cords for many higher power products to mate with the wall receptacles commonly specified for these higher power services. Refer to tables 3a, 3b and 3c to determine if there is a line cord for your product with a plug that meets the local requirements. If not, you must order an unterminated line cord. For the products in table 3a, you must specify a line cord option at the time you order your power product, or an unterminated line cord will be shipped.

Often, higher power products (over 1 kW) are hardwired, i.e. connected directly to a breaker panel or distribution box. The line cord may also be hard wired to the back of the power supply where a universal receptacle is impractical. Typically, a local electrician should be consulted to determine the best alternative to connect a high power product to the ac line. Consider the most appropriate option for your application based on local electrical codes.

TABLE 3A - 800 SERIES LINE CORD OPTIONS

Available for high power products. NOTE: If no line cord option is specified on the purchase order, an unterminated line cord will be shipped.

Power supply series		Option Number	601XA 603XA(1kW)	657XA 667XA E4356A	66000A	6812B 6841A	6813B 6842A
	Unterminated: line cords without plugs	831 832 833 834	8120-5573 n.a. 8120-5568 8120-5566	8120-5488 8120-5490 n.a. 8120-5545	8120-5573 n.a. 8120-5568 8120-5566	8120-5573 n.a. 8120-5568 8120-5566	8120-5573 8120-6502 n.a. 8120-5566
	Terminated: line cords with plugs	841 842 844 845 846 847 848	8120-5572 n.a. n.a. 8120-5570 8120-5565 8120-5567 8120-5569	8120-5491 8120-5489 8120-5546 n.a. n.a. n.a. n.a.	8120-5572 n.a. n.a. 8120-5570 8120-5565 8120-5567 8120-5569	8120-6505 n.a. n.a. 8120-6508 8120-5565 8120-5567 8120-6511	8120-6505 8120-6506 8120-6507 n.a. n.a. n.a. n.a.

TABLE 3B - UNTERMINATED LINE CORDS

(line cords without plugs)

Option 831 12 AWG, 3 wire; UL-listed, CSA-certified; unterminated. Suggested for use in North and South America. Note for 667XA series: intended for use on a dedicated branch circuit and not intended for use in Canada. Note for 603XA and 66000A series: intended for connection to 200-240 Vac service.

Option 832 4-mm^2 wire size, 3 wire; harmonized cordage; unterminated. Suggested for use in Europe and other areas not listed.

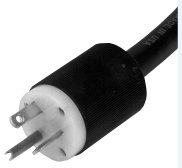
Option 833 1.5-mm^2 wire size, 3 wire; harmonized cordage; unterminated. Suggested for use in Europe and other areas not listed. Note for 603XA and 66000 series: intended for connection to 200-240 Vac service.

Option 834 10 AWG, 3 wire; UL-listed; CSA-certified; unterminated. Suggested for use in North and South America. Note for 603XA and 66000 series: intended for connection to 100-120 Vac service.

Choosing ac Line Voltage and Cord Options for your Agilent Power Products

TABLE 3C - TERMINATED LINE CORDS (line cords with plugs)

Option 841 12 AWG; UL-listed, CSA-certified; with NEMA 6-20P, 20-A, 250-V plug. Suggested for use in North and South America and Japan. Note for 6670 and 6570 Series: Not intended for use in Canada. Intended for use on a dedicated branch circuit.



Option 842 4-mm^2 wire size; harmonized cordage with IEC 309, 32-A, 220-V plug. Suggested for use in Europe and other areas not listed.

Option 844 10 AWG; UL-listed, CSA-certified; with NEMA L6-30P, 30-A, 250 V, locking plug. Suggested for use in North and South America.

Option 845 1.5-mm^2 wire size; harmonized cordage with IEC 309, 16-A, 220-V plug. Suggested for use in Denmark, Switzerland, Austria, China and other countries not listed.

Option 846 10 AWG; UL-listed, CSA-certified; with NEMA L5-30P, 30-A, 120-V locking plug. suggested for use in North America.

Option 847 1.5-mm^2 wire size; harmonized cordage with CEE 7/7, 16-A, 220-V plug. Suggested for use in continental Europe.

Option 848 1.5-mm^2 wire size; harmonized cordage with BS 546, 15-A, 240-V plug. Suggested for use in India and South Africa.

Note: Order the correct option according to local electrical codes. All line cords listed are 2.5 meters (approx. 8.2 ft) long.

Products with 3-Phase Inputs

Some of the higher power products exceed the capability of a single phase line. Agilent offers several power products which require 3-phase inputs, including the 5KW 668XA dc source family, the 6814B and 6834B ac Sources. For 3-phase power distribution up to the building, there are two different distribution systems in wide use: delta, predominantly used in the US; and wye predominantly used in Europe. However, for service inside the building, the 5 wire wye is the predominant configuration. Products which are delta loads, are compatible with either delta or wye.

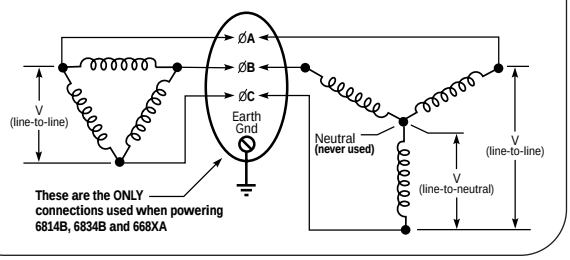
As shown in table 4, the delta has only three current carrying conductors; there is no neutral. The wye configuration has four current carrying conductors. In general, the neutral should carry no significant current. None of the Agilent power products use the neutral connection found on wye systems. Do not connect the neutral to ground.

In selecting the correct operating voltage for 3-phase products you need to distinguish between the line-to-line and the line-to-neutral voltages. The line-to-line voltage is the square root of 3 x the line-to-neutral voltage. It is the line-to-line voltage that is used to specify the input voltage to be applied to Agilent power products. For example, common 3-phase voltages and available options are shown in table 4.

All Agilent 3-phase power products are shipped with either a North American or harmonized unterminated line cord based on the destination country on the purchase order.

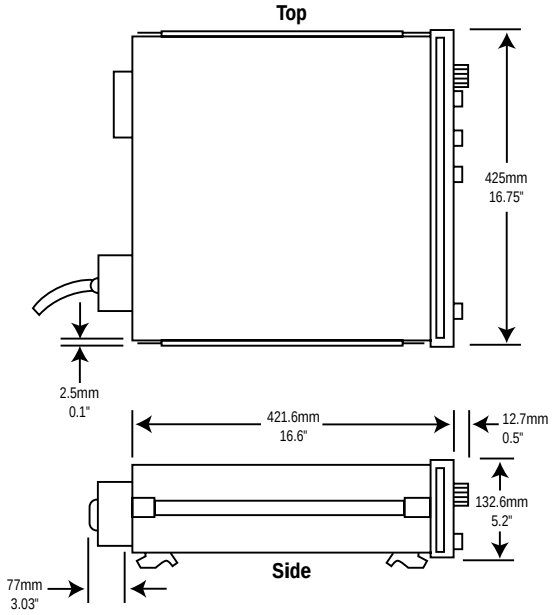
TABLE 4 - THREE PHASE ac INPUT SYSTEMS

6814B/6834B and 668XA	Delta	Wye	
Standard 180-235 volts (line-to-line)	180-235 volts (line-to-line)	180-235 volts (line-to-line)	104-136 volts (line-to-neutral)*
Option 400 360-440 volts (line-to-line)	360-440 volts (line-to-line)	360-440 volts (line-to-line)	208-254 volts (line-to-neutral)*
***Note:**	Never connect to the Neutral line connection when powering an Agilent 3ϕ Product. Included as information ONLY. Standard: p/n 8120-6203 Opt 400: p/n 8120-6204		

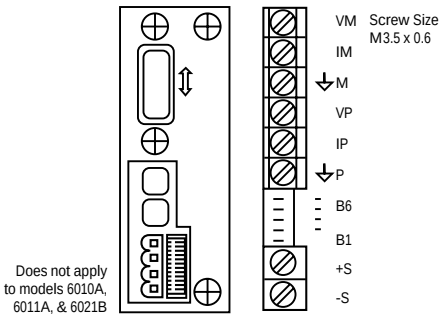


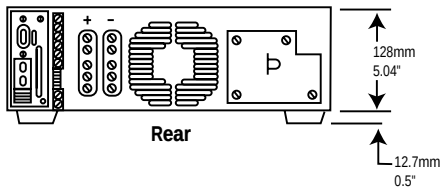
For information on single-phase operation, see page 56 question 2.

Agilent Models: **6010A, 6011A, 6012B, 6015A, 6030A, 6031A, 6032A, 6035A**

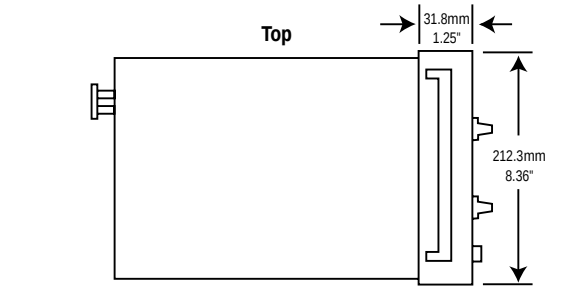


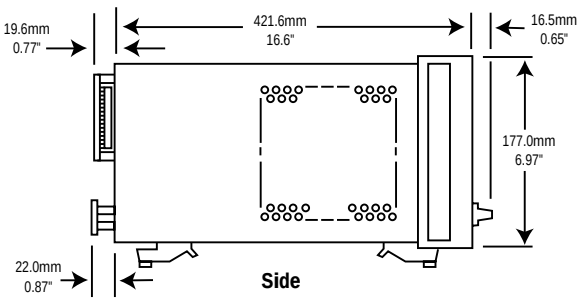
Terminal Strip Detail

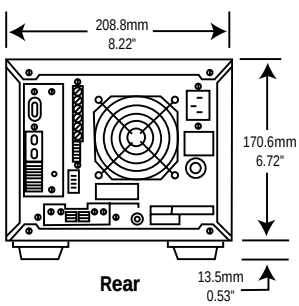




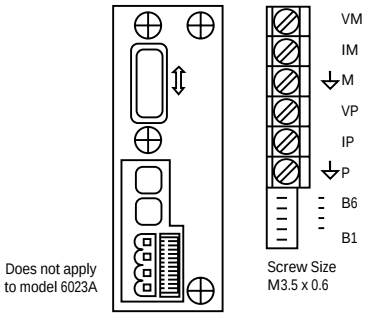
Agilent Models: **6023A, 6028A, 6033A, 6038A**



