

## POWER SUPPLIES

General Purpose: Autoranging—200 & 1000 W Output

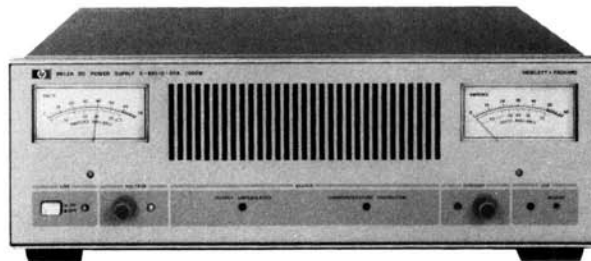
Models 6012A and 6024A

- Autoranging output
- High efficiency, compact and lightweight
- Fast remote programming

- Designed for system applications
- Ten-turn voltage and current controls
- Operating mode status indicators



6024A—200 watts



6012A—1000 watts

### Autoranging Power Supply Description

The model 6012A and 6024A set a new technological standard for laboratory and system dc power supplies. They are the first in a new generation of power supplies from Hewlett-Packard, combining state of the art advances in both component and circuit design. The result is increased performance and flexibility and friendlier operation both on the bench and in automated test and control systems.

Conventional dc power supplies have an output characteristic which is described by a rectangle. The flexibility provided by an autoranging power supply is revealed when its output characteristic is compared to that of a conventional supply. A conventional power supply can provide its maximum output power at only one combination of voltage and current. Autoranging power supplies provided maximum output power capability over a wide and continuous range of voltage or current. This function is performed automatically, requiring no range selection by the operator.

Using the model 6024A as an example, you would have to combine a 20-volt 10-amp supply, a 40-volt 5-amp supply, and a 60-volt 3-amp supply in order to approximate the same capability as the 6024A. (See output curves on next page.) The autoranging feature of these power supplies makes them convenient and cost-effective units capable of satisfying many different dc requirements.

#### In the Lab . . . .

Both models have many features that make them versatile. Mode indicators, adjustable overvoltage protection, 10-turn pots, amplified current monitor, and voltage and current meters are some of the features. A barrier strip at the rear of the supply provides the necessary terminals for current monitoring, remote programming, and remote sensing.

In auto-parallel operation, up to three units of the same model may be connected in parallel to increase the total output current capability while maintaining control from one master power supply. In auto-series operation up to four units may be connected in series to increase the total output voltage to 240 V while maintaining control from one master power supply.

Several LEDs on the front panel indicate the operating status without any additional measurement or control changes. Two 10-turn potentiometers on the front panel provide high resolution control of output voltage and current. A secondary scale on the voltmeter indicates maximum "Amperes Available". Likewise, the ammeter has a secondary scale to indicate the "Volts Available". The secondary scales are calibrated to follow the maximum output power curve and let the user know approximately how much power margin is available at any operating point.

Because of the delicate nature of many loads several types of protection have been included. When operating in constant-voltage mode, a current limit can be set. Similarly, when operating in constant-current mode, a voltage limit can be set.

#### In the System . . . .

System designers frequently need a variety of fixed and programmable power supplies. By standardizing on autoranging power supplies, the system designer can reduce the number of different models required along with their resultant documentation and support.

The standard models can be programmed either with a resistance or a voltage input. Full scale output voltage and current have been normalized to 2500 ohms or 5.0 volts. Both models contain an active down programming circuit. This circuit provides an improvement of up to 15 to 1 in down programming speed over conventional power supplies of similar ratings. Sensing terminals are provided at the rear of the power supply for applications where the load may be located some distance from the supply. When using remote sensing, the power supply maintains regulation at the load rather than at the rear terminals of the supply. The amplified current monitor provides a 0–5 volt output which is directly proportional to the output current.

Some of the most important benefits of using these supplies in systems results from the switching technology employed. A switching frequency of 20 kHz is used which allows most power handling components, as well as the filter capacitors, to be substantially reduced in size. This contributes to the reduced size and weight of the supply. Typical operating efficiency is 75%, which reduces the amount of cooling necessary for the overall system and enables the system to use less power.