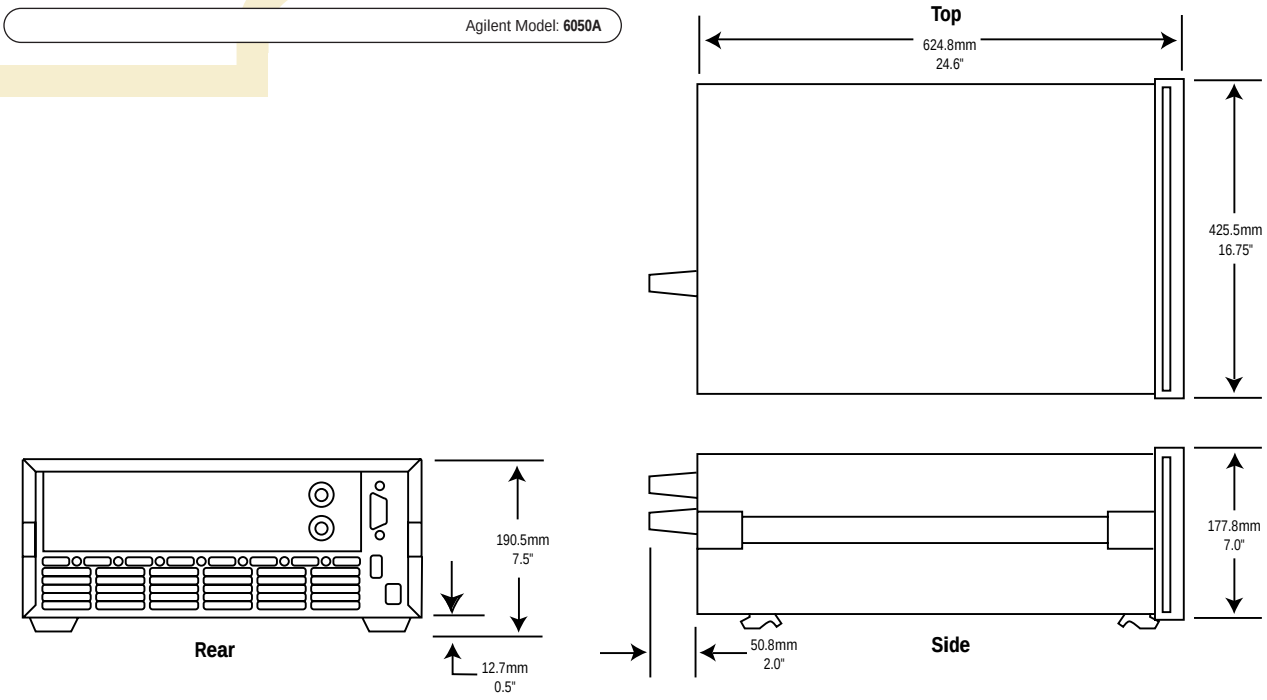




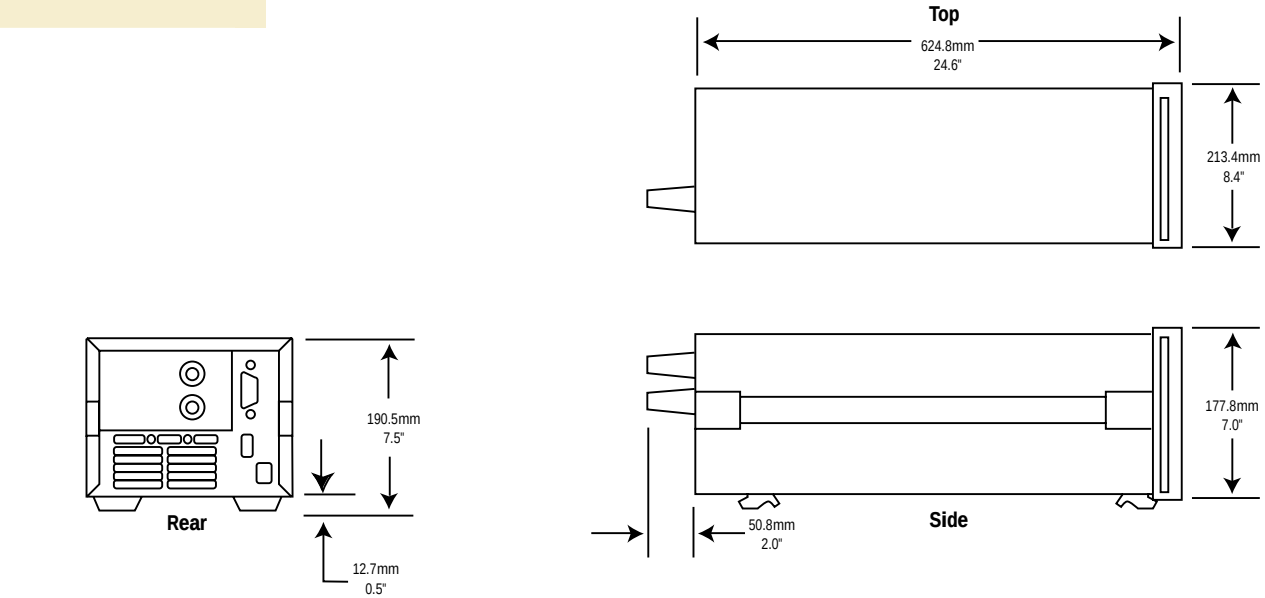
Terminal Strip Detail



Agilent Model: **6050A**

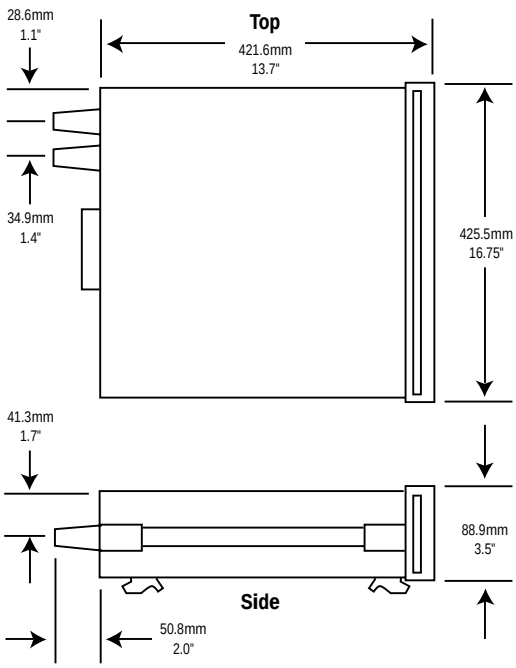


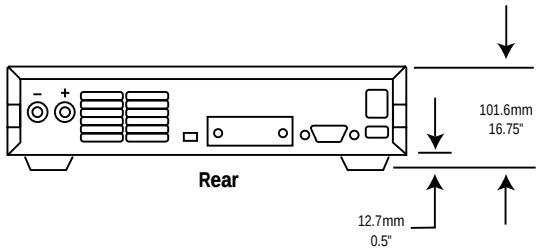
Agilent Model: **6051A**



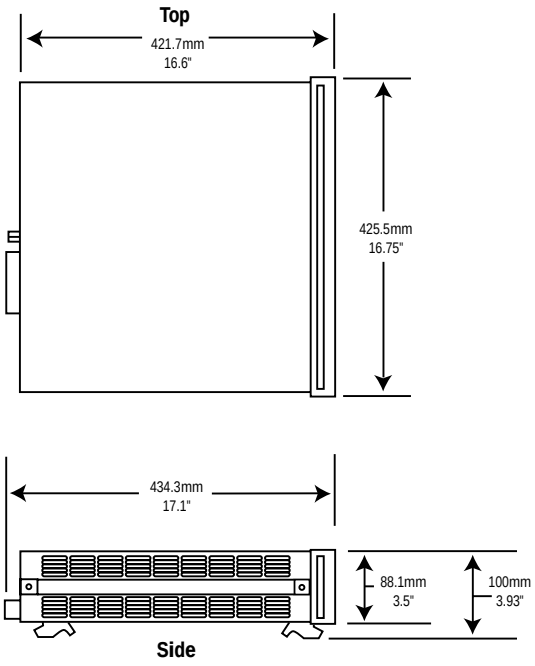
DIMENSION DRAWINGS

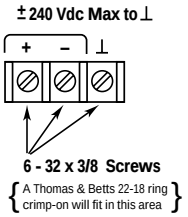
Agilent Models: **6060B, 6063B**



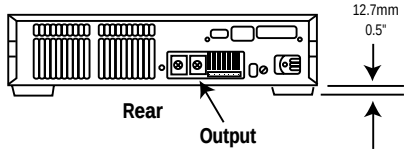


Agilent Models: **6541A, 6542A, 6543A, 6544A, 6545A, 6641A, 6642A, 6643A, 6644A, 6645A**



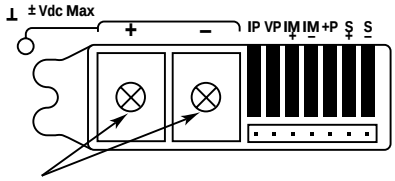


Terminal Screw Size: m4 x 0.7 x 8mm



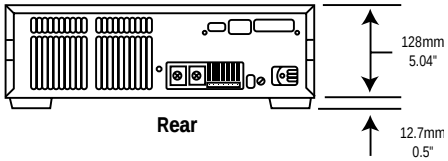
Agilent Models: **6551A, 6552A, 6553A, 6554A, 6555A, 6651A, 6652A, 6653A, 6654A, 6655A, E4350B, E4351B**

Rear Output

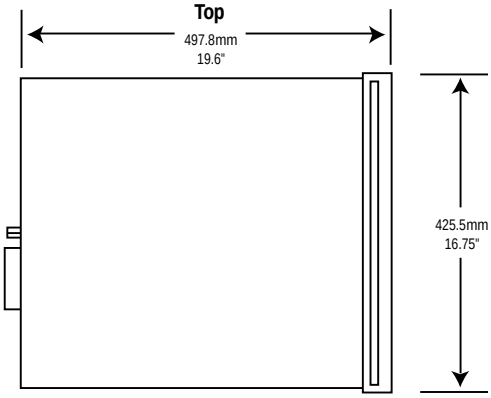


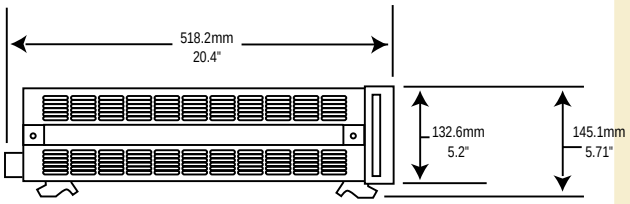
Metric Pan Head, M4 x 0.7 x 8 mm long
(center to center on these two screws is 20 mm, typ)

Terminal Screw Size: 6-32 x 5/16in



Rear

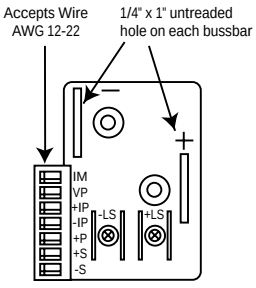




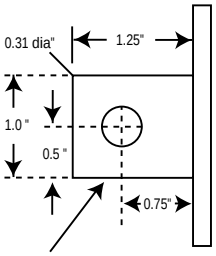
Side

Agilent Models: **6571A, 6572A, 6573A, 6574A, 6575A, 6671A, 6672A, 6673A, 6674A, 6675A, E4356A**

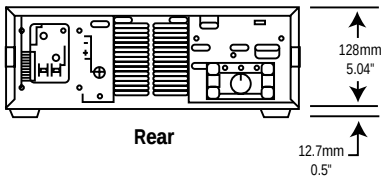
Rear Connector Detail



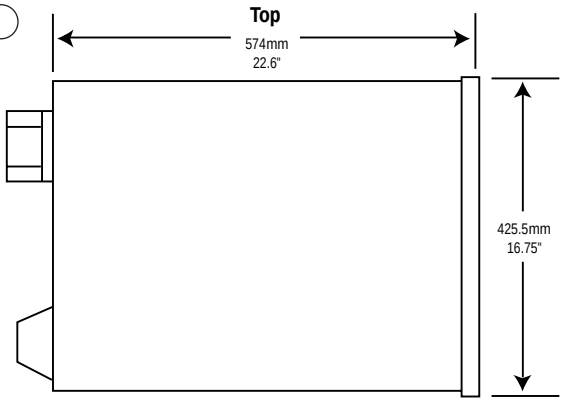
Buss Bar Detail

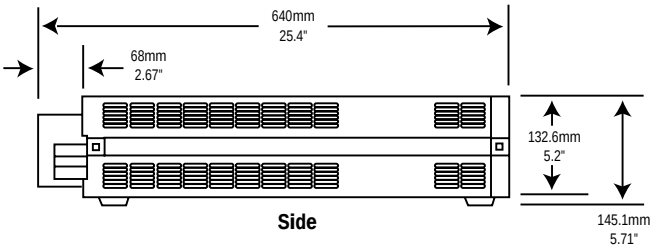


Note: Buss Bar is 1/8" thick cu



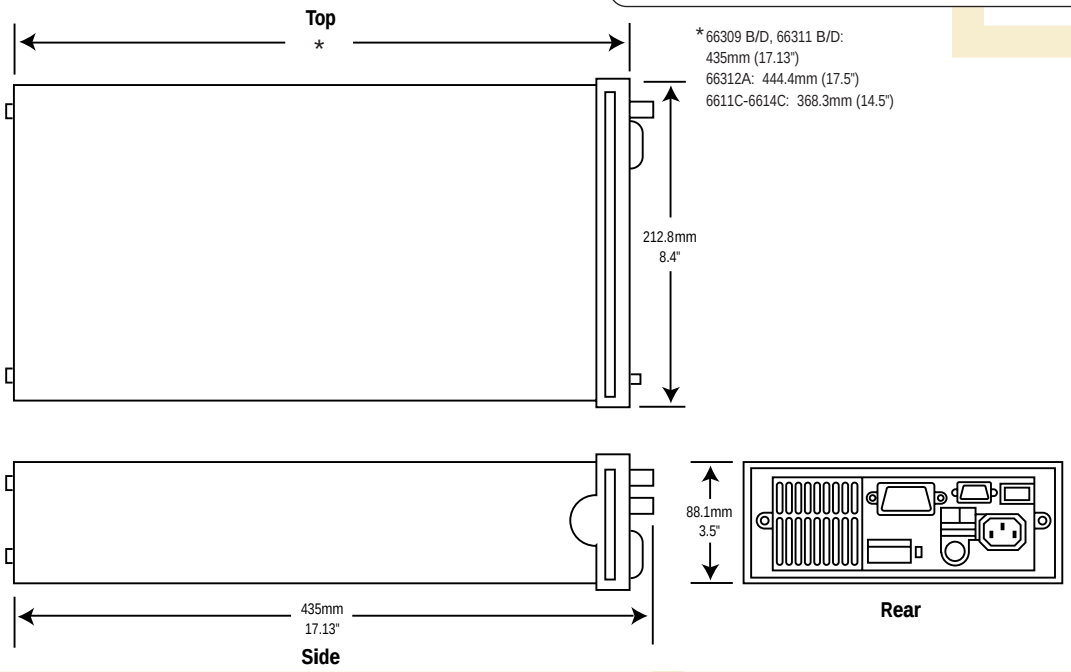
Rear



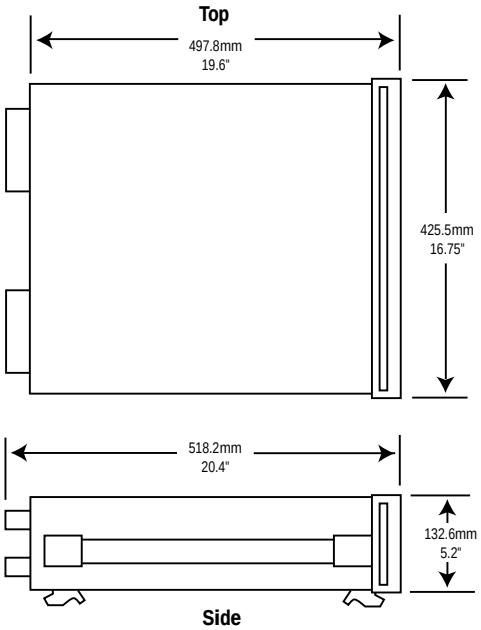


Side

Agilent Models: **6611C, 6612C, 6613C, 6614C, 66309B/D, 66311B/D**



Agilent Models: **6621A, 6622A, 6623A, 6624A, 6625A, 6626A, 6627A, 6628A, 6629A**



Terminal Strip Detail

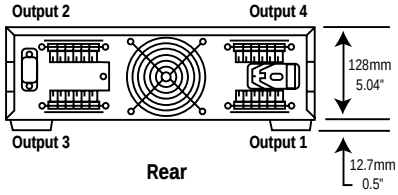
Output 2 & 3

-OV +OV -S -V +V +S

Screw Size:
M35 x 0.6

Output 1 & 4

+S +V -V +S +OV -OV



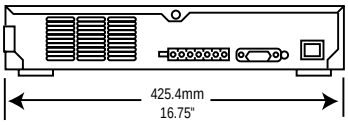
Agilent Models: **6631B, 6632B, 6633B, 6634B, 66332A**

Terminal Strip Detail

Output 2 & 3

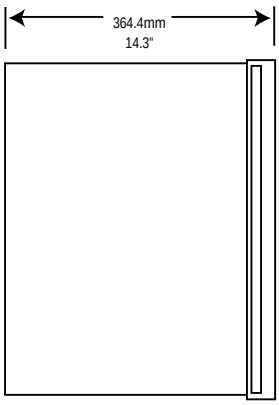
+S + - -S ⊥

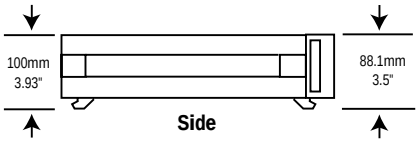
Screw Size:
M35 x 0.6



Rear

Top



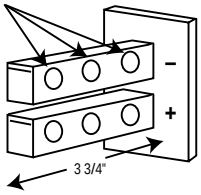


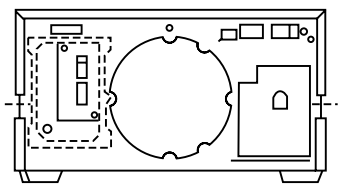
Side

Agilent Models: **6680A, 6681A, 6682A, 6683A, 6684A**

Buss Bar Detail

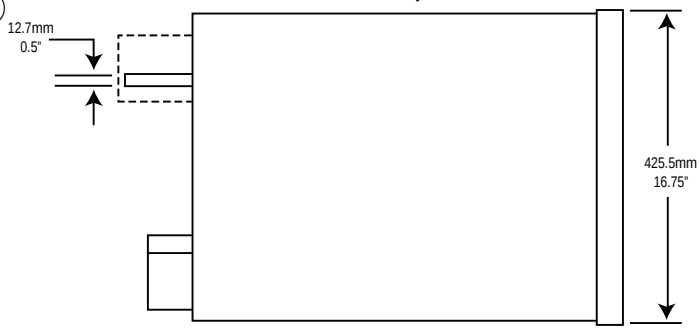
3/8" Diameter (6)

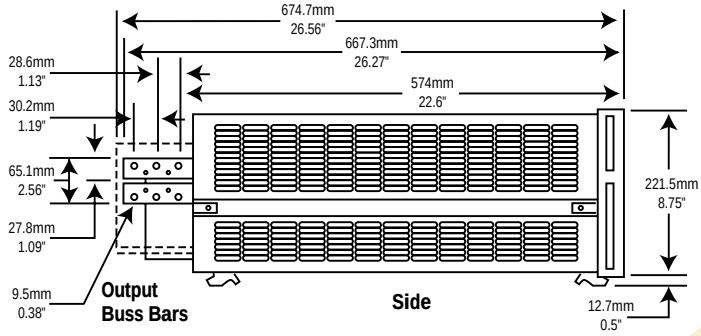




Rear

Top

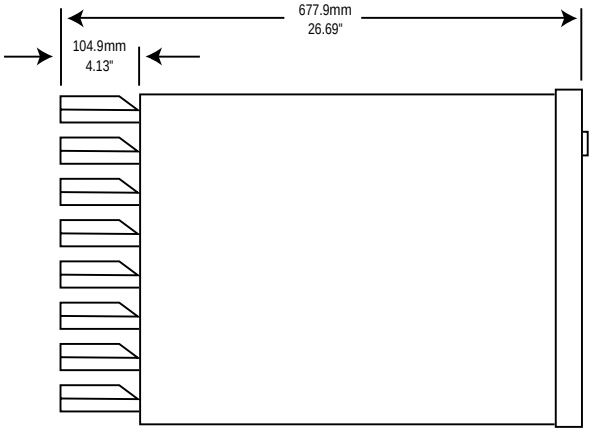




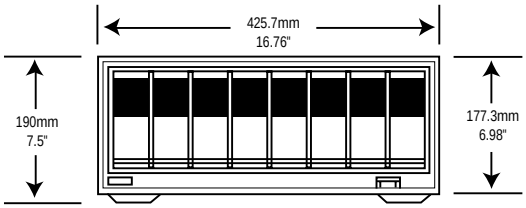
Side

Agilent Model: **66000A**

Top

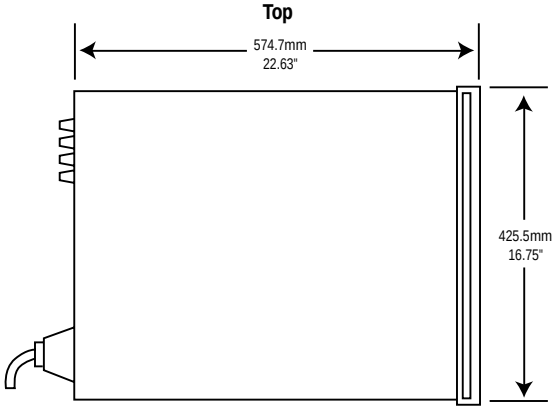


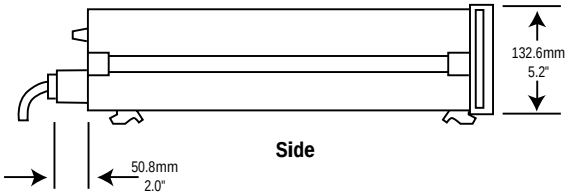
Front



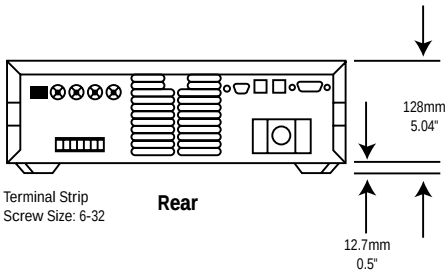
Agilent Models: **6811B, 6812B, 6813B**

Top





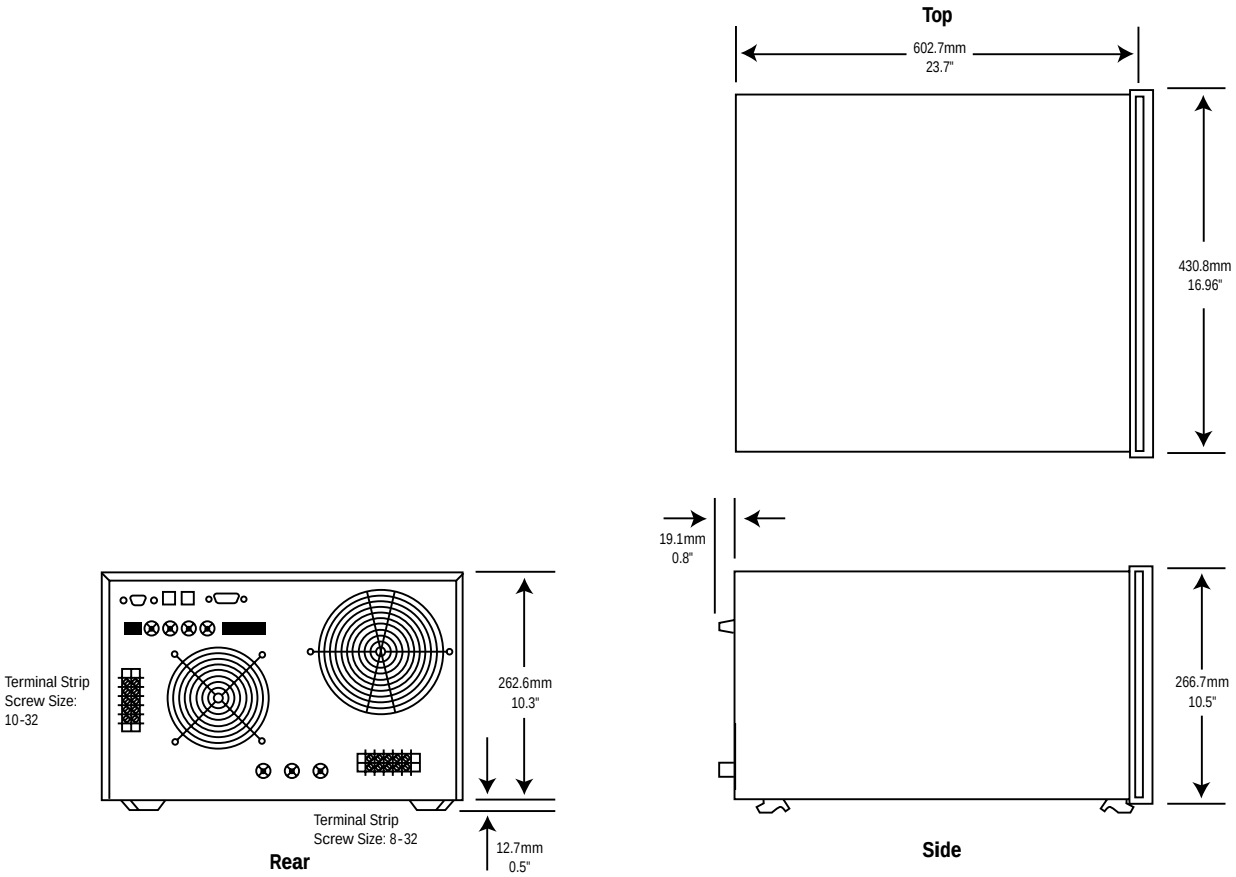
Side



Terminal Strip
Screw Size: 6-32

Rear

Agilent Models: **6814B, 6834B**



10 Most frequently asked questions about using dc power products

1) How do I put the power supply in the constant current mode?

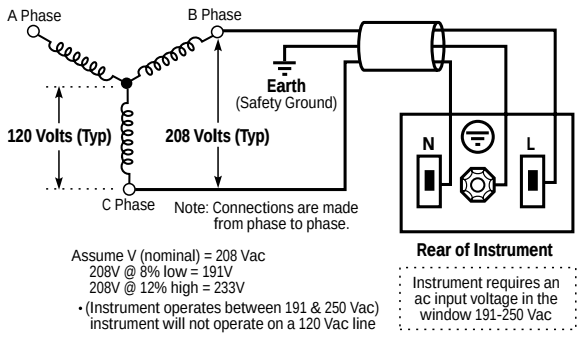
The power supply cannot be "put" into the constant current mode. The output settings of the power supply combined with the ohmic value of the particular load determine whether or not the power supply is in constant current.

ie: The power supply inherently resides in the constant voltage mode. If the output voltage were set to 24 volts and a 6Ω load were placed across the output terminals, Ohm's Law would require that 4amps would flow (24V/6Ω). This presumes that the constant current setting of the power supply were set to a value greater than 4 amps; lets say 5amps. Now, if the 6Ω load were replaced by a 2Ω load, Ohm's Law would suggest that 12 amps (24V/2Ω) would flow. However, the power supply is set to go into constant current at 5 amps. Therefore, the actual output voltage would be 10 volts (2Ω x 5A). The power supply will now remain in constant current for values of load = $0\Omega \leq R < 4.8\Omega$. Once the ohmic value of the load becomes greater than 4.8Ω (24V/5A), the power supply will again revert to constant voltage operation at the value of 24 volts.

2) I have 208 vac, 3 ϕ phase power; can it be used to operate a product requiring 208 V single phase?

Yes, see below.

657xA/667xA Connection to a 3-phase Line



3) Why are the required Watts and VA so different?

Watts is a scalar quantity which is frequently used to measure system efficiency. It is the energy supplied by the utility company over a given period of time and is commonly referred to as power. Except for heavy industrial users, the utility company only bills users for the watts consumed. Watts are directly convertible into mechanical work or BTUs (British Thermal Units) of heat. Wasted power is paid for a second time in terms of additional loading on the user's air-conditioning system. Mathematically, it is a scalar quantity resulting from the vector product of two vector quantities (volts and amps). It is NOT the simple algebraic product of the rms volts times rms current.

VA on the other hand IS the scalar quantity resulting from multiplying the magnitudes (rms) of the vector quantities (volts and amps). This resulting quantity will never be smaller than the watts demanded by an instrument. Uninformed users incorrectly use VA to assess the device's over-all efficiency and power demands. VA is most frequently and correctly used by electricians to determine proper ac mains conductor gage and circuit breaker sizing.

4) How much cooling do I need for my power supply?

Users frequently rack power supplies into an enclosure to supply power to some remotely located external load. Under these conditions, to properly determine the cooling requirements, the systems integrator needs thermal data from the manufacturer for the specific enclosure in question. This data is generally in the form of a curve which relates the rise of the enclosure's internal air temperature to the amount of power (or BTU's) dissipated within the enclosure.

The difference between the maximum power demanded by the external load, and the ac power demanded by the power supply to support the load's needs, is the power dumped into the internal air of the enclosure. Using this number and data for the enclosure, the internal rise can be determined. The internal rise added to the external ambient temperature will determine the temperature of the environment for the power supply. This must be within the ratings of the product or premature failure will occur.

A valuable conversion factor between Watts and BTU's is listed below:

1 BTU/Hr = 0.293 Watt

5) Can Agilent power supplies sink current?

Yes! Sinking, or downprogramming, is the ability of a power supply to pull current into the positive power terminal. Sinking is necessary to discharge the power supply's own output capacitor, or the capacitors that are part of an external load.

Sinking is particularly important, for example, in printed circuit board test systems. The relays in test board systems typically must be switched only when the power supplies have discharged to zero volts, to avoid arcing and burn-out of the relay contacts. Sinking allows the power supply outputs to go to zero quickly, thus providing faster test times, an important factor for reducing overall test cost.

The value of the sink current is fixed and is not programmable, with the exception of the 6630 series, where sink current is set to the same value that is programmed for source current.

In general, sinking is provided to improve a power supply's transition time from a higher to a lower constant voltage operating level, and is not intended to be a steady-state operating condition.

Series	Current Sinking Capability
6620 Multiple Output	110% of source current rating
6620 Precision Output	110% of source current rating
6630 100 Watt	110% of source current rating
6030 Autorangers	50 W/actual output voltage in volts or actual output voltage volts/0.05 ohms, whichever is less
6640 200 Watt	25% of source current rating
6650 500 Watt	20% of source current rating
6670 2000 Watt	50 W/actual output voltage in volts or actual output voltage in volts/0.05 ohms, whichever is less
6680 5000 Watt	50 W/actual output voltage in volts or actual output voltage in volts/0.05 ohms, whichever is less

6) I want to put a microswitch on the safety cover over my UUT so that lifting the cover will program my ATE power supplies to zero volts and protect the operator from harm. Do HP power supplies have this capability?

Yes, all of the GPIB programmable supplies in the 6030, 6640, 6650, 6670 and 6680 series have this capability built-in at no extra cost. It's called "Remote Inhibit" (RI). RI is available as an option at extra cost on the 6620 and 6630 series. A contact closure or TTL low signal programs the output of the supply to zero volts. The power supply can also be programmed to generate a service request (SRQ) via the GPIB in the event that RI is pulled low.