#### Option 002

The optional interface (002) provides a convenient means of integrating these supplies into a custom designed system or one controlled by an HP Multiprogrammer. A 69520A programmer card in conjunction with the option 002 card allows these supplies to be controlled by a 6940B Multiprogrammer. Similarly, the model 69709A programmer card is required when controlling the power supply by a 6942A Multiprogrammer.

The interface features are available through a 37-pin connector on the back of the power supply, and include:

**Remote programming:** both the output voltage and current can be remotely programmed. In addition to external voltage and resistance programming, the interface provides current programming of output voltage and current.

**Status readback:** six optically isolated status lines provide digital outputs to indicate the following states: constant-voltage, constant-current, unregulated output, ac line fault, overtemperature, and over-voltage.

**Remote shutdown:** there are two methods to remotely disable the output. The first method, utilizing two inputs, allows one input to be pulse "set" and the other to be pulse "reset." The second method uses one input whose level determines the output condition. These input lines are TTL compatible and optically isolated to prevent ground loops.

**Output bias supplies:** three bias supplies are available with +5V, +15V, and –15V to power DAC's and other user supplied circuitry.

**Voltage and current readback:** for convenience, both are brought through the option connector.



## DC Output

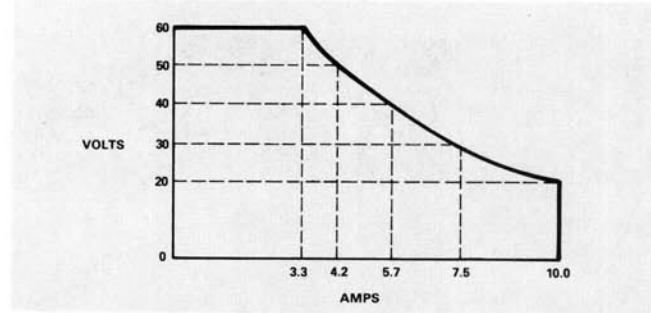
	Voltage	0-60 V	0-60 V
	Current	0-10 A	0-50 A
<b>Model</b>		<b>6024A</b>	<b>6012A</b>
Load effect: (Load regulation)	Voltage	0.01% +3 mV	0.01% +5 mV
	Current	0.01% +3 mA	0.01% +5 mA
Source effect: (Line regulation)	Voltage	0.01% +2 mV	0.01% +3 mV
	Current	0.01% +2 mA	0.01% +5 mA
PAR: (Ripple and noise) rms/p-p, 20 Hz to 20 MHz	Voltage	3 mV / 30 mV	5 mV / 50 mV
	Current	5 mA rms	25 mA rms
Temperature coefficient: Δ/°C after 30 minute warmup	Voltage	0.01% +1 mV	0.01% +2 mV
	Current	0.03% +1 mA	0.01% +3 mA
Drift: (Stability) change in output over an 8 hour interval	Voltage	0.03% +3 mV	0.03% +5 mV
	Current	0.03% +3 mA	0.03% +5 mA
Load effect transient recovery response:	Time	1 ms	2 ms
	Level	75 mV	100 mV
Resolution: (Minimum adjustment of front panel controls)	Voltage	20 mV	20 mV
	Current	5 mA	20 mA
Remote resistance programming accuracy: (2500 ohms necessary for full scale output)	Voltage	0.08% +1 mV	1% +3 mV
	Current	2.4% +1 mA	2.5% +10 mA
Remote voltage programming accuracy: (5.0 volts necessary for full scale output)	Voltage	0.2% +1 mV	0.3% +3 mV
	Current	0.9% +1 mA	1% +10 mA
Programming response time: Maximum time for output voltage to change from 2 V to 60 V or 60 V to 2 V and settle within 200 mV	Up full load	200 ms	120 ms
	Up no load	200 ms	120 ms
	Down full load	300 ms	400 ms
	Down no load	600 ms	1.2 s
Overvoltage trip point range:		2-63 V	2-63 V
Amplified current monitor: 0-5 V represents zero to rated current output	Accuracy	0.9% +7 mV	1% +10 mV
	Output impedance	10 KΩ nom.	10 KΩ nom.
RFI specifications:		Meets VDE 0871/6.78 Level A	
Safety specifications:		Comply with IEC 348, VDE 0411, CSA 556B, CSA 22.2 #0-1975	
DC output isolation:		± 240 Vdc from ground	
Temperature rating: (fan cooled)	Operating	0-55°C	
	Storage	-40 to +75°C	
AC input: (48-63 Hz) (Standard)	Voltage	104-127 Vac	
	Current	5.3 A rms max.	24 A rms max.
Weight:	Net	5.4 Kg (12 lbs)	15 Kg (33 lbs)
	Shipping	7.3 Kg (16 lbs)	16 Kg (35 lbs)