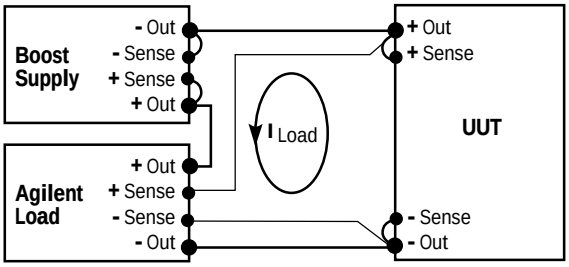
10 Most frequently asked questions about using dc power products

7) Can I use Agilent Electronic Loads in series and in parallel?

Agilent electronic loads are designed to be operated in parallel for more current, but NOT in series for more voltage. Loads are fully protected against damage from current overloads, but will be damaged by voltage above the maximum voltage rating.

8) I must test a 1 volt power supply using a constant current load and I want to use Agilent Electronic Loads. But the Agilent load meets all of its dynamic specs with no derating on down to 3 volts. Below 2 volts, the Agilent load current must be linearly derated. What can I do?

Use a boost supply in series with the UUT. The load will now meet all its specs with no derating, because it always operates above 3 volts. (see the illustration below)



The boost supply can be a low-cost fixed output 3 V or 5 V supply with a current rating at least as high as the maximum peak load current needed. The 6641A (8 V, 20 A), 6651A (8 V, 50 A), 6671A (8 V, 220 A), or 6681A (8 V, 580 A) are all excellent choices. The voltage setting of a programmable boost supply should be set to 3 volts, and the current limit set to full scale.

Select a boost power supply with low p-p ripple and noise. The constant current load will compensate for low-frequency p-p ripple and noise below a few kHz, but high frequency ripple and noise from the boost will appear across the UUT.

9) Why are Agilent's Electronic Loads constant resistance resolution speced in ohms on the low resistance range, but in mSiemens on the two higher ranges?

In general, Agilent's Electronic Loads are not a conventional "resistor". The loads consist of IC's, capacitors, resistors, FETs, etc. They were designed with two major circuits, a cv and cc circuit. These circuits are used to simulate resistance on the two upper ranges.

First, it is necessary to understand why there is a difference in the way in which the ranges are specified (mohms or mS). The constant resistance (CR) mode in the load actually operates using either the constant current (CC) or constant voltage (CV) circuits inside the load. The lowest CR range uses the CV regulating circuits, while the two higher ranges use the CC regulating circuits. It is because of these differences in the circuits used to regulate the load input that the specifications need to be different.

When the CV circuits are used, the load can be viewed as many resistors, all the same value (the resolution), in series to produce the desired resistance. Then, changing the resistance is like changing the number of discrete resistors in series. Therefore, the resolution is the value of one of these series resistors, and putting resistors in series changes the resistance measured in ohms. For the 60501B, the "discrete resistor" or resolution that can be programmed is 0.54 mohms in the 2 ohm range.

When the CC circuits are used, the load can be viewed as many resistors, all the same value (the resolution), in parallel to produce the desired resistance. Then, changing the resistance is like changing the number of discrete resistors in parallel. Therefore, the resolution is the value of one of these parallel resistors, and putting resistors in parallel changes the conductance measured in siemens. For the 60501B, the "discrete resistor" or resolution that can be programmed is 0.14 mS (=7.14 kohms).

For example, in the 2 kohm range, you can program the load input from 2 ohms to 2 kohms (0.5 S to 0.5 mS) with a resolution of 0.14 mS. This would be the equivalent of starting with about 3568 7.143 kohm resistors in parallel with each other, and in parallel with a 2 kohm resistor, and removing one at a time until you had only the 2 kohm resistor left.

Note that the resolution of the conductance is constant at 0.14 mS, however, the resolution of the total parallel resistance is not constant. It depends on how many resistors you have in parallel.

If you have two 7.143 kohm resistors in parallel and remove one, the resolution looks like 3571.5 ohms. If you have 3568 7.143 kohm resistors in parallel and remove one, the resolution looks like (7143/3567) - (7143/3568) = 0.561 mohms. But the conductance resolution is constant at 0.14 mS.

10) Can Agilent power supplies be programmed from 0 to full output voltage using a 0 to 10 V signal source?

Yes, many Agilent power supplies feature remote voltage programming or analog programming capability. However, there is a potential danger in analog programming any power supply, especially a high voltage supply. If the 0 to 10 V programming source is a typical, non-isolated, low-cost, digital-to-analog converter (DAC), it is probably grounded through its digital inputs and/or through the computer's internal power supplies, which are grounded through the computer's power cord. It's easy to overlook this, and the mistake can be very expensive.

If the DAC is non-isolated (or isolated only up to 42 V above ground) and one of the output terminals of the power supply is grounded, either directly or through the UUT, the output capacitor of the power supply can discharge through the computer backplane, motherboard, and the I/O common through the computer power cord ground. The resulting high current may even last long enough to vaporize the thin ground tracks on some or all of the printed circuit boards in the PC.

Be sure the programming source is electrically isolated, is operated from isolated power supplies, and is rated for floating voltages up to the full output voltage of the programmed supply. This is necessary so no one is hurt, and no equipment is damaged, no matter which output terminal of the power supply or UUT is grounded.

For more information, refer to the topic on Constant Voltage Programming with Variable Voltage Gain on page 64.

For additional questions and answers visit our web site at www.agilent.com/find/answers

ac Power and Load Connections

A modern stabilized dc power supply is a versatile high performance instrument capable of delivering a constant or controlled output reliably and with little attention. But to take full advantage of the performance characteristics designed into a supply, certain basic precautions must be observed when connecting it for use on the lab bench or installing it in a system. Factors such as wire ratings, system grounding techniques, and the particular way that ac input, dc output, and remote error sensing connections are made can contribute materially to obtaining the stable, low noise output expected by the user. Careful attention to the following guidelines can help to ensure the trouble free operation of your Agilent power supply.

ac Power Input Connections

Wire Rating

RULE 1. When connecting ac power to a power supply, always use a wire size rated to carry at least the maximum power supply input current.

If a long cable is involved, make an additional check to determine whether a still larger wire size might be required to retain a sufficiently low impedance from the service outlet to the power supply input terminals. As a general guideline, input cables should be of sufficient size to ensure that the voltage drop at maximum rated power supply input current will not exceed 1% of the nominal line voltage.

Continuity

RULE 2. Maintain the continuity of the ac, acc, and grounding wires from the ac power outlet to the power supply input terminals without an accidental interchange.

Interchanging the ac and grounding wires may result in the power supply chassis being elevated to an ac potential equal to the input line voltage. If the chassis is grounded elsewhere, the result may be no worse than some blown fuses. But if the chassis is not grounded, the result could be a potentially lethal shock hazard. Confirm that the chassis is grounded by the grounding wire.

Transformers

RULE 3. If an autotransformer or an isolation transformer is connected between the ac power source and the power supply input terminals, it should be rated for at least 200% of the maximum rms current required by the power supply.

The transformer must have a higher rating than would be suggested by the supply's rms input current because a power supply input circuit does not draw current continuously. Input current peaks can cause a smaller transformer to saturate, resulting in failure of the supply to meet its specifications at full output.

RULE 4. Be sure to connect the common terminal of an auto-transformer to the acc (and not the ac) terminals of both the power supply and the input power line.

If acc is not connected to the common terminal of the auto-transformer, the power supply's input acc terminal will have a higher than normal ac voltage connected to it, contributing to a shock hazard and, in some instances, a greater output ripple.

ac Line Regulator

RULE 5. Do not use an ac line regulator at the input to a regulated power supply without first checking with the power supply manufacturer.

Some regulators tend to increase the impedance of the line in a resonant fashion and can cause power supplies to malfunction, particularly if they use SCR or switching regulators or preregulators. Moreover, since the control action of many line voltage regulators is accompanied by a change in the output waveshape, their advantage in providing a constant rms input to a power supply is small. In fact these changes in waveshape are often just as disruptive in causing power supply output changes as the original line voltage amplitude changes would have been.

Load and Remote Error Sensing Connections

Making Load Connections to One Power Supply

The simplest and most common example of improper load wiring is shown in Figure 1. The voltage at each load depends on the current drawn by the other loads and the voltage drops they cause in some portion of the load leads. Since most load currents vary with time, an interaction among the loads results. This interaction can sometimes be ignored, but in most applications the resulting noise, pulse coupling, or tendency toward inter-load oscillation is unacceptable. The following thirteen steps describe a recommended procedure for connecting the load wiring, grounding the system in a manner that avoids troublesome ground loops, and making connections for remote error sensing.

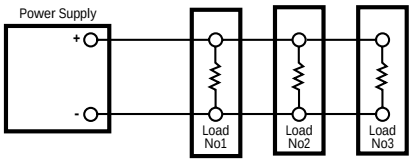


Figure 1 Improper load connections

STEP 1. Select a load wire size that, as an absolute minimum, is heavy enough to carry the power supply output current that would flow if the load terminals were short-circuited.

This is the minimum, however. Impedance and coupling considerations usually dictate the use of load wires larger than would be required just to satisfy current rating requirements. In general, the power supply performance degradation seen at the load terminals becomes significant when the wire size and length result in a load wire impedance comparable to or greater than the effective output impedance of the power supply. Refer to a copper wire resistance table to see if a larger wire size might have to be used to attain an impedance comparable to or smaller than the output impedance of the power supply.

If multiple loads are supplied from a pair of dc distribution terminals not located at the power supply terminals, it is necessary to consider separately the mutual impedance of the wires connecting the power supply to the distribution terminals and the additional impedance of the wires to each individual load. The mutual impedance presents an opportunity for a variation of one load current to cause a dc voltage variation at another load. Fortunately this mutual impedance can be effectively reduced at dc and at low frequencies by using remote error sensing, as will be described later.

ac Power and Load Connections (cont'd)

Connect the Load Wiring

STEP 2. Designate a single pair of terminals as the positive and negative dc distribution terminals.

These two terminals might be the power supply output terminals, the load terminals, or a separate pair of terminals established expressly for distribution. If the power supply is a short distance from the load and remote sensing will not be used, locate the dc distribution terminals as near as possible to the power supply output terminals. Using the power supply output terminals themselves as the distribution terminals results in optimum performance.

If remote sensing is to be used, locate the dc distribution terminals as near as possible to the load terminals. Later in the procedure, sensing leads will be connected from the power supply sensing terminals to the dc distribution terminals as shown in Fig. 2.

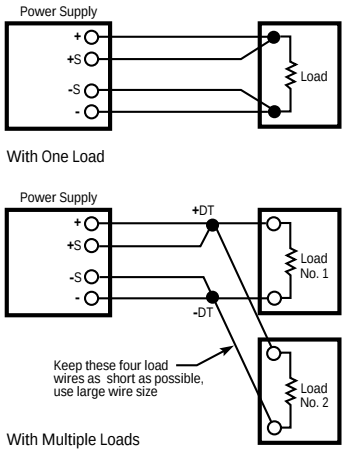


Figure 2 Location of dc Distribution Terminals with Remote Sensing (Distribution Terminals are Shown Solid)

STEP 3. Connect one pair of wires directly from the power supply output terminals to the dc distribution terminals, and connect a separate pair of wires from the distribution terminals to each load.

There should be no direct connection from one load to another except by way of the dc distribution terminals. (Although for clarity the diagrams show the load and sensing leads as straight lines, some immunity against pick-up from stray magnetic fields can be obtained by twisting each pair of load leads and shielding all sensing leads.)

Decouple Multiple Loads

STEP 4. If required, connect a local decoupling capacitor across each pair of distribution and load terminals.

Load decoupling capacitors are often needed when multiple loads draw pulse currents with short rise times. To reduce high frequency mutual coupling effects under these circumstances, capacitors must be connected directly across the load and distribution terminals. The capacitors used for decoupling must be selected to have a high frequency impedance that is lower than the impedance of the wires connected to the same load, and their connecting leads must be kept as short as possible to minimize impedance.

Grounding the System

Since no two ground points have exactly the same potential, the idealized concept of a single ground potential is a snare and a delusion. In many cases the potential difference is small, but a difference in two ground potentials of even a fraction of a volt could cause amperes of current to flow through a complete ground loop. (Ground loop is a term used to describe any conducting path formed by two separate connections to ground). Ground loops can cause serious interference problems when voltages developed by these currents are coupled into sensitive signal circuits.

To avoid ground loop problems, there must be only one ground return point in a power supply system. (A power supply system includes the power supply, all of its loads, and all other power supplies connected to the same loads). The selection of the best ground return point depends on the nature and complexity of the dc wiring. In large systems, practical problems frequently tend to force compromises with the ideal grounding concept. For example, a rack mounted system consisting of separately mounted power supplies and loads generally has multiple ground connections. Each instrument usually has its own chassis tied to the third grounding wire of its power cord, and the rack is often connected by a separate wire to ground. With the instrument panels fastened to the rack frame, circulating ground currents are inevitable. However, as long as these ground currents are confined to the ground system and do not flow through any portion of the power supply dc distribution wiring, their effect on system performance is usually negligible. To repeat, separating the dc distribution circuits from any conductive paths in common with ground currents will in general reduce or eliminate ground loop problems. The only way to avoid such common paths is to connect the dc distribution system to ground with only one wire. Figure 3 illustrates this concept: dc and signal currents circulate within the dc system, while ground loop currents circulate within the ground system. Steps, 5, 6, and 7 make specific recommendations for avoiding ground loop problems.

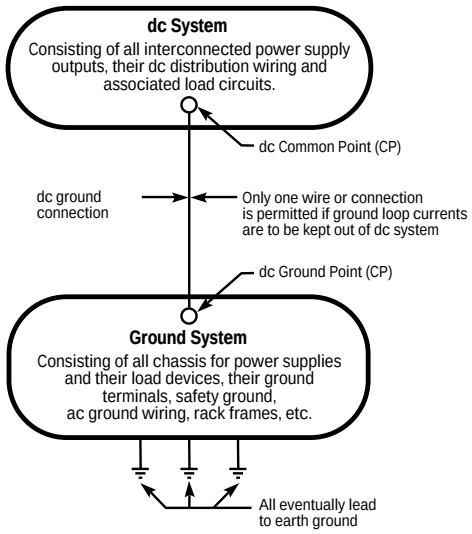


Figure 3 Isolating Ground Loop Paths from the dc system

ac Power and Load Connections (cont'd)

Select the dc Common Point

STEP 5. Designate one of the dc distribution terminals as the dc common point.
There should be only one dc common point in a dc system. If the supply is to be used as a positive source, then the negative dc distribution terminal is the dc common point. If it is to be a negative source, then the positive dc distribution terminal is the dc common point. Here are some additional suggestions for selecting the best dc common point for five different classes of loads:

a. Single Isolated Load. A single isolated load exists when a power supply is connected to only one load and the load circuit has no internal connections to the chassis or ground. If the power supply output terminals are to be used as the dc distribution terminals, then the dc common point will be either the positive or negative power supply output terminal (Fig. 4A). If remote sensing is to be used and the load terminals will serve as the distribution terminals, then either the positive or negative load terminal will be the dc common point (Fig. 4B).

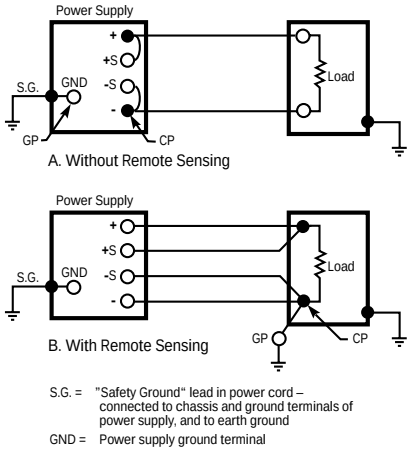


Figure 4 Preferred Ground Connections for a Single Isolated Load

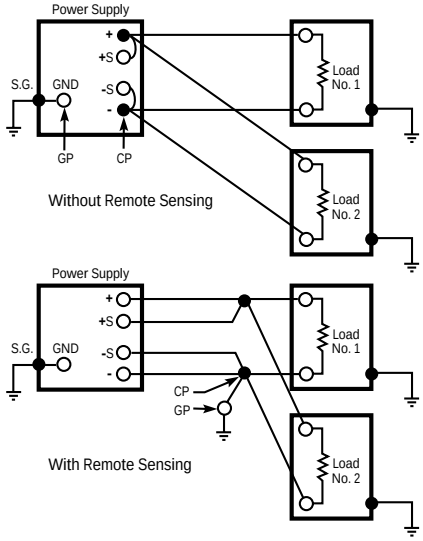


Figure 5 Preferred Ground Connections for Multiple Ungrounded Loads

b. Multiple Ungrounded Loads. This alternative applies when separate pairs of load leads connect two or more loads and none of the load circuits has an internal connection to chassis or ground (Fig. 5). Use the positive or negative dc distribution terminal as the dc common point.

c. Single Grounded Load. When a power supply is connected to a single load that has a necessary internal connection to chassis or ground as in Fig. 6, or when a supply is connected to multiple loads only one of which has a necessary internal connection to chassis or ground as in Fig. 7, the load terminals of the grounded load must be designated the dc distribution terminals, and the grounded load terminal is necessarily the dc common point.

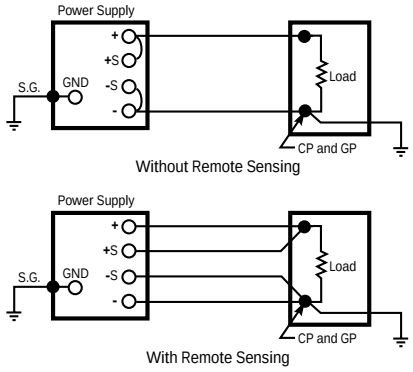


Figure 6 Preferred Ground Connections for a Single Grounded Load

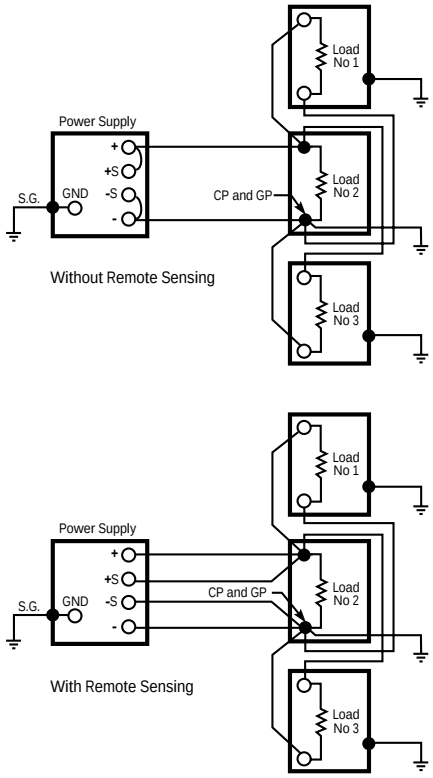


Figure 7 Preferred Ground Connections for Multiple Loads, Only One of Which is Grounded Internally

ac Power and Load Connections (cont'd)

d. Multiple Loads, Two or More of Which are Individually Grounded.

This undesirable situation must be eliminated if at all possible. Ground loop currents circulating through the dc and load wiring cannot be avoided so long as separate loads connected to the same power supply or dc system have separate ground returns as shown in Fig. 8.

One possible solution is to break the ground connection in all of the loads and then select the dc common point using the multiple ungrounded load alternative as in (b) above. Another would be to break the ground connection in all but one of the loads and select the dc common point as in alternative (c). If there are two or more loads with ground connections that cannot be removed and the system is susceptible to ground loop problems, then the only satisfactory solution is to increase the number of power supplies and to operate each grounded load from a separate supply. Each combination of power supply and grounded load would be treated as in alternative (c).

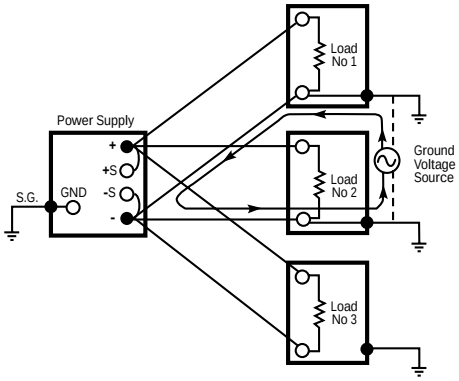


Figure 8 Improperly Connected dc Distribution System with Two Grounded Loads forming a Ground Loop

e. Load System Floated at a dc Potential Above Ground.

It is sometimes necessary to operate the power supply output at a fixed voltage above or below ground potential. The usual procedure in these circumstances is to designate a dc common point using whichever of the preceding four alternatives is appropriate, just as though conductive grounding were to be used. Then connect this dc common point to the dc ground point through a 1 microfarad capacitor as shown in Figure 9.

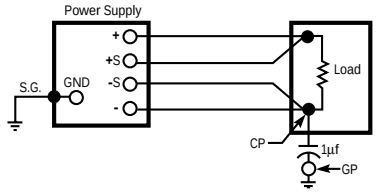


Figure 9 Floating a Load System at a dc Potential Above Ground

Select the dc Ground Point

STEP 6. Designate the terminal that is connected to ground as the dc ground point.

The dc ground point can be any single terminal, existing or added, that is conductively connected to the ground of the building wiring system and then eventually to earth ground.

STEP 7. Connect the dc common point to the dc ground point, making certain there is only one conductive path between these two points.

Make this connection as shown in Figures 4, 5, 6, or 7. Make the connection as short as possible and use a wire size such that the total impedance from the dc common point to the dc ground point is not large compared with the impedance from the ground point to earth ground. Flat braided leads are sometimes used to further reduce the high frequency component of the ground lead impedance.

Making Remote Error Sensing Connections

Normally a power supply operating in the constant voltage mode achieves its optimum line and load regulation, its lowest output impedance, drift, and PARD, and its fastest transient recovery performance at the power supply output terminals. If the load is separated from the output terminals by any lead length (as in Fig. 10), some of these performance characteristics will be degraded at the load terminals-usually by an amount proportional to the impedance of the load leads compared with the output impedance of the power supply.

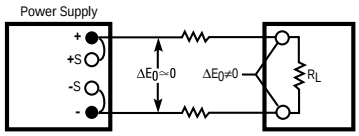


Figure 10 Load Voltage Variations Caused by Load Lead Voltage Drops when Remote Error Sensing is not Used

With remote error sensing, a feature included in nearly all Agilent power supplies, it is possible to connect the input of the voltage feedback amplifier directly to the load terminals so that the regulator performs its function with respect to the load terminals rather than with respect to the power supply output terminals. Thus, the voltage at the power supply output terminals shifts by whatever amount is necessary to compensate for the voltage drop in the load leads, thereby maintaining the voltage at the load terminals constant (Fig. 11).

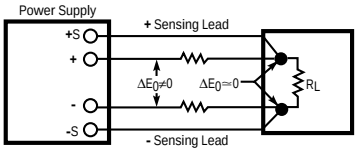


Figure 11 Regulated Power Supply with Remote Error Sensing.

Making the Sensing Connections

STEP 8. Remove the jumper connections between the power supply sensing and output terminals, and connect the power supply sensing terminals to the dc distribution terminals as shown in Fig. 12.

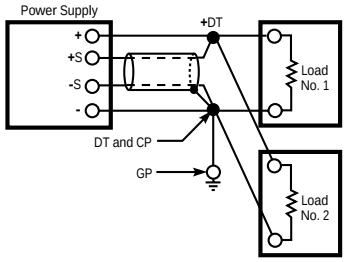


Figure 12 Properly Grounded Power Supply System with Remote Error Sensing

ac Power and Load Connections (cont'd)

Use an insulated shielded pair for the sensing leads. Do not use the shield as one of the sensing conductors.

STEP 9. Connect one end of the sensing lead shield to the dc common point and leave the other end unconnected.

In nearly all cases this method of connecting the sensing shield minimizes ripple at the dc distribution terminals.

Protect Against Open Sensing Leads Step

STEP 10. Avoid the possibility of an open remote sensing path, either on a long-term or a transient basis.

Opening a sensing lead causes the power supply output voltage to increase. Protective circuits in the supply provide some load protection by limiting the amount of the increase, but eliminating all switch, relay, or connector contacts from the remote sensing path helps to minimize the possibility of any loss of regulation due to this cause.

Check the Load Wire Rating

STEP 11. Verify that the voltage drop in the load leads does not exceed the capabilities of the remote sensing circuit.

Most well regulated power supplies have an upper limit to the load lead voltage drop around which remote sensing can be connected without losing regulation. This maximum voltage drop is typically 0.5, 1, or 2 volts, and may apply to the positive, the negative, or both the positive and negative output leads. See the instruction manual for the exact load lead voltage drop limitations of a particular power supply.

Remember too, that any voltage drop lost in the load leads reduces the maximum voltage available for use at the load. Either of these limitations sometimes dictates the use of a larger wire size than would be required by wire current rating or impedance considerations.

Check for Power Supply Oscillation

STEP 12. Verify that the power supply does not oscillate when remote sensing is connected.

Although dc and low frequency performance are improved by remote sensing, phase shifts associated with long load and sensing leads can affect the stability of the feedback loop seriously enough to cause oscillation. This problem can frequently be corrected by readjusting a "transient recovery" or "loop stability" control inside the supply if the circuit includes one; follow the adjustment procedure in the manual. Another remedy that is often effective is to disconnect the output capacitor inside the power supply (some models have a rear panel jumper that can be removed for this purpose) and to connect a similar capacitor across the dc distribution terminals.

Check for Proper Current Limit Operation

STEP 13. Check that the operating point of the current limit circuit has not been affected by the remote sensing connections.

With some power supply designs, the resistance of one of the output conductors adds to the resistance used for current limit monitoring when remote sensing is used. This reduces the threshold value at which current limiting begins and makes readjustment of the current limit circuit necessary. To determine whether connecting remote sensing has changed the current limit setting, turn off the supply, short terminal -S to -OUT and +S to +OUT at the power supply, and check whether the current limit value differs from the value without these terminals shorted. If it does differ significantly, the current limit control needs readjustment.

Making Load Connections to Two or More Power Supplies in the Same System

The following four rules must also be observed in extending the preceding techniques to systems containing two or more power supplies.

dc Distribution Terminals

RULE 1. There must be only one point of connection between the dc outputs of any two power supplies in the multiple power supply system. This point must be designated as one of the two dc distribution terminals for those two power supplies.

Thus there are always exactly (N +1) dc distribution terminals in any system, where N is the number of power supplies. (This is true unless parallel supplies share the same distribution terminals, or supplies are connected in series with no other connections to their intermediate terminals).

dc Common Point

RULE 2. One of the (N+1) dc distribution terminals must be designated as the dc common point for the system.

There can be only one dc common point allowed in a system.

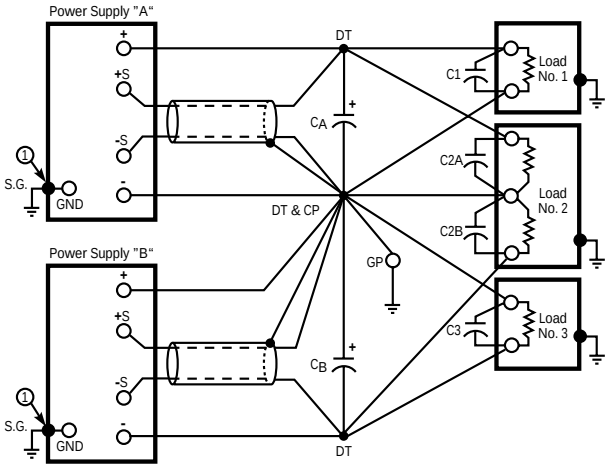
dc Ground Point

RULE 3. There must be only one dc ground point in a multiple power supply system.

This rules out the possibility of connecting two grounded loads in the same system.

RULE 4. There must be only one conductive path between the system dc common point and the system dc ground point.

This rule is repeated from Step 7 above as a reminder because of the far greater number of possible paths to ground in a multiple power supply system. Figure 13 shows an example of a properly connected and grounded multiple power supply system.



① Power supply chassis ground connection via 3rd wire saftey ground lead and rack frame.