## System Interface Specifications

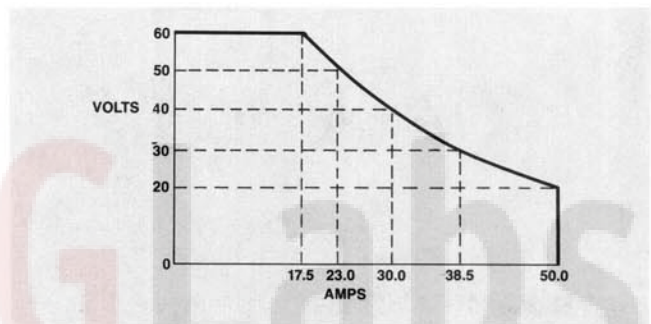
		6024A	6012A
Sink current necessary for full scale output of voltage:	Voltage	2 mA	2mA
	Accuracy	0.3% + 7 mV	0.4% + 9 mV
Sink current necessary for full scale output of current:	Current	2 mA	2 mA
	Accuracy	1% + 2 mA	1.1% + 15 mA
Isolation: (Between status and control lines equipment ground, and power supply output)	Voltage	600 Vdc	600 Vdc

## Multiprogrammer Interface Cards

Model 69520A (for 6940B Multiprogrammer)			
Programming resolution	Voltage	60 mV	60 mV
	Current	10 mA	50 mA
Model 69709A (for 6942A Multiprogrammer)			
Programming Resolution	Voltage	60 mV	60 mV
	Current	10 mA	50 mA



Autoranging operating area for the 6024A



Autoranging operating area for the 6012A

## Ordering Information

### 6024A Autoranging Power Supply

#### Options

<b>002:</b> System interface	\$305.00
<b>100:</b> 87-106 Vac, 48-63 Hz (For use in Japan only. 150W maximum output power)	N/C
<b>220:</b> 191-233 Vac, 48-63 Hz	N/C
<b>240:</b> 208-250 Vac, 48-63 Hz	N/C
<b>907:</b> Front handle kit (p/n 5061-0089)	\$56.00
<b>908:</b> Rack flange kit (p/n 5061-0057) for single product system installation	\$53.50
<b>910:</b> Extra operating and service manual (p/n 06024-90001)	\$10.00

### 6012A Autoranging Power Supply

#### Options

<b>002:</b> System Interface	\$305.00
<b>100:</b> 87-106 Vac, 48-63 Hz (For use in Japan only. 150W maximum output power)	N/C
<b>220:</b> 191-233 Vac, 48-63 Hz	N/C
<b>240:</b> 208-250 Vac, 48-63 Hz	N/C
<b>907:</b> Front handle kit (p/n 5061-0089)	\$56.00
<b>908:</b> Rack flange kit (p/n 5061-0077)	\$33.00
<b>909:</b> Combination of Option 907 front handle kit and Option 908 rack flange kit	\$82.00
<b>910:</b> Extra operating and service manual (p/n 06024-90001)	\$10.00

## Accessories

<b>5061-0094:</b> Cabinet lock-together kit to connect two 6024As	\$38.00
<b>5061-0077:</b> Rack flange kit to mount two locked 6024As	\$32.50