S.G = "Safety Ground" lead in power cord
GND = Power supply ground terminal
C_A, C_B = Power supply output capacitors removed and placed across DT's
C1, C2, C3, = Load decoupling capacitors

Figure 13 A Properly Connected Multiple Power Supply System

Agilent Application Notes

AN 90B dc Power Supply Handbook

Helpful information for the user attempting to solve both traditional and unusual application problems with regulated power supplies.

p/n 5952-4020

AN 250-2 Battery Charging/Discharging

Precise control of the charging and discharging characteristics of batteries in applications ranging from satellite design to battery development and evaluation.

p/n 5952-4033

AN 372-1 Power Supply Testing

An electronic load offers a broad range of operating modes, providing versatile loading configurations needed for characterizing and verifying dc power supply design specifications.

p/n 5952-4190

AN 372-2 Battery Testing

An electronic load can be used to discharge batteries of various chemistries to determine actual capacity, capacity retention, and impedance.

p/n 5952-4191

AN 376-1 Biasing 3-Terminal Devices for Test

Measuring the operating characteristics of a wide variety of three-terminal devices can be accomplished with a single test configuration. This reduction in set-up time is especially valuable in environments where many different types of components need to be evaluated, such as failure analysis labs, R & D, and incoming inspection.

p/n 5952-4193

AN 1246 Pulsed Characterization of Power Semiconductors Using Electronic Loads

An electronic load eliminates the self-heating problems associated with measuring the on-state voltage drop and transconductance (or current gain) of power semiconductors.

p/n 5091-7636

AN 1273 Compliance Testing to the IEC 3000-3-2 (EN 61000-3-2) and IEC 1000-3-3 (EN 61000-3-3) standards

Regulatory standards for ac line phenomena are critical to maintaining the quality of ac power distribution systems. This application note provides an introduction to these standards as well as an insight into their scope and intent.

p/n 5964-1917E

AN 1293 Sequential Shunt Regulation

This sequential shunt regulation is widely used for regulating the satellite bus voltage, powered by solar arrays. The E4350B/E4351B solar array simulators (SAS) are ideal for this type of application.

p/n 5965-7329E

AN 1310 Considerations when selecting a system power supply for mobile communication device testing

Pulsed battery drain currents, regulated charge currents, and remote DUT (Device Under Test) fixtures, dictate the need for specialized power sourcing, loading, and measurement capabilities for testing mobile communications devices. Many of these capabilities are not available in general-purpose system power supplies.

This guide will assist the test system designer in selecting a system power supply by properly evaluating test system and power supply needs that are unique to the application and not immediately obvious

p/n 5968-2424E

AN 1319 Compliance Testing to the IEC/EN 61000-4-8

Electronic equipment can encounter magnetic fields at power line frequencies in a variety of places. As such, it is wise to ensure that the equipment will operate reliably when exposed to these power line frequency magnetic fields. The IEC/EN 61000-4-8 standard describes how equipment should be tested for immunity to power line frequency magnetic fields. This application note provides a discussion of the standard, including interpretation of the requirements and suggestions for equipment selection.

p/n 5968-3730E

Product Note

Testing Uninterruptible Power Supplies using Agilent 6800 Series ac power source/analyzers

Agilent ac sources can be used to help test uninterruptible power supplies in many different environments, including research and development, manufacturing, and incoming inspection. Ensuring that the UPS is designed and operating properly is essential to guarantee that the UPS will satisfactorily protect sensitive equipment against ac mains voltage abnormalities.

p/n 5965-7329E

Product Note

Zero Volt Electronic Load

Increasing demand for lower voltage power supplies is pressuring test system designers to identify electronic load test equipment designed to adequately perform at these lower voltages. Read how to configure Agilent DC Electronic Loads, with option J04, to perform accurate dynamic loading completely down to zero volts.

p/n 5968-6360E

Publications

Agilent offers a variety of free publications to help you choose the Agilent product that best fits your application, to help you benefit from applications knowledge acquired by users inside and outside of Agilent, and to help you maintain your Agilent products. Check for complete listing in the back of the 2001 Test and Measurement Catalog, which is available from your local Agilent Sales Representative.

Analog Programming Methods

The output voltage and current of the power supplies in this section can be remotely controlled with either a voltage or resistance signal. There are terminals on the rear panels of these power supplies to facilitate this.

Resistance Programming

Programming the output voltage or current of a power supply with resistance is simple with Agilent analog programmable power supplies. Using the terminal strip on the rear panel for the power supply, the front panel encoders used to control voltage and current can be disconnected. User supplied variable or fixed resistors can then be connected in their place. The resistance values needed are stated in the specifications for each individual power supply.

Voltage Programming

Programming of the output voltage or current of a power supply with a voltage signal can be accomplished in any of a few ways. Normally, the programming voltage is supplied by a DAC. The programming technique used is dependent upon the characteristics of the particular DAC and power supply being used. For all the techniques, however, the connections to the power supply are made to the terminals provided on the rear panel.

In the specification for each power supply, the voltage programming coefficient is given. This is the ratio of the programming signal voltage to the resultant output voltage or current of the power supply.

One type of power supply has scaled voltage coefficients. This means that the full scale programming voltage required is a specific value, for example five volts, regardless of the power supply full scale output voltage or current. Providing a DAC for this signal directly is a practical solution.

Constant Voltage Programming with Unity Voltage Gain

Another type of power supply has a 1v/1v voltage coefficient. This means that the output increases one volt for each one volt increase in the programming voltage signal. For lower voltage power supplies, a DAC could be used directly to program the power supply. This is called programming with unity gain and is shown in Figure 1.

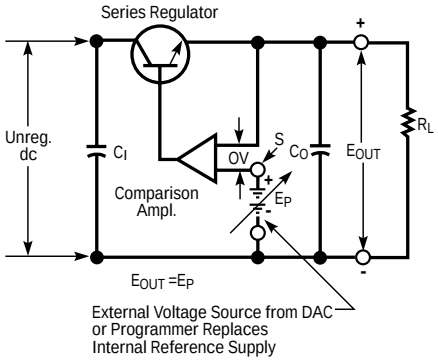


Figure 1 Voltage Programming with Unity Voltage Gain

Constant Voltage Programming with Variable Voltage Gain

In most cases, the power supply output voltage is greater than the DAC output, so the "Variable Voltage Gain" programming method, shown in Figure 2, must be used. This configuration requires two external precision wirewound resistors (Rp and Rr). As indicated by the equation in Figure 2, Rp can be selected so that the resulting voltage gain is either less than or greater than unity. Also note that the summing point S is made available at external terminals on all Agilent analog programmable power supplies, so no internal wiring changes are needed.

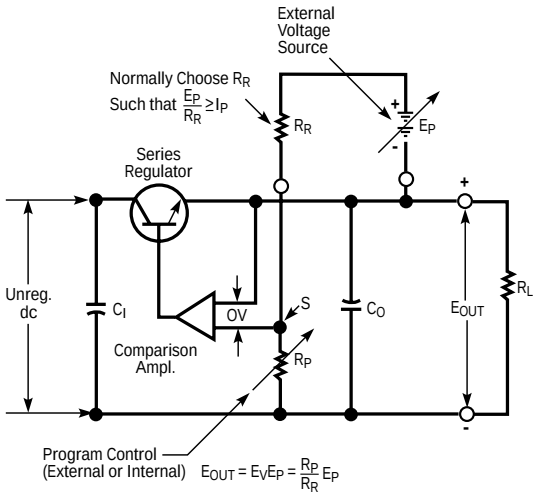


Figure 2 Voltage Programming with Variable Voltage Gain

When programming the output using a remote voltage source, the use of a zener diode across the programming terminals will prevent the power supply output from exceeding a predetermined limit, even though the programming source may provide an excessively high input command. The relationship between the zener diode and the output limit value depends upon the power supply design and the programming connection, but in any case can be determined by considering the power supply as equivalent to an operational amplifier. The zener diode must have a current rating equal to or greater than the largest current which the remote programming source can provide - in some cases the power rating of the zener diode can be reduced by employing a fixed resistance in series with the programming path.

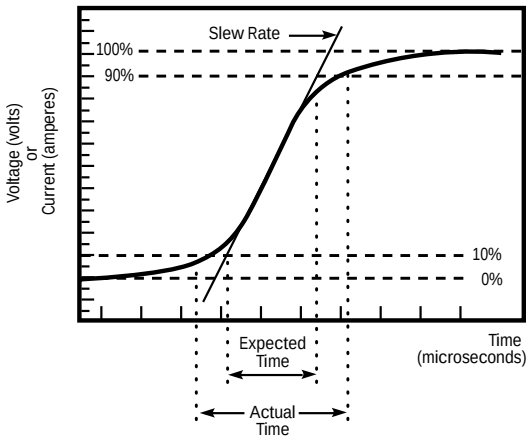
Constant Current Remote Programming

The same principles for constant voltage programming apply to constant current programming, since either a resistance or a voltage may be applied to the remote programming terminals. If the constant current programming terminals are accidently opened, however, the current limiting protection normally provided by the constant current setting will be lost. Particular care must be taken to insure that no open circuit conditions exist for even a short interval of time. Such an open circuit will program the power supply to an output current in excess of its rating, and would probably destroy the regulating components of the supply. Any constant current programming mechanisms involving switches should therefore use make-before-break switches.

Power Products Terms

ac input current: the maximum current into the power supply or electronic load. The current specified is worst case (low line voltage, full output).

Actual transition time: for an electronic load, either the total slew time (voltage or current change divided by slew rate - time) or the minimum transition time, whichever is longer.



Risetime Transition Limitation

Ambient temperature: the temperature of the air immediately surrounding the power supply or electronic load.

Analog programming: controlling the output voltage and/or current with an analog signal. This signal could be a voltage, current or resistance. This is similar to using the power supply as an amplifier.

Auto-parallel operation: a master-slave connection of the outputs of two or more supplies or the inputs of two or more electronic loads used for obtaining a current rating greater than can be obtained from a single load or supply. Only supplies that have the same voltage and current ratings should be paralleled.

Autoranging power supply: a power supply that can provide maximum rated power over a wide and continuous range of voltage and current settings.

Auto-series operation: a master-slave connection of the outputs of two or more supplies used for obtaining a voltage greater than can be obtained from one supply. Only supplies that have the same voltage and current ratings should be connected in series.

Auto-tracking operation: a master-slave connection of two or more supplies each of which has one of its output terminals in common with one of the output terminals of all of the other supplies.

Command processing time: the average time required for a power supply output voltage, or electronic load input voltage or current, to begin to change following receipt of a voltage or current set command over GPIB. This is effectively the time it takes for the power supply or electronic load to interpret the voltage set command and initiate a response.

Common mode noise: the current flowing from either output terminal (+ and –) through the power supply to chassis ground.

Complementary tracking: a master-slave interconnection of two supplies in which the voltage of the slave is equal to or proportional to that of the master and of opposite polarity with respect to a common point. (See also master-slave operation).

Compliance voltage: the output voltage of a power supply operating in the constant-current mode.

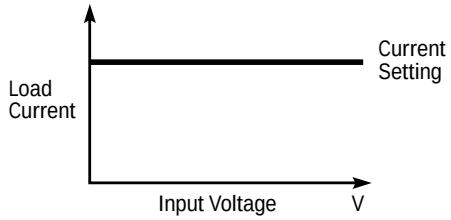
Constant-current (CC) power supply: a power supply that stabilizes output current with respect to changes in load impedance. Thus, for a change in load resistance, the output current remains constant while the output voltage changes by whatever amount necessary to accomplish this.

Constant-current/voltage/resistance mode electronic load: an electronic load that can operate in one of the following ways:

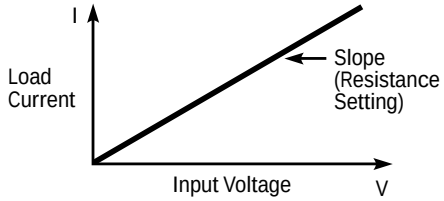
CC= ratio of voltage to current in accordance with the programmed value regardless of the input voltage

CV= ratio of voltage to current in accordance with the programmed value regardless of the input current

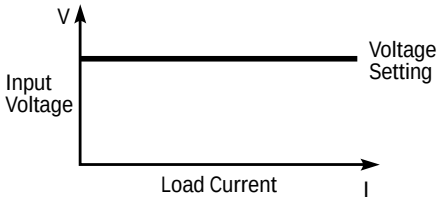
CR= ratio of voltage to current while maintaining the programmed resistance value



Constant-Current Mode



Constant-Resistance Mode



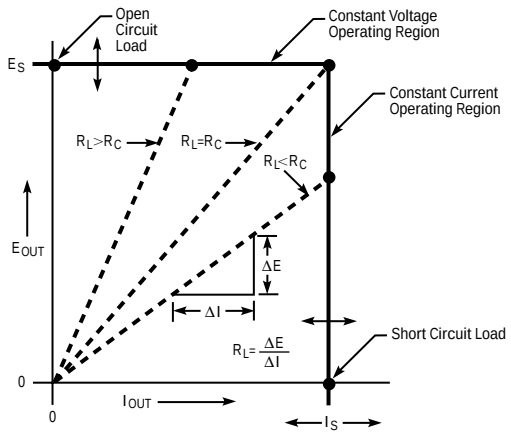
Constant-Voltage Mode

Constant-current/voltage/resistance regulation: the change in the steady-state value of the stabilized electronic load input voltage, current, or resistance resulting from a full scale source change, with all other influence quantities held constant.

Constant-voltage (CV) power supply: a power supply that stabilizes output voltage with respect to changes in influence quantities. Thus, for a change in load resistance, the output voltage remains constant while the output current changes by whatever amount necessary to accomplish this.

Power Products Terms (cont'd)

Constant-voltage/constant current (CV/CC) power supply: a power supply that operates as a constant-voltage power supply or a constant-current power supply, depending on load conditions. The supply acts as a constant-voltage source for comparatively large values of load resistance and as a constant-current source for comparatively small values of load resistance.



Constant-Voltage/Constant-Current Output Characteristics

Constant-voltage/current limiting (CV/CL) power supply: a power supply similar to a constant-voltage/constant-current supply except that at comparatively small values of load resistance, its output current is limited instead of being stabilized.

Crest factor: the ratio of the zero-to-peak value to the rms value of a waveform. This term is often used to specify the maximum peak amplitude that an ac power supply can source (relative to its maximum rms rating) without distortion.

Crowbar: see overvoltage protection.

Current limiting: the action, under overload or short-circuit conditions, of limiting the output current of a constant-voltage supply to some predetermined maximum value (fixed or adjustable) and automatically restoring the output voltage to its normal value when the overload or short circuit is removed. There are three types of current limiting:

- by constant-voltage/constant-current crossover
- by decreasing the output voltage as the current increases
- by decreasing both voltage and current as the load resistance decreases.

DFI: a TTL compatible output signal that can be used as an alarm and automatically initiates an action for multiple power supply or electronic load shutdown. The DFI signal is commonly connected to RI of the next supply. (See RI)

Downprogramming: the ability of a power supply to discharge its output capacitors independently of load. The use of an active down programming device can reduce the fall time of the output voltage.

Drift: the maximum change of a power supply output or load input voltage or current during an 8-hour period following a 30-minute warmup, with all influence and control quantities maintained constant during the warm-up time and the period of drift measurement. Drift includes both periodic and random deviations over the bandwidth from zero frequency (dc) to a specified upper frequency limit.

Efficiency: expressed in percent, efficiency is the total output power of the supply divided by the active input power. Unless otherwise specified, Agilent measures efficiency at maximum rated output power and at worst case conditions of the ac line voltage.

Electromagnetic interference (EMI): any type of electromagnetic energy that could degrade the performance of electrical equipment. The EMI generated by a power supply can be propagated either by conduction (via the input and output leads) or bt radiation from the units' case. The terms "noise" and "radio-frequency interference" (RFI) are sometimes used in the same context.

Electronic Load: an active device which absorbs power. Loads are used for the testing of the power producing products.

Foldback: immediate shutdown of the power supply output when a crossover between constant voltage and constant current mode occurs. Both the voltage and current levels are reduced (folded back).

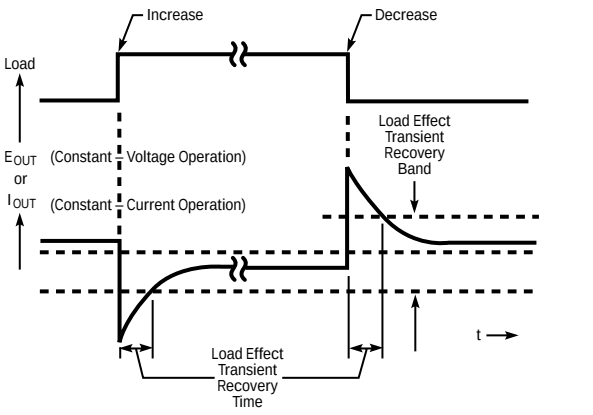
Harmonics: the occurrence of this type of distortion is based upon the mathematical principle that all periodic waveforms are made up of a series of sine waves. As a result, harmonic distortion is produced at frequencies that are integer multiples of the fundamental or desired signal frequency. When viewed in the frequency domain, harmonics have an amplitude (often expressed in db), frequency, and phase characteristic relative to the fundamental.

Isolation: the maximum voltage (including output voltage) either output terminal may be floated from earth ground.

Load cross regulation: the affect on one output of a multiple output power supply when another output is programmed from zero to full rated current.

Load Effect: also known as "load regulation". Load effect is the change in the steady-state value of the stabilized output voltage or current resulting from a full-load change in the load current of a constant-voltage supply or the load voltage of a constant-current supply, with all other influence quantities maintained constant.

Load effect transient recovery time: the time interval between a specified step change in the load current of a constant-voltage supply (usually a full-load or 5-amp change, whichever is smaller) or in the load voltage of a constant-current supply and the instant when the stabilized output quantity returns to and stays within a specified transient recovery band.



Load Effect Transient Recovery Waveforms

Power Products Terms (cont'd)

Master-slave operation: a method of interconnecting two or more supplies or electronic loads such that one of them (the master) serves to control the others (the slaves). The outputs of the slave supplies or inputs of the slave electronic loads always remain equal to or proportional to the output of the master. The outputs of the master supply and of one or more slaves may be connected in series, in parallel, or with just their negative or positive output terminals in common. (See also "complementary tracking"). The inputs of the master electronic load and one or more slaves may be connected in parallel only.

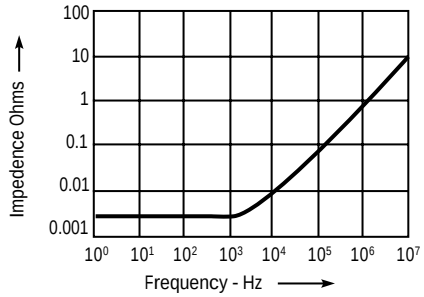
Minimum transition time: the shortest possible time in which an electronic load input can change from one level to another. This is determined by the small signal bandwidth of the load.

Modulation: analog programming of the output voltage and/or current. The output programming response time determines the maximum slew rate at which the power supplies output can be programmed.

Nominal value: the value that exists "in name only"; not the actual value. For example, in the case of a power supply with a calibrated output control, the nominal value is the value indicated by the control setting. For a supply with a fixed output, the nominal output is the output indicated on the nameplate. The nominal value of a 120-volt ±10% line voltage is 120 volts.

"One-Box": a power supply that can be controlled by direct connection to a computer (with no additional programmers) and that can provide measured data to a computer without external voltmeters or ammeters.

Output Impedance: at any frequency of load change, ΔEout/ΔIout. Strictly speaking, the definition applies only for a sinusoidal load disturbance, unless the measurement is made at zero frequency (dc). The output impedance of an ideal constant voltage power supply would be zero at all frequencies, while the output impedance for an ideal constant current power supply would be infinite at all frequencies.



Typical Output Impedence of a Constant Voltage Power Supply

Overcurrent protection: protection of the power supply, electronic load and/or connected equipment against excessive output current.

Overvoltage protection: protection of the power supply, electronic load and/or connected equipment against excessive output voltage. Overvoltage protection is usually by means of a crowbar protection circuit, which rapidly places a low resistance shunt across the supply's output terminals to reduce output voltage to a low value if a predetermined voltage is exceeded. A supply equipped with an overvoltage crowbar must also be protected by a means for limiting or interrupting the output current.

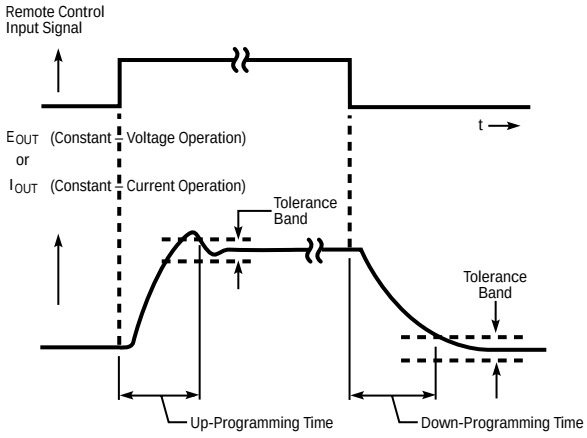
Peak-to-peak noise: is the range between maximum and minimum noise level. Sometimes called noise "spikes." Peak-to-peak noise is typically low in energy and does not show up in a RMS measurement, 20-20 Mhz.

Phase angle: specifies the time domain phase relationship between two sine waves. The unit of phase angle is the degree, with one cycle corresponding to 360 degrees of phase.

Programming speed: the maximum time required for the programmed output voltage or current to change from a specified initial value (usually zero or maximum output) to a value within a specified tolerance band of a specified newly programmed value (for most models 99.9% or 0.1% of maximum output, respectively) following the onset of a step change in an analog programming signal, or the gating of a digital signal.

Readback: the ability of a power supply or electronic load to measure its actual output voltage and/or current, and provide the reading to a computer.

Remote Control: also referred to as "remote programming." Remote control is the setting of the power supply or electronic load voltage, current, or other function by means of an external control quantity such as a variable resistance, voltage, or current, or by a digital signal from a computer.



Programming Speed Waveforms (height of overshoot and width of tolerance band exaggerated)

Remote sensing: remote sensing, or remote error sensing, is a means by which a power supply or electronic load monitors the stabilized voltage directly at the load or source respectively, using extra sensing leads. The resulting circuit action compensates for voltage drops up to a specified limit in the load leads.

Resolution: for a bench supply, the smallest change in output voltage or current that can be obtained using the front panel controls. For a system supply or electronic load, the smallest change that can be obtained using either the front panel controls, or a computer.

Reverse voltage protection: protection of the power supply or electronic load against reverse voltage applied at the outputor input terminals.

RI (discrete fault indicator/remote inhibit): a rear-panel port that can be used to disable the power supply output independently of the GPIB. This port can also be used to chain multiple power supplies together such that an emergency shutdown of one output automatically signals the other supplies to disable their outputs.

Power Products Terms (cont'd)

Ripple and Noise (dB): a term often used to specify rms or peak ac source noise relative to the maximum rms or peak output rating. The specification is calculated as follows: dB = 20 Log (Vnoise/Vrating).

Rms (or effective) amplitude or noise: an average signal or noise level based on energy content. The root mean square (rms) content is often called the ac component.

SCPI (Standard Commands for Programmable Instruments): is a programming language for controlling instrument functions over the GPIB (IEEE 488) instrument bus. The same SCPI commands and parameters control the same functions in different classes of instruments.

SCR regulated supplies: power supplies designed with this topology are very efficient and have moderate noise specifications. They are often used for industrial applications.

Serial link: a means by which up to 16 power supplies with this feature can share one GPIB primary address. The power supplies can be connected with cables similar to U.S. modular telephone cables. They are independently controlled using GPIB secondary addressing.

Series regulation: power supplies designed with this topology have fast programming speeds and low noise. Also referredto as a "linear" topology.

Slave operation: see "master-slave operation".

Slew rate: for any given electronic load input transition, the change in current or voltage over time.

Source effect: also known as "line regulation", source effect is the change in the steady-state value of the stabilized output or input voltage or current resulting from any change in the ac source voltage within its specified range, with all other influence quantities maintained constant. Source effect may be measured at any output or input voltage and current within rating.

Specifications: describe the power supply or electronic load warranted performance.

Supplemental characteristics: give typical but nonwarranted performance parameters.

Switching regulation supplies: power supplies designed with this topology are efficient and can have laboratory-grade specifications.

Temperature effect coefficient: the maximum steady-state change in a power supply's output voltage or current or electronic load's input voltage or current per degree Celsius following a change in the ambient temperature within specified limits, with all other influence quantities maintained constant.

Total harmonic distortion: the ratio of the rms sum of the harmonic components to the rms value of a periodic waveform. This is typically expressed as a percent or in decibels (dB).

Voltage limiting: the action of limiting the output voltage of a constant-current supply to some predetermined maximum value (fixed or adjustable) and automatically restoring the output current to its normal value when the load conditions are restored to normal. There are two types of voltage limiting:

- by constant voltage/constant current crossover
- by decreasing the output current as the voltage increases

Warm-up time: the time interval from when a power supply or electronic load is turned on until its output complies with all performance specifications.

Support

Supporting Your Success

We firmly believe that our obligation to you as a customer goes far beyond just the delivery of your new power product. Agilent's commitment to engineering excellence is equaled by our commitment to help you achieve the best results from your equipment for years to come. Our flexible support solutions in user documentation, hardware, and support services bring you many benefits:

- Shorten the period between purchase and effective use of the product
- Deepen your understanding of your Agilent power product and its capabilities
- Make available unique resources for maintenance and troubleshooting
- Your results are measured in greater overall productivity and lower cost of ownership.

User Documentation

A thorough understanding of your equipment's capabilities is essential to achieving maximum performance from your investment. That is why we provide user documentation that is organized with the precise information you need to use your new Agilent power product in your application. When needed, the maintenance section provides complete information on performance tests, calibration procedures, and troubleshooting procedures along with circuit diagrams and replacement parts lists.

Your Agilent power product is delivered with the essential user documentation needed for you to understand the product's capabilities and to use it in your application. New products have service information in a separate document. If you wish to order service documentation or additional copies of user documentation (such as operating manuals, user's guides, quick-start guides, and programming guides), call Agilent Technical Support Parts at 1-877-447-7278 (U.S. only). For international customers, our web site is updated regularly with online-viewable or downloadable manuals. Visit us at www.agilent.com/find/manuals

Service and Calibration

To help minimize equipment downtime, Agilent maintains a worldwide service organization staffed with trained engineers and technicians who are backed by the designers and a large inventory of replacement parts. Maintenance and repair technology comes right out of the original design centers for your power products. When things do go wrong we correct them quickly and cost-effectively.

Our Customer Service Centers rely on automated processes to calibrate instruments and diagnose problems. Our investment in automation enhances the quality of repair and repeatability of calibration. This efficiency results in savings for you.

We know turnaround time is important to you. Our Customer Service Centers will quickly and accurately enable you to get back to business promptly. They will repair or calibrate any Agilent instrument covered by an Agilent Service Agreement in most parts of the world within five working days of receiving the equipment. Whatever your needs, we intend to be as flexible as possible in meeting them. Repair and calibration are offered, to commercial or military requirements, on a per-incident basis or under a service agreement. For more information, ask your local Agilent Customer Service Center for additional details. Regional phone numbers can be found on the back of this catalog. U.S. residents can also call the Agilent Instrument Support Center at 1-800-403-0801.

Warranty

Product warranties are a means by which Agilent provides customers with a safety net to protect them from product early failures due to design, workmanship, or component problems. Warranties also provide important feedback on product reliability which is essential for ongoing quality improvement programs.

The traditional warranty coverage for Agilent power products is for three years from date of shipment when the defective product is returned to a an Agilent Customer Service Center for repair.

Because of recent advances in design methodology and component reliability, the warranties on our recently introduced system power supplies and dc electronic loads have now been extended to three years. The products with the new three year warranties are highlighted throughout the product description section of this catalog.

Support Options

Agilent Support Options add support services to product warranty to provide you with quality support for an extended period of time. These competitively priced and easily ordered services demonstrate our commitment to quality and low cost of ownership.

Option W30 - 3 Year Customer Return Repair Coverage. Adds two years to product warranty to provide you with a total of three years of return-to-Agilent repair service from the time of hardware delivery.

Option W32 - 3 Year Customer Return Calibration Coverage. Provides 3 years of return-to-Agilent calibration service from the time of hardware delivery. Coverage includes scheduled calibration at our recommended calibration cycle, as well as calibration after a repair performed by Agilent. Please ask your local Sales Representative for price and availability.

Consulting Services

As measurements and technology have become more complex, Agilent's equipment has become more sophisticated. Our wide range of consulting services helps you to take full advantage of your equipment's capabilities. Whether you need a few hours of guidance from an experienced consultant or a complete custom plan, our Application Engineers and Project Centers are ready to help. Please ask your local Sales Representative for more details.

Regulatory Compliance

All Agilent Power Products meet the following regulatory specifications **unless otherwise noted.**

These products comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (ISM 1A) and carry the CE-marking accordingly.

These products comply with the Australian EMC requirements and carry the C-tick mark.

In addition, these products comply with the following safety standards:

EN61010.1 (1993)
UL 3111-1 (1st Ed. 1994)
CSA 22.2 No. 1010.1 (1993)

Ordering Information

Communication With Agilent

We are committed to providing convenient local support and the best possible attention to customer needs on a worldwide basis. A listing of our offices appears on the back cover of this catalog. Your entry point to the resources of Agilent is through the local office nearest you. Our field engineers and order support specialists are well-equipped to provide you with assistance in product selection, as well as related business information such as current product availability, prices and delivery to your location.

Agilent field offices are tied into a sophisticated intra-company communications system. This not only means prompt transmission of orders to any of our product responsible divisions, but it also speeds the flow of regular messages among all our field offices and factories. The objective, of course, is to provide the fastest possible response to your product interests.

Placing Your Order and Delivery

Our employees at the field office nearest you will be pleased to provide assistance in selecting the Agilent equipment most appropriate to your needs and to help you prepare your order. If you need information on prices and availability, or would like someone to take your order, call one of the offices listed on the back cover of this catalog

Should you need more detailed applications information, you may also request a copy of the dc Power Supply Handbook (application note AN-90B, part number 5952-4020). Agilent has this application note and most other literature in stock and ready to mail.

We want to be sure the product we deliver to you is exactly the one you want. Therefore, when placing your order, please specify the product's model, accessory, or part number, as well as the products name. Be as complete as possible in specifying exactly what you would like, including standard options.

The products can be ordered using your VISA, MasterCard, American Express Card, or open an account over the phone. Selected products in this catalog (identified by the telephone icon) are available for off-the-shelf shipment as well. You can receive your products within 5 working days of placing the order. This applies to standard products only, and a maximum order of five per product. Everything you order is backed by our 60 day money back guarantee.

Shipping Methods

Power product shipments to destinations in the USA use express or truck transportation. If fast delivery is needed, we gladly ship by air freight, air express or air parcel post, when specified on your order, at prevailing rates.

Shipments to destinations outside the USA are made by either surface or air.

Pricing, Quotations and Pro Forma Invoices

To obtain destination prices, formal quotations, pro forma invoices, or other information you need before ordering, contact your local Agilent office, distributorship, or Customer Call Center serving your area.

Inside the USA:
Call the Test & Measurement Customer Business Center, 1-800-829-4444, or write, P.O. Box 4026, Englewood, CO 80155-4026.

If you are an international customer requiring formal paperwork such as pro forma invoices of FAX, FIC, or C&F quotations, please contact the Agilent office or representative serving your area. A list of international offices can be found on the back cover of this catalog. Exportation or importation assistance is also available.

Terms of Sale

Agilent's standard terms for established customers in the USA are net 30 days from invoice date. Other terms are contained in the customer's purchase agreement.

Leasing, rental and extended financing are available. Your nearby Agilent office will be pleased to discuss your requirements and work with you in setting up an appropriate program.

Outside the USA, please contact your nearest Agilent sales office or an authorized subsidiary or distributor regarding terms for orders placed with them.

Product Changes

Although product information and illustrations in this catalog were current at the time it was approved for printing, Agilent, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications, designs, and models without notice. We also reserve the right to correct printing errors and change prices.

On-line Technical Support

Call us and speak to one of our on-line, experienced sales engineers. You can get quick product specifications, discuss your application or get help with a competitive comparison. All Agilent sales engineers have firsthand experience with our power products and are ready to answer your questions.

Modification Service

Modification of maximum output voltage or current
Improvement of a specific performance specification such as accuracy, resolution, programming speed, etc.
Alteration of a control loop's compensation in order to accommodate a highly reactive load
System hardware integration

Power Products Modification Service

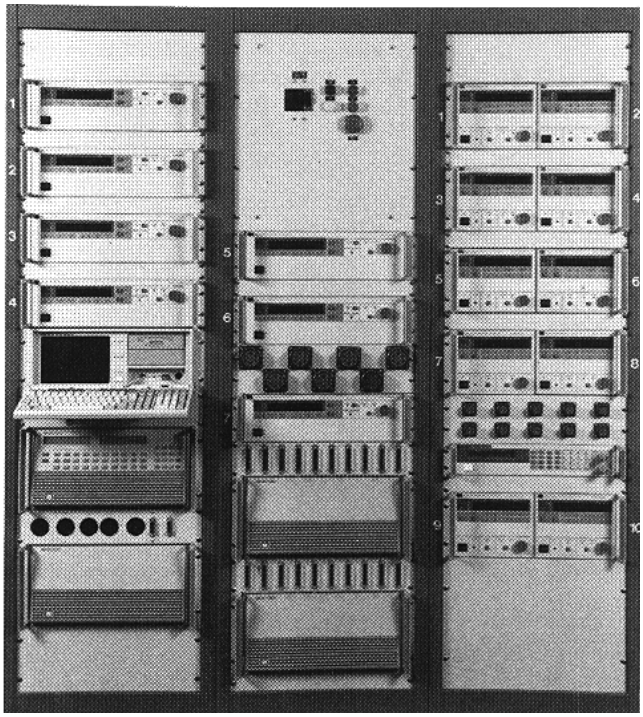
While the products in this catalog are intended to satisfy a wide range of customer applications, Agilent recognizes that these products may not match all needs. To better meet your specific power supply and load requirements, Agilent offers a special modification service. This service entails the design and manufacture of modified versions of standard catalog models of dc power supplies and electronic loads.

The modified products are designed, manufactured, tested, to the same high quality and reliability standards as other HP products. Any necessary updates are provided for the operating and service documentation.

By taking advantage of Agilent's engineering expertise to address your special power supply needs, your engineering staff can focus on your main business. The associated engineering costs can be amortized over a number of units, contingent on volume commitment and other project specifics.

OEM customers may find this capability particularly valuable when integrating power supplies into their final product. While the scope of this service is usually limited to the modification of a standard product, our engineers welcome discussion to determine the feasibility of meeting particular requirements.

By providing completely integrated power systems that meet customer's requirements, our customers can concentrate on their main business. If you have a special requirement for a system, power supply or electronic load that is not in the catalog, contact your local sales office with your specifications. Please see the back cover of this catalog for regional phone numbers.



Available Modifications

6060B-J08: 70 volt input voltage
662xA-S50: Non-latching Remote Inhibit (RI)
664xA-S50: Non-latching Remote Inhibit (RI)
665xA-S50: Non-latching Remote Inhibit (RI)
667xA-S50: Non-latching Remote Inhibit (RI)
6654A-J05: 50 V, 10 A
6673A-J08: 40 V, 50 A
6675A-J07: 200 V, 11 A

For a complete listing of available modifications, refer to pages 4 & 5 of this catalog.

An up-to-date listing can also be found on our web site at www.agilent.com/find/specials

AGILENT MODEL NUMBER INDEX

MODEL NUMBER INDEX

Agilent Model #	Output Rating* Max. Watts	Max. Volts	Max. Amps	Page
59510A	4000	200	60	33
59511A	4000	200	60	33
6010A	1200	200	17	31
6011A	1064	20	120	31
6012B	1200	60	50	31
6015A	1050	500	5	31
6023A	242	20	30	31
6028A	240	60	10	31
6030A	1200	200	17	19
6031A	1064	20	120	19
6032A	1200	60	50	19
6033A	242	20	30	19
6035A	1050	500	5	19
6038A	240	60	10	19
6050A**	1800	-	-	34
6051A**	600	-	-	34
6060B**	300	60	60	34
6063B**	250	240	10	34
6541A	200	8	20	28
6542A	200	20	10	28
6543A	200	35	6	28
6544A	200	60	3.5	28
6545A	200	120	1.5	28
6551A	500	8	50	29
6552A	500	20	25	29
6553A	500	35	15	29
6554A	500	60	9	29
6555A	500	120	4	29
6571A	2000	8	220	30
6572A	2000	20	100	30
6573A	2000	35	60	30
6574A	2000	60	35	30
6575A	2000	120	18	30
6611C	40	8	5	9
6612C	40	20	2	9
6613C	50	50	1	9
6614C	50	100	0.5	9
6621A	160	20/20	10/10	22
6622A	160	50/50	4/4	22
6623A	160	20/50/20	5/2/10	22
6624A	160	20/20/50/50	5/5/2/2	22
6625A	75	50/50	0.5/1	21
6626A	150	50/50/50/50	0.5/0.5/1/1	21
6627A	160	50/50/50/50	2/2/2/2	22
6628A	100	50/50	1/1	21
6629A	200	50/50/50/50	1/1/1/1	21
6631B	80	8	10	12
6632B	100	20	5	12
6633B	100	50	2	12
6634B	100	100	1	12
6641A	200	8	20	14
6642A	200	20	10	14
6643A	200	35	6	14
6644A	200	60	3.5	14
6645A	200	120	1.5	14
6651A	500	8	50	15
6652A	500	20	25	15
6653A	500	35	15	15
6654A	500	60	9	15
6655A	500	120	4	15
6671A	2000	8	220	16
6672A	2000	20	100	16
6673A	2000	35	60	16
6674A	2000	60	35	16

Agilent Model #	Output Rating* Max. Watts	Max. Volts	Max. Amps	Page
6675A	2000	120	18	16
6680A	5000	5	875	18
6681A	5000	8	580	18
6682A	5000	21	240	18
6683A	5000	32	160	18
6684A	5000	40	128	18
6811B	375 VA	300 V_{rms}	3.25 A_{rms}	38
6812B	750 VA	300 V_{rms}	6.5 A_{rms}	38
6813B	1750 VA	300 V_{rms}	13 A_{rms}	38
6814B	3000 VA	300 V_{rms}	20 A_{rms}	38
6834B (1ϕ)	4500 VA	300 V_{rms}	30 A_{rms}	38
6834B (3ϕ)	1500 VA/ϕ	300 V_{rms} /ϕ	10 A_{rms}	38
60501B**	150	60	30	34
60502B**	300	60	60	34
60503B**	250	240	10	34
60504B**	600	60	120	34
60507B**	500	150	60	34
66000A	-	-	-	24
60001A	-	-	-	24
66101A	128	8	16	24
66102A	150	20	7.5	24
66103A	150	35	4.5	24
66104A	150	60	2.5	24
66105A	150	120	1.25	24
66106A	150	200	0.75	24
66309B/D	40	15	3	10
66311B/D	40	15	3	10
66319B/D	40	15	3	10
66321B/D	40	15	3	10
66332A	100	20	5	10
E3610A	30	8/15	3/2	27
E3611A	30	20/35	1.5/0.85	27
E3612A	30	60/120	0.5/0.25	27
E3614A	48	8	6	27
E3615A	60	20	3	27
E3616A	60	35	1.7	27
E3617A	60	60	1	27
E3620A	50	25/25	1/1	32
E3630A	35	6/+20/-20	2.5/0.5/0.5	32
E3631A	25	25/-25/6	1/1/5	20
E3632A	120	15/30	7/4	13
E3633A	200	8/20	20/10	13
E3634A	200	25/50	7/4	13
E3640A	30	8/20	3/1.5	8
E3641A	30	35/60	0.8/0.5	8
E3642A	50	8/20	5/2.5	8
E3643A	50	35/60	1.4/0.8	8
E3644A	80	8/20	8/4	8
E3645A	80	35/60	2.2/1.3	8
E3646A	60	two 8/20	two 3/1.5	23
E3647A	60	two 35/60	two 0.8/0.5	23
E3648A	100	two 8/20	two 5/2.5	23
E3649A	100	two 35/60	two 1.4/0.8	23
E4350B	480	60	8	26
E4351B	480	120	4	26
E4356A	2000	70/80	30/26	17
N3300A	1800			34
N3301A	600			34
N3302A	150	60	30	36
N3303A	250	240	10	36
N3304A	300	60	60	36
N3305A	500	150	60	36
N3306A	600	60	120	36

* Maximum volts and amps listed may not be available simultaneously. Refer to product description for details. More than one voltage value listed indicates multiple outputs. Maximum watts column indicates total power.

** Indicates electronic load.

Index for Obsolete Agilent Products

Obsolete Model #	Closest Alternative*
6002A	664xA
6024A	6028A
6034A	6038A
6200B	E3616A
6201B	E3616A
6202B	E3616A
6203B	E3614A
6204B	E2617A
6205C	(2) E3611A
6206C	E3617A
6211A	E3612A
6212C	E3612A
6213A	E3610A
6214C	E3610A
6215A	E3611A
6216C	E3611A
6217A	E3612A
6218C	E3612A
6220B	E3617A
6224B	6453A
6226B	6544A
6227B	(2) E3616A
6228B	(2) E3617A
6234A	E3620A
6235A	E3630A
6236B	E3630A
6237B	E3611A and E3620A
6253A	(2) E3615A
6255A	(2) E3616A
6256B	E6552A
6259B	6572A
6260B	6572A
6261B	6573A
6263B	6542A
6264B	6552A
6265B	6554A
6266B	6543A

Obsolete Model #	Closest Alternative*
6267B	6553A
6268B	6574A
6269B	6573A
6271B	6544A
6274B	6574A
6281A	E3614A
6282A	6542A
6284A	E3615A
6286A	6542A
6289A	E3616A
6291A	6543A
6294A	E3617A
6296A	6544A
6299A	6634B or (2) E3617A
6384A	6542A
6427B	6552A
6428B	6011A
6433B	6012B
6434B	6012B
6438B	6544A, 6634B
6439B	6012B
6448B	6015A
6453B	(2) 6572A
6456B	(2) 6572A
6459A	(2) 6573A
6464C	(2) 6681A
6466C	(2) 6681A
6612B	6612C
6632A	6632B
6633A	6633B
6634A	6634B
6814A	6814B
6834A	6834B
66111A	66311B
66311A	66311B
E4350A	E4350B

* These products are closest in ratings to the discontinued model, but are not identical. Refer to the catalog for the features and specifications of the suggested alternative.

ordering information

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